What is ICT ?

ICT (Information & Communication Technology) is a multidisciplinary branch combining **Computer Science, Electronics, Communication, and IT**. It focuses on **software development, embedded systems, networking, AI, IoT, Data Science, Cloud, VLSI, and Cybersecurity**

- Why ICT after 10th or $12^{th}$

ICT has a **very wide scope** – students can enter fields like **AI/ML, Data Science, IoT, Cloud Computing, Robotics, Cyber Security, VLSI, Software & Web Development, Mobile App Development, Embedded Systems, Networking** etc.

The syllabus is **practical and future-oriented** (projects every semester, internships, industry tie-ups, expert talks) which prepares students for both **jobs and higher education**

Students also get chances in **research, innovation, hackathons, IPRs, and international exposure**

- Diploma and degree

    Diploma (after 10th) :

    - Diploma is **3 years**, mainly focusing on **fundamentals of electronics, programming, hardware, networking, and software basics**.
    - After diploma, students can take **direct admission into Degree (B.Tech ICT) in 2nd year** (lateral entry).

- **Degree (B.Tech ICT @ Marwadi University)**

    - **8 semesters (4 years)** with subjects ranging from basics (electronics, programming, mathematics) to advanced (AI/ML, Cloud, IoT, VLSI, Blockchain, Cyber Security, Big Data, etc.)
    - Includes **internships** (6 weeks in 4th & 6th sem, 6 months in 8th sem)
    - Focus on **project-based learning**, research, innovation, and industry tie-ups.
    - Prepares students for **placements, higher education, or startups**.

Department Vision and mission

**Vision:** To build students' capacity through quality education that enables them to address industry and societal problems while becoming contributors.

**Mission (4 key areas):**

- M1: Develop problem-solving abilities through project-based learning
- M2: Provide blended teaching and assessment approaches to enhance learning
- M3: Provide exposure to various domains for students to choose their area of interest
- M4: Maintain continuous industry interaction to prepare industry-ready students

# Program Educational Objectives (PEOs)

Five objectives covering:

- PEO1: Applying engineering principles to solve real-world societal problems
- PEO2: Working on multidisciplinary projects in diverse industrial environments
- PEO3: Exploring recent ICT technological developments
- PEO4: Enhancing knowledge through self-learning, certifications, and higher education
- PEO5: Acting ethically and socially responsible as solution providers and entrepreneurs

# Program Specific Outcomes (PSOs)

Two specific outcomes:

- PSO1: Identifying, analyzing, and solving real-time industry problems in software development, embedded systems, VLSI design, IoT, and communication technologies
- PSO2: Contributing as analyst and developer in cloud computing, DevOps, security, machine learning, artificial intelligence, and big data

- Chandrasinh Parmar sir
  Electronics and Communication
  Contact no : 9824416484

- Arjav Bavarva Sir
  Networking and Cloud
  Contact no : 7016685360

- Sunil Lavadiya
  IOT
  9428228839

- Tapan Nahar
  System and Signals
  9983250843

- Nishith Kotak
  Data Science
  7405468045

- Vijay Dubey
  IOT
  9723265278
- Suhag Baldaniya
  Software Development
  9537330702

- Rakesh Oza
  VLSI
  9978068186

- Chirag Visani
  Software Development

- SharmArzoo Alam
  Software Development
  8866152292

- Vishal Akbari
  Cyber Security
  7698903070

- Mitesh Solanki
  IOT
  9586571164

- Sunera Kargatha

- Harikesh Chauhan
  Software Development
  6390327075

- Dharmendra D Zala
  Cloud and Networking
  9574219380

- Naimish Rathod

Facilities (Labs and components):

# Laboratory Infrastructure

General Lab Features

- **Well equipped laboratories with 24X7 access**
- **Industry Supported/sponsored Labs**

# Lab Components (Based on Curriculum Subjects)

**Microcontroller and Interfacing** lab

**VLSI Physical Design** lab

**Software Engineering** lab

**Computer Networks** lab

Data Science Lab

Department archivements :

# Research & Innovation Achievements

- **12 projects selected in NEW GEN IEDC, DST India** with funding of ₹2 lakhs each
- **2 projects selected in SSIP** (Student Startup and Innovation Policy), Marwadi University
- **70+ IPRs (Intellectual Property Rights) registered**

# State Level Achievements

- Various state-level competition participations and recognitions

# Student Ambassador Programs

- ICT students serving as ambassadors in various initiatives

# International Exposure

- **Student internationalization programs**
- International internship opportunities
- Global university partnerships

# Higher Education Placements

- Students successfully advancing to prestigious institutions for higher studies

# Industry Recognition

- Strong placement records across multiple domains

- ICT students are actively taking leadership roles in various clubs and communities
- **Co-curricular and extra-curricular activities on Saturday** - Regular weekend activities organized through clubs

- Copititve programing club
  Unity : Kaushal Parmar
  Git – Github  : Abhay Nathwani
  Custoum Header files and libraries in C : Aryan Langhnoja
  Working with CLI Terminal – Kausal Parmar

- Data Science Club
  Chat bot
  Data Visulaization

- Circitology Club
  Drone Making

- Cloud Computing and DevOps Club

  Introduction to EC2 – Prince Kakkad

  Host PHP web site on EC2 – Janvi Egera

  Git-Github – Devarsh Bhatt

Also Conducting Hackathones By various clubs and Giving title as a price and title of coder of the month like

# Celebrating Cultural Events

## Frolic Event

### Sports activities with faculty-student interaction:

### Sports Activities:

- Cricket
- Basketball
- Race
- Tug of War
- Chess
- Carrom
- E-sports Gaming

## Confidence Event

### Cultural Activities:

- Dance
- Food Competition
- Rangoli Competition
- Debate Competition
- Poetry

## Engineers Day Celebration

### Annual celebration event for engineering students

B.Tech ICT 2021-25

Darshan Padia – Fintech Global Center – 10 LPA

Dev Mehta – rtCamp -12LPA

Mustafa Bharmal rtCamp – 12LPA

B.Tech ICT 2022-26

1. Rishit Rathod -  TSS  - 4.2 LPA

2. Abhay Nathwani - Fintech Global - software developer - 10 to 15 LPA

3. Aryan Langhnoja - Ace Data  Analytics - software developer - 5.1 to 5.7 LPA

4. Umang Hirani- Ace Data  Analytics - software developer - 5.1 to 5.7 LPA

5. Ishika Sheth - Triyanshi - BDE - 3 LPA

6. Krish Mamtora - Roima Intelligence Inc - Technical Intern - 5 to 7LPA

7. Harsh Sanghvi - Websmith solution - AI ML engineer -4 to 7 LPA

8. Tvisha Gami- Websmith Solution - AI ML Engineer with 4 to 7 LPA

9.Vidya Bharti Sinha - Mobiuso- Software Engineer - 4 to 5LPA

10. Jay mangukiya - satva solutions - trainee SD - 3.5 to 6 LPA

11.  Aryan mahida - satva solutions - trainee SD - 3.5 to 6 LPA

- Simform Solution - SDE Trainee - 6LPA

12. Dhruvi Patel - Synobiz Systems Pvt Ltd - SAP B1 Technical Consultant - 3.0 to 4.0 LPA

    - Injala - .net developer - 4.5 LPA

13. Vatsal Parmar -Synobiz Systems Pvt Ltd - SAP B1 Technical Consultant - 3.0 to 4.0 LPA

    Ally soft -3.5 LPA to 4.5 LPA

14. Bhavik Kaladiya - Azilen - Devops - 4 - 5.5 LPA
15. Hit racchadiya - cybercom - SDE - 3.6 LPA
16. Rohan Roy - Improvised - devops - 4LPA
17. Ritesh Sanchala - tech extensor - .net / Angular Developer - 3-5LPA
18. Vivek Chavda - VasyERP - java developer -4.2LPA
19. Nidhi Dattani - AllySoft - Mern Stakc developer - 3.5 to 4.5
20. Jenil Vaghasiya - Ally Soft - Mern Stack developer - 3 LPA
21. Vatsal Parmar - Ally Soft - Mern Stack Developer - 3.5 to 4.5 LPA
22. Prashant Savaliya - Ally Soft - mern stack developer - 4 to 4.5 LPA
23. Vrajkumar Nandwana - Empypreal Infotech Private Limited - AI ML Engineer - 3LPA
24. Neel Raiyani - Empyreal Infotech Pvt Ltd - .node Js developer - 3 LPA

# Student Achievements

### National Level

- **Gaziabad Hackathon Competition** (Sustainability Solutions for Humanity) - Oct 2024
- **Skill India Competition 2024** winners:
  - Jatan Sanghvi
  - Hasti Hajipara
  - Dhruvkumar Vyas

# Hackathon – Coding Ninja Hackathon

**Winners:**

- Abhay Nathwani
- Ritesh Sanchela
- Aryan Langhnoja

**Achievement:** Winner at 1st position across India

### Other Achievements

# ICT Students as Ambassadors

**Fenil Vadher** selected as a Google Student Ambassador

**Dhyana Kothari** selected as a Google Student Ambassador

**Ashutosh Kumar** selected as a Student Ambassador of Udemy

**Rudra Miyani** selected as a Student Ambassador of Internshala

# Research Papers

# Patents and Copyrights

- **70+ IPRs (Intellectual Property Rights) registered**
- **Promoting filing of IPRs** in subjects like CPSI, HCD, etc.

# International Internships

- **Malhar Shah - 2024** (specific international program participant mentioned)
- **Dhruvi Kothari -2024**

# Student Exchange Programs

Dhruvi Bhalodiya

Priyanshi Madani

Selected at student Exhange Program at romaina

# Alumni Network

- Alumni involvement in **research and innovation activities**
- Alumni contributing to **student development and mentorship**

# Industry Support

## Industry-Sponsored Infrastructure

- **Industry Supported/sponsored Labs**
- Zuru Tech Sponsored Lab
- Tie-up with e-Infochips

**Marwadi University**
**Faculty of Technology**
**Department of Information and Communication Technology**

## Subject Code: 01EC0101

## Subject Name: Basics of Electronics Engineering

## B. Tech. Year – I (Semester I)

**Objective:** After completion of this course, student will be able to:

1. Understand operation of semiconductor devices & Operational Amplifier
2. Understand DC analysis and AC models of semiconductor devices.
3. Apply concepts for the design of Regulators and Amplifiers
4. Verify the theoretical concepts through simulation sessions
5. Implement and analyze the mini projects based on concept of electronics circuit concepts

**Credits Earned:** 04 Credits

**Course Outcomes:** After completion of this course, student will be able to:

1. Understand the Voltage current and operation of semiconductor devices, circuits, and operational Amplifier
2. Apply basic fundamentals of semiconductor devices and operational amplifier to illustrate/show the operation of application
3. Apply the basic knowledge of simulation tool & Circuit level concepts to synthesize real life problems
4. Analyze the behaviour of Electronics circuits containing Semiconductor device, Operational Amplifier or Verify using Modern tools
5. Design, implement and analyse of electronic circuits to solve the problem with in society

**Pre-requisite of course:** NA

**Teaching and Examination Scheme:**

<table>
<tr><th colspan="3" rowspan="2">Teaching Scheme (Hours)</th><th rowspan="3">Credits</th><th colspan="3">Theory Marks</th><th colspan="2">Tutorial / Practical Marks</th><th rowspan="3">Total Marks</th></tr>
<tr><th>E</th><th colspan="2">I</th><th>V</th><th>T</th></tr>
<tr><th>Theory</th><th>Tutorial</th><th>Practical</th><th>ESE</th><th>IA</th><th>CSE</th><th>Viva</th><th>Term Work</th></tr>
<tr><td>03</td><td>00</td><td>02</td><td>04</td><td>50</td><td>30</td><td>20</td><td>25</td><td>25</td><td>150</td></tr>
</table>

**Contents:**

| Uni t | Topic s | Hour s |
|---|---|---|
| 1 | **Fundamentals of Semiconductor Material**<br><br>Energy Band Diagram of conductor, semiconductor, and insulator; Bhor AtomicModel for Atom, Crystal Structure of Semiconductor Materials, Intrinsic and Extrinsic Semiconductor Materials | 04 |
| 2 | **Semiconductor Diodes**<br><br>Symbol and Construction, Operating Characteristics in Forward and ReverseBias, Applications of Diode as Switch, Clipper, Clamper and Rectifier; SpecialPurpose Diodes: Zener Diode; Optical Diodes like LED, Photo Diode, Laser Diode, Seven Segment Display; Other Diodes like Varactor Diode, Schottky Diode, PIN Diode, Tunnel Diode, Step Recovery Diode. | 06 |
| 3 | **Bipolar Junction Transistor (BJT)**<br><br>History of BJT invention; Types, Symbol, and Construction of BJT; Basic Operation of BJT; BJT Configurations: Common Base, Common Emitter, Common Collector with Operation, Input/output Characteristics; Applicationsof Transistors as Switch and Amplifier. | 06 |
| 4 | **BJT Biasing**<br><br>DC Operating Point, Fixed (Base) Biasing, Emitter Biasing, Voltage Divider Bias, Emitter Feedback Bias, Collector Feedback Bias, Collector and Emitter FeedbackBias. | 07 |
| 5 | **Field Effect Transistor**<br><br>Types, Symbol, Construction, Operation, Input/output Characteristics andApplications of Junction Filed Effect Transistor (JFET), Metal Filed Effect Transistor (MOSFET) | 06 |
| 6 | **Operational Amplifiers**<br><br>Introduction to OpAmp, Differential and Common Mode Operation, OpAmp Basics, Practical OpAmp Circuits, OpAmp Applications as Summer, Integratorand Differentiator | 07 |
| 7 | **Basic of Organic Electronics**<br><br>Introduction, Types of Organic Materials, Organic Electronic Devices, Applications | 06 |
| | **Total Hours** | 42 |

**Suggested Text books / Reference books:**

1. Albert Malvino and David Bates, "Electronics Principles" Tata McGraw-Hill, 7th Edition, 2006.
2. Robert Boylestad and Louis Nashelsky, "Electronic Devices and Circuit Theory", PearsonEducation, 10th Edition, 2009.
3. Hagen Klauk "Organic Electronics: Materials, Manufacturing, and Applications", WILEY – VCH,2006, ISBN: 978-3-527-31264-1
4. Thomas L. Floyd, "Electronics Devices: Conventional Current Version", Pearson Education, 7thEdition, 2008.
5. S Salivahanan and N Suresh Kumar, "Electronics Device and Circuits" Tata McGraw-Hill EducationPrivate Limited, 2nd Edition, 2008.
6. Jacob Milman and Christos C. Halkias, "Electronics Device and Circuits", Tata McGraw-Hill, 3rdEdition, 2008.

**Suggested Theory distribution:**

The suggested theory distribution as per Bloom's taxonomy is as per follows. This distribution serves asguidelines for teachers and students to achieve effective teaching-learning process.

| Distribution of Theory for course delivery and evaluation | | | | | |
|---|---|---|---|---|---|
| Remember | Understand | Apply | Analyze | Evaluate | Create |
| 20% | 20% | 30% | 15% | 10% | 5% |

**Suggested List of Experiments:**

Minimum 12 experiments to be performed during the semester

1. To study and perform the V-I characteristic of Silicon Diode and Zener Diode.
2. To use the Zener Diode as voltage regulator.
3. To use silicon Diode as a Clipper and Clamper.
4. To analyze the Half Wave, Full Wave and Bridge Rectifiers.
5. To study and perform the Input and Output characteristic of BJT.
6. To use Transistor as a Switch.
7. To Analyze CE, CB and CC Amplifier Circuit.
8. To measure the variation of current gain with variation in temperature for different biasing of atransistor.

9. To study and perform the Input and Output characteristic of FET.
10. To study and perform the Input and Output characteristic of MOSFET.
11. To Study and Perform the Common mode and Differential mode of operation for OpAmp.
12. To use OpAmp as summer, Integrator and Differentiator.
13. To test the performance of negative feedback amplifier and compare gain, BW with and without feedback.
14. To Study and Perform Wien Bridge Oscillator.
15. To Analyze Voltage Regulator by using Integrated Circuit.
16. Design a full wave bridge rectifier for input 50 Hz 10Vp-p AC signal and expected output of 5 V DC signal.
17. Design a regulated power supply using Zener diode for input variation of 10 to 20 Vp-p.
18. A silicon diode has a reverse current of 5 μA at 25°C and 100 μA at 100°C. What are the values of the saturation current and the surface-leakage current at 25°C?
19. Demonstrate Automatic street light control system using LED.
20. Design a +5 to +25 V variable power supply.

**Supplementary Resources:**

1. http://textofvideo.nptel.iitm.ac.in/video.php?courseId=117103063
2. https://www.coursera.org/course/eefunlab
3. https://www.coursera.org/course/introtoelectronics
4. https://www.edx.org/course/circuits-electronics-1-basic-circuit-mitx-6-002-1x
5. http://www.learnabout-electronics.org
6. http://www.electronics-tutorials.ws
7. http://101science.com/Radio.htm
8. http://www.electronicsandyou.com

**Marwadi University**
**Faculty of Technology**
**Department of Information and Communication Technology**

## Subject Code: 01MA1101

## Subject Name: Differential and Integral Calculus

## B. Tech. Year – I (Semester I)

**Objective:**

This paper aims to provide an essential background of differential and integral calculus to students ofscience and engineering courses at graduate level. A good science or engineering graduate is expected to have a sound knowledge of these two areas of mathematics as Differential and integral calculus are essential tools for learning Technology, Engineering and Sciences.

**Credits Earned:** 05 Credits

**Course Outcomes:** After completion of this course, student will be able to:

1. Expand functions using Maclaurin’s and Taylor’s series.
2. Apply and solve first order differential equations to real life problems
3. Verify Euler’s theorem and Modified Euler’s theorem for given function of several variable
4. Apply Multiple Integral to evaluate the Surface Area and Volume of any 3D objects
5. Apply the concepts of convergence and divergence of infinite series in problem of science, technology and engineering.
6. Apply the method of Lagrange’s multiplier to solve the problems of constrained optimization.

**Pre-requisite of course:** NA

**Teaching and Examination Scheme:**

| Teaching Scheme (Hours) | | | Credits | Theory Marks | | | Tutorial / Practical Marks | | Total Marks |
|---|---|---|---|---|---|---|---|---|---|
| | | | | E | I | | V | T | |
| Theory | Tutorial | Practical | | ESE | IA | CSE | Viva | Term Work | |
| 04 | 02 | 00 | 05 | 50 | 30 | 20 | 25 | 25 | 150 |

**Contents:**

| Unit | Topics | Hours |
|---|---|---|
| 1 | **Infinite Series**<br>Concept of sequence, nature of infinite series, Properties for convergence,geometric series, Tests for convergence of positive term series. | 10 |
| 2 | **Expansion of functions**<br>Concept of Expansion of functions, Taylor's series expansion, Maclaurin's seriesexpansion | 07 |
| 3 | **Ordinary Differential Equations**<br>Reorientation, order and degree, Variable separable method, Linear differentialequations, Bernoulli's and Exact differential equations. | 10 |
| 4 | **Partial differentiation**<br>Partial derivatives, Euler's theorem, Modified Euler's theorem and their applications, Implicit functions, Chain rule, Total differentials. | 08 |
| 5 | **Applications of Partial differentiation**<br>Errors and approximations, Tangent plane and normal line to a surface, Constrained optimization using Lagrange's multiplier, Jacobian. | 07 |
| 6 | **Multiple Integrals**<br>Calculation of double and triple integrals, reverse the order of integration,Change into polar, spherical and cylindrical coordinates. | 10 |
| | **Total Hours** | 52 |

**Suggested Text books / Reference books:**

1. M. D. Weir et al: Thomas' Calculus, 11th Ed., Pearson Eduaction, 2008.
2. Stewart James: Calculus Early Transcendental, 5th Ed., Thomson India, 2007
3. Wylie & Barrett: Advanced Engineering Mathematics, Mc graw Hill pub.
4. Greenberg M D: Advanced Engineering Mathematics, 2nd ed., Pearson
5. B.S.Grewal: Higher Engineering Mathematics, 43rd ed., Khanna publishers
6. Erwin Kreyszig , Advanced Engineering Mathematics, 9/e, JOHN WILEY & SONS, INC
7. H. K. Dass, Advanced Engineering Mathematics, S Chand Publishing..

**Suggested Theory distribution:**

The suggested theory distribution as per Bloom's taxonomy is as per follows. This distribution serves asguidelines for teachers and students to achieve effective teaching-learning process.

| Distribution of Theory for course delivery and evaluation | | | | | |
|---|---|---|---|---|---|
| Remember | Understand | Apply | Analyze | Evaluate | Create |
| 20% | 20% | 30% | 15% | 10% | 5% |

**Supplementary Resources:**

1. http://mathworld.wolfram.com/
2. http://en.wikipedia.org/wiki/Math

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# Subject Code: 01EE0104

## Subject Name: Electrical Circuits

## B. Tech. Year – I (Semester I)

**Objective:**

Students are expected to learn basics of Electrical Engineering which will help them to apply these concepts in day-to-day life. The course is divided into two parts: DC circuits and AC circuits. Analysis of DC circuit using theorems will useful to solve any electronics network. Grounding and Bonding willensure safe and quality working conditions.

**Credits Earned:** 05 Credits

**Course Outcomes:** After completion of this course, student will be able to:

1. Interpret the role of resistor, capacitor and inductor and their behaviour under various systemconditions.
2. Analyze different types of magnetic circuit.
3. Describe qualitative comparison between AC and DC system.
4. Analyse and solve DC Circuits and AC Circuits with network theorems.
5. Obtain two port parameters of given electric network.
6. Analyse earth resistance to ensure safe and quality working environment.

**Pre-requisite of course:** Basic concepts of Physics

**Teaching and Examination Scheme:**

| Teaching Scheme (Hours) | | | Credits | Theory Marks | | | Tutorial / Practical Marks | | Total Marks |
|---|---|---|---|---|---|---|---|---|---|
| | | | | E | I | | V | T | |
| Theory | Tutorial | Practical | | ESE | IA | CSE | Viva | Term Work | |
| 04 | 00 | 02 | 05 | 50 | 30 | 20 | 25 | 25 | 150 |

**Contents:**

| Unit | Topics | Hours |
|---|---|---|
| 1 | **Fundamentals of DC Circuits**<br>Definition of Current, Voltage, e.m.f., Power, Energy, Resistance, Ohm's Law, Effect of variation in temperature on resistance, Series, Parallel and series- parallel connection of resistances, Comparison between series and parallel circuits, Open circuit and Short circuit, Delta-Star and Star-Delta transformation, Kirchoff's Laws, Nodal Analysis, Mesh Analysis of Electrical Networks | 06 |
| 2 | **Network Theorems**<br>Ideal voltage and current sources, Practical Sources, Dependent Sources: Voltage Dependent Voltage Source, Voltage Dependent Current Source, Current Dependent Voltage Source, Current Dependent Current Source. Network theorems: Superposition Theorem, Thevenin's Theorem, Norton's Theorem, Maximum Power Transfer Theorem, Reciprocity Theorem. | 08 |
| 3 | **Two Port Parameters**<br>Need and application of Two Port parameters: Z-parameters, Y-parameters, h-parameters, ABCD-parameters | 06 |
| 4 | **Magnetic Circuits and Electromagnetics**<br>Definition of quantities related to magnetic circuits, Comparison of electric and magnetic circuits, Concept of Ampere turns, Leakage flux, Magnetization curve Electromagnetic induction, Faraday's Laws, Induced emf and direction of induced emf, self-inductance, mutual inductance, coefficient of coupling, energy stored in magnetic field, Charging and discharging of inductor, magnetic hysteresis, eddy current losses | 06 |
| 5 | **Electrostatics and Capacitance**<br>Electric charge, permittivity, Coulomb's law, Electric Flux, Electric Field, Flux density, Electric field Intensity, Electric potential and potential gradient, Dielectric strength. Capacitor, Types of capacitors, series and parallel connection of capacitors, energy stored in capacitor, charging and discharging of capacitor. | 06 |

| | | |
|---|---|---|
| 6 | **Fundamental of AC Quantities**<br><br>Generation of Alternating voltage and current, Sinusoidal function-Terminologies, Form Factor and Peak Factor, Phase and Phase Difference, Phasor representation of alternating quantities, Phasor addition and subtraction. | 05 |
| 7 | **Analysis of AC circuits**<br><br>Behaviour of purely resistive, inductive and capacitive AC circuits, Phase relation between voltage and current in AC circuit, Power Factor and its significance in series RL circuit, RC and RLC circuit, Active, Reactive and Apparent Power, Series, Parallel and Series-Parallel AC circuits, phasor method, admittance method of analysis of AC circuits. | 07 |
| 8 | **Resonance**<br><br>Introduction, series resonance, selectivity and bandwidth, quality factor, voltage/current magnification, parallel resonance, bandwidth and Q-factor of parallel resonant circuits, Comparison of series and parallel resonance circuits, Application of resonance in Electrical and Electronics Engineering | 03 |
| 9 | **Grounding and Bonding**<br><br>Introduction, Shock and Fire Hazards, National Electrical Code Grounding Requirements, Essentials of a Grounded System, Ground Electrode, Earth Resistance Tests, Earth–Ground Grid Systems, Power Ground System, Signal Reference Ground, Signal Reference Ground Methods, Single-Point and Multipoint Grounding, Ground Loops, Electrochemical Reactions Due to Ground Grids, examples of Grounding Abnormalities or Problems, Loss of Ground Causes Fatality, Stray Ground Loop Currents Cause Computer Damage | 05 |
| | **Total Hours** | 52 |

**Suggested Text books / Reference books:**

1. E. Hughes, ‘Electrical and Electronic Technology’, Prentice Hall India, 10th edition, 2008
2. V.N. Mittal, ‘Basic Electrical Engineering’, Tata Mcgraw-Hill, 2nd edition, 2006.
3. A. Chakrabarti, S. Nath, C. Chanda, ‘Basic Electrical Engineering’, Tata McGrawHill Education India Pvt. Ltd, 2013.
4. B. L. Theraja, ‘Electrical Technology’, S. Chand Publication, 2012.
5. Boylestad, Robert L. Introductory circuit analysis’, Pearson Education India, 2016.
6. Kumar, KS Suresh, ‘Electric circuits and networks’, Pearson Education India, 2009.
7. C. Sankaran, ‘Power Quality’, CRC Press, 2002.

**Suggested Theory distribution:**

The suggested theory distribution as per Bloom's taxonomy is as per follows. This distribution serves asguidelines for teachers and students to achieve effective teaching-learning process.

| Distribution of Theory for course delivery and evaluation | | | | | |
|---|---|---|---|---|---|
| Remember | Understand | Apply | Analyze | Evaluate | Create |
| 15% | 45% | 20% | 15% | 5% | 0% |

**Suggested List of Experiments:**

1. To study and demonstrate function of basic instruments
2. To observe the effect of temperature variation on resistance
3. To determine of B-H curve of magnetic material
4. To determine equivalent capacitance of series and parallel connection of capacitors
5. To determine basic terms of alternating waveform
6. To determine power in a single-phase circuit using wattmeter
7. To determine parameters in series RL, RC and RLC circuit
8. To study and observe series resonance in RLC circuit
9. To verify Superposition theorem
10. To verify Maximum Power Transfer theorem
11. To obtain and verify h-parameter and ABCD-parameters of electric network

**Supplementary Resources:**

1. http://nptel.ac.in/courses/103107081/
2. http://nptel.ac.in/courses/103106109/
3. https://ocw.mit.edu/courses/audio-video-courses/#chemical-engineering

**Marwadi University**
**Faculty of Technology**
**Department of Information and Communication Technology**

# Subject Code: 01CT0103

## Subject Name: Foundation skills in sensor interfacing

## B. Tech. Year – I (Semester I)

**Objective:**

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

1. To stimulate students programming and debugging abilities
2. To improve the logical ability
3. To design programs using open-source integrated development environments and programmable microcontroller-based boards
4. To interface various sensors and modules like IR, ultrasonic, temperature, humidity, accelerometer, gyroscope, etc.
5. To control various aceturates and electronics devices
6. To implement data transfer using various protocols like Bluetooth, Wi-Fi, GSM, etc.

**Credits Earned:** 01 Credit

**Course Outcomes:** After completion of this course, student will be able to:

1. Understand application-based programming concept
2. To create programs for various open-source programmable boards
3. To develop programs for specific requirements with interfacing of various components and modules
4. To develop hardware and software interfacing for engineering applications

**Pre-requisite of course:** NA

**Teaching and Examination Scheme:**

<table>
<tr><th colspan="3" rowspan="2">Teaching Scheme (Hours)</th><th rowspan="3">Credits</th><th colspan="3">Theory Marks</th><th colspan="2">Tutorial / Practical Marks</th><th rowspan="3">Total Marks</th></tr>
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<tr><th>Theory</th><th>Tutorial</th><th>Practical</th><th>ESE</th><th>IA</th><th>CSE</th><th>Viva</th><th>Term Work</th></tr>
<tr><td>00</td><td>00</td><td>02</td><td>01</td><td>00</td><td>00</td><td>00</td><td>25</td><td>25</td><td>50</td></tr>
</table>

**Contents:**

| Unit | Topics | Hours |
|---|---|---|
| 1 | **Open source boards and IDE**<br>Overview, various boards, hardware specifications, components and variouspins, gui of ide, installation of ide, combination of software and hardware, connection with hardware and libraries | 04 |
| 2 | **Programming using IDE**<br>Program structure, data types, variables, constants, operators, control statements, loops, functions, arrays, strings | 08 |
| 3 | **Function libraries**<br>Input and output functions, character functions, math functions, tone generation, communication protocols and trigonometric functions | 04 |
| 4 | **User centric applications**<br>Concept of pulse width modulation, sensors and actuators interfacing, short- range and long-range communication, project implementation and debuggingskills | 12 |
| | **Total Hours** | 28 |

**Suggested Text books / Reference books:**

1. Massimo Banzi, "Getting Started with Arduino", O'Reilly Media, September 2011: Second Edition
2. Michael Margolis, "Arduino Cookbook", O'Reilly Media, March 2011, First Edition
3. Rui Santos and Sara Santos, "Arduino For Beginners"
4. Alan G. Smith, "Intro Arduino Book A piece of cake!"

**Suggested Theory distribution:**

The suggested theory distribution as per Bloom's taxonomy is as per follows. This distribution serves asguidelines for teachers and students to achieve effective teaching-learning process.

| Distribution of Theory for course delivery and evaluation | | | | | |
|---|---|---|---|---|---|
| Remember | Understand | Apply | Analyze | Evaluate | Create |
| 10% | 10% | 30% | 20% | 10% | 20% |

**Suggested List of Experiments:**

Minimum 12 experiments to be performed during the semester

1. Introduction to open source boards and programing IDEs
2. Various pins available on boards and it's functionally
3. Basic programming to interface LEDs and switches
4. Data types and variables, interfacing of LCD Display
5. Operators and control statement, Interfacing of Temperature and Humidity sensors
6. Programming using with Time, Loops and Functions, Interfacing Ultra sonic sensor for distance measurement
7. Use of Strings and arrays in programming
8. Function Libraries installation and use
9. High voltage applications and controlling, Interfacing of DC Motors
10. Speed and intensity control using PWM
11. IR transmitters and receivers applications
12. Robotics application design using servo motor interfacing
13. Integration of communication protocols like bluetooth, Wi-Fi, GSM, etc.
14. Project assessment

**Supplementary Resources:**

1. https://www.arduino.cc/en/Main/Education
2. https://www.tutorialspoint.com/arduino
3. http://tronixstuff.com/tutorials
4. https://www.arduino.cc/en/Guide/HomePage
5. https://startingelectronics.org/software/arduino/learn-to-program-course

## Subject Code: 01CT0101

## Subject Name: Introduction to Computer Programming

## B. Tech. Year – I (Semester I)

**Objective:**

In this basic course, we will move through a number of introductory C concepts, such as basic syntax, looping, arrays, pointers, and elementary functions and data types. The course will also aim to stimulate students into thinking like programmers and provide an understanding of programming techniques that reaches beyond familiarity and basic fluency with the C programming language.

**Credits Earned:** 04 Credits

**Course Outcomes:** After completion of this course, student will be able to:

1. Understand Flowchart, Algorithms and Pseudocode that helps to develop logical base of anyproblem statement
2. Understand the usage of different primitive, derived and user defined datatypes
3. Analyze the use of different conditional and looping control statements in a complex problem
4. Apply the knowledge of decisional control statements to deal with pre-processors, macros, pointers and file management to enhance the coding skills.
5. Apply overall programming knowledge that brings the solution of real-world problems/ usecases

**Pre-requisite of course:** NA

**Teaching and Examination Scheme:**

| Teaching Scheme (Hours) | | | Credits | Theory Marks | | | Tutorial / Practical Marks | | Total Marks |
|---|---|---|---|---|---|---|---|---|---|
| | | | | E | I | | V | T | |
| Theory | Tutorial | Practical | | ESE | IA | CSE | Viva | Term Work | |
| 03 | 00 | 02 | 04 | 50 | 30 | 20 | 25 | 25 | 150 |

**Contents:**

| Unit | Topics | Hours |
|---|---|---|
| 1 | **Introduction to c language**<br>Pseudo code solution to problem, problem solving using flowchart and algorithm, Basic concepts in a C program, Structure of 'C' program, compilation and linking processes, Declaration, Assignment & Print statements, Data Types, operators and expressions, Type Conversion and TypeCasting, Programming examples and exercises | 06 |
| 2 | **Branching and looping**<br>Two-way selection (if, if-else, nested if-else, cascaded if-else), switch statement, ternary operator? Go to, Loops (For, while-do, do-while) in C, break and continue,Programming examples and exercises | 06 |
| 3 | **Arrays and strings**<br>ARRAYS AND STRINGS: Using an array, Using arrays with Functions, Multi- Dimensional arrays. String: Declaring, Initializing, Printing and reading strings,string manipulation functions, String input and output functions, array of strings, programming examples and Exercises. | 06 |
| 4 | **Functions & pointers**<br>FUNCTIONS: Functions in C, Argument Passing – call by value, call by reference, Functions and program structure, location of functions, void and parameter less Functions, Recursion, Programming examples and exercises. POINTERS: Introduction to Pointers, Pointers as Function Parameter, Pointer,Arithmetic, Pointers and Arrays, Function Pointers, Programming examples and exercises. | 07 |
| 5 | **Structure, union & file management**<br>STRUCTURE: Need of Structure, Basic of structures, structure declaration and definition, structures and Functions, Array of structures, structure Data types,type definition, UNION: Union declaration and definition, structure vs union, FILE MANAGEMENT: Introduction to file management and its functions, opening and closing of files, Input and output operations, Programming examples and exercises. | 08 |

| | | |
|---|---|---|
| 6 | **Pointers and preprocessors & data structures** Pointers and address, pointers and functions (call by reference) arguments, pointers and arrays, address arithmetic, character pointer and functions, pointers to pointer, Initialization of pointer arrays, Dynamic memory allocations methods, Introduction to Preprocessors, compiler control Directives, Programming examples and exercises. Introduction to Data Structures: Primitive and non-primitive data types, Abstract data types, Definition and applications of Stacks, Queues, Linked Lists and trees. | 09 |
| | **Total Hours** | 42 |

**Suggested Text books / Reference books:**

1. Paul Deitel, Harvey Deitel, C How to Program, Pearson, 7th edition
2. Pradip Dey & Manas Ghosh, Programming in C, Oxford Publication, 2nd edition
3. Ritchie Dennis M, Kernighan Brain W, C: Programming Language, Prentice Hall Of India Private limited, 2nd edition
4. E. Balagurusamy, Programming in ANSI C, Tata Mcgraw-Hill Publishing Com. Ltd., 7th edition
5. Yashavant P. Kanetkar, Let Us C, BPB Publications, 10th edition
6. E.V. Kameshwar, Numerical techniques in C, BPB Publications
7. Schildt, Herbert, The Complete Reference C, Tata Mcgraw-Hill Publishing Com. Ltd., 4th edition

**Suggested Theory distribution:**

The suggested theory distribution as per Bloom's taxonomy is as per follows. This distribution serves as guidelines for teachers and students to achieve effective teaching-learning process.

| Distribution of Theory for course delivery and evaluation | | | | | |
|---|---|---|---|---|---|
| Remember | Understand | Apply | Analyze | Evaluate | Create |
| 10% | 15% | 30% | 15% | 15% | 15% |

**Suggested List of Experiments:**

Minimum 12 experiments to be performed during the semester

1. Write a program to print student detail.
2. Write a program to calculate simple interest.
3. Write a program that accepts centigrade and convert it into Fahrenheit.
4. Write a program that accepts two numbers in A and B interchange value of A and B variable.
5. Write a program to demonstrate the use of the basic data types int, char and float.
6. Write a program to demonstrate the use of Arithmetic operators by getting two numbers fromthe user
7. Write a program that accepts a number from keyboard and find weather the number is ODD orEVEN using Conditional operators.
8. Write a program to demonstrate the use of increment and decrement operator.
9. Write a program to demonstrate the use of shorthand operators.
10. Write a program to demonstrate the use of sizeof() of operator.
11. Write a program to demonstrate the use of bitwise operators.
12. Write a program that accepts three numbers from the user and print maximum of them.
13. Demonstrate the use of GOTO statement.
14. Write a program to input the Name and the Salary of an Employee. Calculate and print the Name,Salary and Bonus of the Employee, where bonus= 5.3% if salary is at least Rs. 10,000 and 6.5% otherwise.
15. Admission to professional course is subject to the following conditions. Marks in Mathematics>=60
16. Marks in Physics>=50 Marks in Chemistry>=40
17. Total in all three subjects>=200 or total in mathematics and physics>=150
18. Given the marks in the three subjects, write a program to process the application to list theeligible candidates.
19. Write a program that accepts two numbers and one code (1,2,3,4) from the user. According to the code, the operations to be performed, using switch case statements as follows: (Code: 1→ Addition, 2→ Subtraction, 3→ Multiplication, 4→ Division).
20. Write a program that reads the marks for five subjects of a student. Calculate and print the gradefor the student [i.e. Grade A, B, C, D and F] using Else-If ladder.
21. Write a program that do sum=1+3+5+……. N terms Print value of Sum.
22. Write a program to print the Fibonacci Series [i.e. 1,1,2,3,5,8,13…N terms].
23. Write a program to accept one number from the user.
24. Display reverse of that number.
25. Find if it is Armstrong or not.
26. Write a program that accepts a number from the user and print prime numbers from 0 to that number.
27. Write a C program to display various Patterns.
28. Write a program to accept 5 numbers in an array and display it.
29. Write a program to accept 9 numbers in form of matrix and display in matrix form.
30. Write a program to accept 5 numbers in array and find maximum and minimum value of it.
31. Write a program to accept 5 numbers in array and find maximum and minimum value of it.
32. Write a program to sort all elements of 1-D array in ascending and descending order.
33. Write a program to calculate and display addition of two matrix.

34. Write a program to count number of vowels in a given string.
35. Write a program to check whether entered string is palindrome or not.
36. Write a program for string concatenation without using library function.
37. Write a program to demonstrate the Library function for string.
38. Write a function which receives number as argument and return sum of digit.
39. Write a program for calculating Fibonacci series using UDF and call by value
40. Write a program to calculate Factorial using recursion in UDF.
41. Write a program to find Average, maximum and minimum of Array elements using UDF.
42. Write a program to calculate total number of positive, negative and zero value in array using UDF.
43. Write a program to swap two numbers using UDF and pointer.
44. Write a program using pointer to read in an array of integers and print its elements in reverseorder.
45. Write a C program to create a structure of employees with Full Name, Last Name, City and Salary. Display it for n employees.
46. Write a program to demonstrate nested structure. (make structures for circle and rectangle)
47. Write a program to create array of structure. Make a structure for student having student_no, student_name, student_marks.
48. Write a program to create union cricketer having player_name, batting_avg, player_age.P forswapping of two values with help of UDF and call by reference.
49. Write a program to Display contents of a file on screen. Use functions (fopen,fclose, getc,putchar,eof)
50. Write a program to count number of characters in a file.

**Supplementary Resources:**

1. http://nptel.ac.in/courses/106105085/4
2. http://nptel.ac.in/courses/106104128
3. https://ocw.mit.edu/courses/electrical-engineering-and-computer-science/6-087-practical- programming-in-c-january-iap-2010

# Subject Code: 01CT0104

# Subject Name: ICT Workshop

## B. Tech. Year – I (Semester I)

**Objective:**

This course deals with basic introduction of system components of electronic systems, and provides hands on practice in assembling, interconnecting, testing, and repairing such system by making use ofvarious tools. Also, this course will provide a much needed knowledge of computer hardware and networking, enabling them to identify and rectify the onboard computer hardware, software and network related problems. With the help of this course the student will be able to understand the hardware specifications that are required to run operating system and various application programs.

**Credits Earned:** 01 Credits

**Course Outcomes:** After completion of this course, student will be able to:

1. Understand Basic Electronic components and tools.
2. Understand Basic Computer components and tools.
3. The students will apply knowledge of engineering to design and conduct experiments usingPCB design software
4. Identify the existing configuration of the computers and peripherals.
5. Apply their knowledge about computer peripherals to identify / rectify problems onboar
6. Integrate the PCs into local area network and re-install operating system and various application programs.

**Pre-requisite of course:** NA

**Teaching and Examination Scheme:**

| Teaching Scheme (Hours) | | | Credits | Theory Marks | | | Tutorial / Practical Marks | | Total Marks |
|---|---|---|---|---|---|---|---|---|---|
| | | | | E | I | | V | T | |
| Theory | Tutorial | Practical | | ESE | IA | CSE | Viva | Term Work | |
| 00 | 00 | 02 | 01 | 00 | 00 | 00 | 25 | 25 | 50 |

**Contents:**

| Unit | Topics | Hours |
|---|---|---|
| 1 | **Introduction to Basics of Electronic Components and Instruments**<br>Study of electronic components- active & passive, Electronic Instruments: CRO,Function generator, Power Supply, Multi-meter, IC tester. Solder practice | 04 |
| 2 | **Introduction to Computer Components**<br>Basics of computer modules, Understanding the input-Output devices, Understanding the primary and Secondary Storage Memory, Understanding the functionality of ALU | 04 |
| 3 | **Assembling a PC**<br>Assembling various computer parts like Processor (CPU), Computer Case, Optical Drives, Memory, Power Supply, Motherboard, Processor Fan, Case Fan | 05 |
| 4 | **Introduction to various network components**<br>Understanding Network Components like Routers, Hubs, Switch, Bridge,Gateways, NICs, Wireless Access Points, Modems | 05 |
| 5 | **PCB Design Process**<br>Conception Level Introduction: Specifying Parts, Packages and Pin Names, Libraries and Checking foot prints of the components, Partlist, Placing Parts,Routing Traces, Modifying Traces, Mounting Holes, Adding Text, PCB Layout,Pattern Transfer. | 06 |
| 6 | **Installation of operating system**<br>Introduction to Operating systems, Step wise process to install Operating Systems | 04 |
| | **Total Hours** | 28 |

**Suggested Theory distribution:**

The suggested theory distribution as per Bloom's taxonomy is as per follows. This distribution serves asguidelines for teachers and students to achieve effective teaching-learning process.

| Distribution of Theory for course delivery and evaluation | | | | | |
|---|---|---|---|---|---|
| Remember | Understand | Apply | Analyze | Evaluate | Create |
| 10% | 15% | 20% | 20% | 15% | 20% |

**Suggested List of Experiments:**

1. Identify the hardware and software list of the given system.
2. Install and uninstall given software step-by-step.
3. Explain step-by-step installation process for given operating system.
4. Designing single layer PCB and understanding Double layer PCB.

## Subject Code: 01PE0101

## Subject Name: Physical Education/Sports/Yoga

## B. Tech. Year – I (Semester I)

**Objective:** Fitness is the key for any Kind of success, the main aim of this course to make students Fit Mentally and physically by making them participate in different Games which includes Indoor Games and Outdoor Games.

**Credits Earned:** 01

**Course Outcomes:** After completion of this course, student will be able to:

- Students will be able to understand the basic principles and practices of Physical Education, Sports and Yoga.
- Students will be able to instruct the Physical Activities, Sports and Yoga practices for Healthy Living.
- To develop professionalism among students to conduct, organize & officiate Physical Education, Sports and Yoga events at Universities and National Level.
- Students are being given Professional level training in all Games where in they represent the University at national Level.

**Pre-requisite of course:** NA

**Teaching and Examination Scheme:**

| Teaching Scheme (Hours) | | | Credits | Theory Marks | | | Tutorial / Practical Marks | | Total Marks |
|---|---|---|---|---|---|---|---|---|---|
| | | | | E | I | | V | T | |
| Theory | Tutorial | Practical | | ESE | IA | CSE | Viva | Term Work | |
| 00 | 00 | 02 | 01 | 00 | 00 | 00 | 00 | 00 | 00 |

**Contents:**

| Unit | Topics | Hours |
|---|---|---|
| 1 | Introduction to Physical Education/Sports/Yoga | 2 |
| 2 | Health and Wellness | 2 |
| 3 | Adventure Sports | 2 |
| 4 | Sports & Recreation | 2 |
| 5 | Fitness for Careers | 2 |

| | LIST OF SPORTS GAMES (Outdoor) | |
|---|---|---|
| 1 | Foot ball –Basic Skills taught to all students | 3 |
| 2 | Cricket : Basic skills of this Game taught to students | 3 |
| 3 | Basket Ball – Basic skills of this Game taught to students | 3 |
| 4 | Volley Ball - Basic skills of this Game taught to students | 3 |
| 5 | Kabaddi - Basic skills of this Game taught to students | 3 |
| 6 | Yoga _ Basic knowledge of Asanas/ Prayanam | 3 |

**Marwadi University**
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# Subject Code: 01SL0102

## Subject Name: Reading and Writing for Technology

## B. Tech. Year – I (Semester I)

**Objective:**

This course offers an orientation towards reading and writing in technical contexts. It aims at helping learners in acquiring reading and writing ability in English to foster their learning in the specified domain i.e. technology. It engages students through various activities to learn techniques and approaches of reading and writing skills. to develop their reading capability in terms of understanding, identifying, analyzing and critically evaluating texts; to understand and comprehend various forms of writings used in technical education and academic contexts and to develop their writing abilities.

**Credits Earned:** 02 Credits

**Pre-requisite of course:** NA

**Course Outcomes:** After completion of this course, student will be able to:

1. To enhance reading skills for academic purposes
2. To evolve appropriate writing competence for academic purposes
3. To carry out reading and writing tasks in the context of technology and technology related content
4. To express their ideas in formal, academic written form

**Teaching and Examination Scheme:**

| Teaching Scheme (Hours) | | | Credits | Theory Marks | | | Tutorial / Practical Marks | | Total Marks |
|---|---|---|---|---|---|---|---|---|---|
| | | | | E | I | | V | T | |
| Theory | Tutorial | Practical | | ESE | IA | CSE | Viva | Term Work | |
| 02 | 00 | 00 | 02 | 00 | 30 | 20 | 25 | 25 | 100 |

**Contents:**

| Unit | Topics | Hours |
|---|---|---|
| 1 | **Introduction to Technical Communication**<br>History/ Story of Technical Writing, English in Technical Communication | 03 |
| 2 | **Reading Strategies**<br>Know your textbook: Exploring the textbook, its parts and purposes, approachingreading: Reading Strategies, Reading for Various Purposes: reference books, stories, articles, technical surveys, reports, blog posts, & reviews | 12 |
| 3 | **Writing Strategies**<br>Understanding the writing process: Thinking about writing processes, key Attributes of academic and technical texts, Writing process - Visualizing your text Approaching Writing: Writing Strategies, Understanding various forms ofwriting: essay, case study, research paper, term paper, maths/physics problems, lab report, book report/review, surveys, blog posts, & dissertation, Writing for various purposes: essays, writing answers in exam, lab reports, process and instructions, reviews, blog post, & assignments | 13 |
| | **Total Hours** | 28 |

**Suggested Text books / Reference books:**

1. Tavia, Yasmin. "Story of Technical Writing." *YouTube*, 28 March 2016, https://www.youtube.com/watch?v=QomPdtnZa4k. Accessed 30 June 2017.
2. AbodeTCS. "Future of TechComm." *YouTube*, 16 July 2012, https://www.youtube.com/watch?v=dSdhnyDF0YY. Accessed 30 June 2017.
3. Lowe, Janet. *Google Speaks: Secrets of World's Greatest Billionaire Entrepreneurs, Sergey Brin andLarry Page*. John Wiley & Sons, 2009.
4. Howard, Nicole. *The Life Story of a Technology*. Greenwood Press, 2005.
5. "Engineering Stories." Engineering Stories, 2017, https://engineerstories.com/. Accessed 30 June 2017.
6. "10 Breakthrough Technologies 2017." MIT Technology Review, 2017, https://www.technologyreview.com/lists/technologies/2017/. Accessed 30 June 2017.
7. High, Peter. "Top 10 Technology Stories of 2016." Forbes, 4 Jan. 2017, https://www.forbes.com/sites/peterhigh/2017/01/04/top-ten-technology-stories-of-2016/2/#2d72b2be9de7. Accessed 30 June 2017.

8. Teaching and Learning Resources for Me. "Understanding the Purpose of Different Types of Texts." YouTube, 12 Sept. 2015, https://www.youtube.com/watch?v=lZtxWTk7tpk. Accessed 30 June 2017.
9. Galloway, Bek. "Purposes and Text Types." YouTube, 30 Sept. 2016,
10. https://www.youtube.com/watch?v=-LULx42tOA4&t=34s . Accessed 4 July 2017.

**Suggested Theory distribution:**

The suggested theory distribution as per Bloom's taxonomy is as per follows. This distribution serves asguidelines for teachers and students to achieve effective teaching-learning process.

| Distribution of Theory for course delivery and evaluation | | | | | |
|---|---|---|---|---|---|
| Remember | Understand | Apply | Analyze | Evaluate | Create |
| 30% | 30% | 30% | 10% | 0% | 0% |

**Supplementary Resources:**

1. Kane, Thomas S. The Oxford Essential Guide to Writing. Berkeley, 2000
2. Anderson, P. Technical Communication. Harcourt Brace, 1998.
3. Cox, Kathy, and David Hill. Eap Now!: English for Academic Purposes. Pearson Australia, 2011.
4. Doren, Charles Van, and Mortimer J. Adler. How to Read a Book. Washington Square Press, 1974.
5. Emden, Joan Van. Writing for Engineers. Palgrave Macmillan, 2005.
6. Glendinning, Eric H., and Beverly Holmström. Study Reading: A Course in Reading Skills forAcademic Purposes. Cambridge University Press, 2012.
7. Hamp-Lyons, Liz, and Ben Heasley. Study Writing: A Course in Writing Skills for AcademicPurposes. Cambridge University Press, 2013.
8. Langan, John, and Judith Nadell. Doing Well in College: A Concise Guide to Reading, Writing, andStudy skills. McGraw-Hill Book Col., 1980.
9. Vise, David A., and Mark Malseed. The Google Story. Bantam Dell, 2008.

**Marwadi University**
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## Subject Code: 01SL0103

## Subject Name: Speaking and Presentation Skills

## B. Tech. Year – I (Semester I)

**Objective:**

The course intends to make students confident in speaking in English with the help of various language functions. It also focuses on developing students’ presentation skills.

**Credits Earned:** 02 Credits

**Course Outcomes:** After completion of this course, student will be able to:

1. Develop speaking competence for academic purpose
2. Speak on a given topic in the context of technology
3. Express ideas in an organized way for conversations and interactions related to academic requirements
4. Enhance the ability to make a presentation on a given topic

**Pre-requisite of course:** NA

**Teaching and Examination Scheme:**

| Teaching Scheme (Hours) | | | Credits | Theory Marks | | | Tutorial / Practical Marks | | Total Marks |
|---|---|---|---|---|---|---|---|---|---|
| | | | | E | I | | V | T | |
| Theory | Tutorial | Practical | | ESE | IA | CSE | Viva | Term Work | |
| 02 | 00 | 00 | 02 | 00 | 30 | 20 | 25 | 25 | 100 |

**Contents:**

| Unit | Topics | Hours |
|---|---|---|
| 1 | **Speaking/Interacting in an Academic Context**<br>Greetings, introducing self and peers, Asking and sharing information, expressingpoints of view, Discussions, facing viva voce, Group discussions, Facing an interview (interview skills) | 12 |
| 2 | **Effective Presentation Skills**<br>Introduction to effective presentation skills, Preparing the presentation (Collection of Data/Information, exploring the topic etc.), Using ICT for the presentation, getting ready for the presentation, Effective body language, Effective pronunciation, Interacting with the audience (Q & A), Practice (withvideo recording), Feedback and Suggestions | 16 |
| | **Total Hours** | 28 |

**Suggested Text books / Reference books:**

1. TED Talks
2. INK Talks
3. Toastmasters Videos
4. Courtroom Dramas

**Suggested Theory distribution:**

The suggested theory distribution as per Bloom's taxonomy is as per follows. This distribution serves asguidelines for teachers and students to achieve effective teaching-learning process.

| Distribution of Theory for course delivery and evaluation | | | | | |
|---|---|---|---|---|---|
| Remember | Understand | Apply | Analyze | Evaluate | Create |
| 10% | 30% | 30% | 30% | 0% | 0% |

**Supplementary Resources:**

1. “Communication.” the muse. 2017. https://www.themuse.com/tags/communication. Accessed 4July 2017.
2. Presentation Magazine. 2017. https://www.presentationmagazine.com/. Accessed 4 July 2017.
3. “Presentation Skills.” SKILLS YOU NEED. 2017. https://www.skillsyouneed.com/presentation-skills.html. Accessed 4 July 2017.
4. Siddons Suzy. The Complete Presentation Skills Handbook. Kogan Page, 2008.
5. Sprague Jo, and Douglas Stuart. The Speaker’s Handbook. 8th ed., Thomson Wadsworth, 2008.

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## Subject Code: 01EC0102

## Subject Name: Digital Electronics

## B. Tech. Year – I (Semester II)

**Objective:**

1. To understand the basic of Digital Electronic concepts required in analysis and design of digitalelectronic circuits and systems.
2. To understand the number system, logic gates, Boolean algebra, etc.
3. To understand Construction and operation of various digital circuits such as Adder, Subtractor,Multiplexer, Demultiplexer, Decoder, Encoder, Flip-flops, Counters, Registers and memory devices.
4. To devolve the capability to Simplify, Analyze and Design the Various Digital Electronic Circuits.

**Credits Earned:** 04 Credits

**Course Outcomes:** After completion of this course, student will be able to:

1. Develop understanding of basic digital circuits like logic gates, logic families, flip flops andmemory devices.
2. Use knowledge of various number systems and binary codes to solve conversion problems.
3. Apply concepts of Boolean algebra and other minimization techniques for digital circuit design.
4. Design digital circuits using different combinational and sequential logic.
5. Implement various combinational and sequential circuits using appropriate hardware/simulation.

**Pre-requisite of course:**

Elementary knowledge of science and mathematics

**Teaching and Examination Scheme:**

<table>
<tr><td colspan="3" rowspan="2">Teaching Scheme (Hours)</td><td rowspan="3">Credits</td><td colspan="3">Theory Marks</td><td colspan="2">Tutorial / Practical Marks</td><td rowspan="3">Total Marks</td></tr>
<tr><td>E</td><td colspan="2">I</td><td>V</td><td>T</td></tr>
<tr><td>Theory</td><td>Tutorial</td><td>Practical</td><td>ESE</td><td>IA</td><td>CSE</td><td>Viva</td><td>Term Work</td></tr>
<tr><td>03</td><td>00</td><td>02</td><td>04</td><td>50</td><td>30</td><td>20</td><td>25</td><td>25</td><td>150</td></tr>
</table>

**Contents:**

| Unit | Topics | Hours |
|---|---|---|
| 1 | **Number Systems and Codes**<br>Analogue versus Digital, Various Number Systems and Conversion between them, Accuracy of Conversion, Floating-Point Numbers, Various Binary Codes. | 06 |
| 2 | **Digital Arithmetic**<br>Basic Rules of Binary Addition and Subtraction, Binary Addition and Subtraction using Complements, BCD Addition and Subtraction, Binary Multiplication and Division, Floating-Point Arithmetic. | 04 |
| 3 | **Logic Gates and Related Device**<br>Positive and Negative Logic, Various Logics Gates with IEEE/ANSI symbols, Boolean equations, truth table and IC Details. Universal Gates, Gates with OpenCollector/Drain output, Tristate Gates, AND-OR-INVERT Gates, Schmitt Gates, Special Output Gates, Fan-Out of Logic Gates, Buffers and Transceivers | 04 |
| 4 | **Logic Families**<br>Significance of Families, Characteristic Parameters, Types of Logic Families: TTL,ECL, CMOS, Bi-CMOS, NMOS and PMOS, Comparison between various logic families. Interfacing between CMOS and TTL logic families | 03 |
| 5 | **Boolean Algebra and Simplification Techniques**<br>Introduction, Postulates and Theorems, Various types of Boolean expressions,Simplification Techniques - Karnaugh Map Method and Tabulation Method | 04 |
| 6 | **Combinational Logic Circuits**<br>Combinational Circuits and its implementations, Arithmetic Circuits - Adders and Subtractors, BCD Adder, Look-Ahead Carry Generator, ALU, Multiplier, Magnitude comparator. Multiplexer, Encoders, Demultiplexers and Decoders,<br>Parity Generation and Checking. | 08 |
| 7 | **Sequential Logic Circuits**<br>R-S and D Flip-flop, Level Triggered and Edge-Triggered Flip-flops, J-K and T Flip-flop, Synchronous and Asynchronous Input, Flip-flop Timing Parameters, Application of Flip-flop. Ripple Counter, Synchronous Counter, Modulus Counter, Binary Ripple Counter, Synchronous Counters, UP/Down Counters, Decade and BCD Counters, Presettable Counters, Decoding Counter, Cascading Counter, Designing Counter with Arbitrary Sequences, Shift Register, Shift Register Counters, IEEE/ANSI Symbols for counters and Registers. | 10 |

| | | |
|---|---|---|
| 8 | **Memory Devices**<br>Anatomy of Computer, A computer Systems, Computer Memory, RAM andROM, Expanding Memory Capacity | 03 |
| | **Total Hours** | 42 |

**Suggested Text books / Reference books:**

1. Anil K. Maini, "Digital Electronics: Principles, Devices and Applications" Wiley-India Pvt. Ltd, 1stEdition, 2008
2. David J. Comer "Digital Logic & State Machine Design", 3rd Indian Edition, Oxford University Press.
3. M Morris Mano, "Digital Logic and Computer Design", 4th Edition, 2009, Pearson, LPE, R.P.Jain,"Modern Digital Electronics", McGraw-Hill, 4th ed. 2010.
4. Malvino & Leach "Digital Principles and Applications", 7th Edition, McGraw-Hill Education

**Suggested Theory distribution:**

The suggested theory distribution as per Bloom's taxonomy is as per follows. This distribution serves asguidelines for teachers and students to achieve effective teaching-learning process.

| Distribution of Theory for course delivery and evaluation | | | | | |
|---|---|---|---|---|---|
| Remember | Understand | Apply | Analyze | Evaluate | Create |
| 15% | 20% | 30% | 20% | 10% | 5% |

**Suggested List of Experiments:**

Minimum 12 experiments to be performed during the semester

1. Study data sheet of various digital logic circuits and see how to test these circuits using Digital ICTester.
2. Study of Digital IC Testers, Logic State Analyzer and Digital Pattern Generators.
3. Verify the truth tables of various Digital Logic Gates.
4. Verify the application of NAND and NOR logic gates as universal gates.
5. Implementation of Boolean Logic Functions using logic gate ICs.
6. Design and implement digital logic for given case study.
7. Measure digital logic gate specifications such as propagation delay, noise margin, fan in and fanout.
8. Implement various combinational logic circuits such as adder, subtractor, decoder, encoder,multiplexers, demultiplexer, etc.

9. Design any one code converter and implement using discrete ICs on the bread board.
10. Verify operation of SR and JK flipflop.
11. Verify operation of D latch and edge triggered D flipflop.
12. Verify the operation of shift registers.
13. Verify the operation of synchronous counter.
14. Verify the operation of asynchronous counter.
15. Design and Implementation of combinational lock circuit with varying number of bits (For example4, 8 …..)
16. Design and Implementation of visitor counter for Shopping Mall.
17. Design and Implementation of 4 bit Arithmetic and Logic Unit with minimum 4 functions usingdigital integrated circuits.
18. Design and Implementation of a scrolling display.
19. Design and Implement a digital dice which will generate any random number from 1 to 6.
20. Note: A student and faculty may choose any other such problem which includes the concept usedin the course.

**Supplementary Resources:**

1. https://www.javatpoint.com/digital-electronics
2. https://www.geeksforgeeks.org/digital-electronics-logic-design-tutorials/
3. https://www.tutorialspoint.com/digital_circuits/index.htm
4. https://www.coursera.org/learn/digital-systems

**Marwadi University**
**Faculty of Technology**
**Department of Information and Communication Technology**

## Subject Code: 01ME0105

## Subject Name: Engineering Drawing and Computer Aided Design

## B. Tech. Year – I (Semester II)

**Objective:**

Engineering Drawing is an effective language of engineers. It is the Foundation block which strengthens the engineering & technological structure. Moreover, it is the transmitting link betweenideas and realization.

**Credits Earned:** 04 Credits

**Course Outcomes:** After completion of this course, student will be able to:

1. Interpret engineering drawings using fundamental technical mathematics.
2. Construct basic and intermediate geometry.
3. To improve their visualization skills so that they can apply these skills in developing newproducts.
4. To improve their technical communication skill in the form of communicative drawings.
5. To sketch engineering objects in freehand mode.
6. To create 3D computer model and its realization using FDM based 3D printing.

**Pre-requisite of course:** NA

**Teaching and Examination Scheme:**

| Teaching Scheme (Hours) | | | Credits | Theory Marks | | | Tutorial / Practical Marks | | Total Marks |
|---|---|---|---|---|---|---|---|---|---|
| | | | | E | I | | V | T | |
| Theory | Tutorial | Practical | | ESE | IA | CSE | Viva | Term Work | |
| 02 | 00 | 04 | 04 | 50 | 30 | 20 | 25 | 25 | 150 |

**Contents:**

| Unit | Topics | Hours |
|---|---|---|
| 1 | **Introduction to Engineering Drawing & Sketching**<br>Drawing instruments and accessories, BIS –SP 46 and Use of Plane Scale. construction of different polygon, divide the line and angle in parts. | 06 |
| 2 | **Orthographic Projections**<br>Fundamental of projection along with classification, Projections from the pictorial view of the object on the principal planes for view from front, top andsides using first angle projection method and third angle projection method, full sectional view. | 08 |
| 3 | **Isometric Projections and Isometric View or Drawing**<br>Isometric Scale, Conversion of orthographic views into isometric projection, isometric view or drawing. | 08 |
| 4 | **Perspective Sketching**<br>Introduction to perspective drawing, concept of Horizon, vanishing point and eye level, 1-Point, 2-Point perspective sketching, looking Up/Down/Straight ahead, Illumination source and shadow, Perspective distortion, perspective sketching by observation, perspective sketching by imagination, Basics of 3-Point perspective (Bird's eye view) | 18 |
| 5 | **Basics of CAD & 3-D printing**<br>Introduction of CAD tools, Mesh, sketching, extruding using CAD tools, Basics ofFDM based rapid prototyping. | 12 |
| | **Total Hours** | 52 |

**Suggested Text books / Reference books:**

1. Engineering Graphics by Dr. R.L.Jhala- Mc Graw Hill Education Publication, New Delhi.
2. A Text Book of Engineering Graphics by P.J.Shah S.Chand & Company Ltd., New Delhi
3. A text book of Engineering Drawing by R.K.Dhawan, S.Chand & Company Ltd., New Delhi
4. A text book of Engineering Drawing by P.S.Gill, S.K.Kataria & sons, Delhi.
5. Perspective Drawing Handbook by Joseph DÁmelio, Dover Publication
6. Perspective Drawing for Beginners by Len A. Doust, Dover Publication
7. Perspective Made Easy by Ernest Norling, Dover Publication

**Suggested Theory distribution:**

The suggested theory distribution as per Bloom's taxonomy is as per follows. This distribution serves asguidelines for teachers and students to achieve effective teaching-learning process.

| Distribution of Theory for course delivery and evaluation | | | | | |
|---|---|---|---|---|---|
| Remember | Understand | Apply | Analyze | Evaluate | Create |
| 14% | 22% | 22% | 14% | 14% | 14% |

**Suggested List of Activities:**

1. Practice sheet (which includes dimensioning methods, different types of line, construction of different polygon, divide the line and angle in parts)
2. Orthographic projection.
3. Isometric projection.
4. Freehand sketching with 1-Point perspective by observation and imagination.
5. Freehand sketching with 2-Point perspective by observation and imagination.
6. Freehand sketching with 3-Point perspective by observation and imagination.
7. Incorporating shadow and reflection in perspective sketching.
8. CAD tool-based design of simple 3D solid geometry.
9. Design project including Ideation, Visualization, Sketching, CAD modelling and 3D Printing.

**Supplementary Resources:**

1. https://www.designtechcadacademy.com/knowledge-base/introduction-to-cad
2. https://fractory.com/engineering-drawing-basics/
3. https://www.autodesk.in/solutions/technical-drawing
4. https://ocw.mit.edu/courses/mechanical-engineering/2-007-design-and-manufacturing-i-spring- 2009/related-resources/drawing_and_sketching/

**Marwadi University**
**Faculty of Technology**
**Department of Information and Communication Technology**

# Subject Code: 01EN0101

## Subject Name: Basics of Environmental Studies

## B. Tech. Year – I (Semester II)

**Objective:**

Students should gain basic understanding of Environmental Engineering

**Credits Earned:** 02 Credits

**Course Outcomes:** After completion of this course, student will be able to:

1. Understand and realize the multidisciplinary nature of Environment & its components.
2. Know the importance of natural resources for the sustainable development of life.
3. Understand the effect of growing population on the Environment.
4. Classify the different types of pollution and measure to control pollution
5. Learn about the Environmental issues faced globally and various steps taken globally to solvesuch Environmental issues.

**Pre-requisite of course:** NA

**Teaching and Examination Scheme:**

<table>
<tr><td colspan="3" rowspan="2">Teaching Scheme (Hours)</td><td rowspan="3">Credits</td><td colspan="3">Theory Marks</td><td colspan="2">Tutorial / Practical Marks</td><td rowspan="3">Total Marks</td></tr>
<tr><td>E</td><td colspan="2">I</td><td>V</td><td>T</td></tr>
<tr><td>Theory</td><td>Tutorial</td><td>Practical</td><td>ESE</td><td>IA</td><td>CSE</td><td>Viva</td><td>Term Work</td></tr>
<tr><td>02</td><td>00</td><td>00</td><td>02</td><td>50</td><td>30</td><td>20</td><td>00</td><td>00</td><td>100</td></tr>
</table>

**Contents:**

| Unit | Topics | Hours |
|---|---|---|
| 1 | **Introduction and Ecology**<br>Introduction to Environment, Ecology, Ecosystem | 04 |
| 2 | **Population and Environment**<br>Factors Affecting Human Settlement, Define Over Population & Explain the Cause, Effect on Environment & Control of it, Methods of Population forecasting | 05 |
| 3 | **Environmental Resources**<br>Forest resources, Energy resources, Water Resources and Land Resources | 07 |
| 4 | **Environmental Pollution**<br>Water pollution, Air & Noise Pollution, Environmental sinks, solid and hazardous waste, E-waste & Biomedical waste, Introduction to Green chemistry | 07 |
| 5 | **Global Environmental Issues**<br>Greenhouse Effect, Global warming, ozone layer depletion, Climate change, Acid Rain, Global Efforts to control issues | 03 |
| 6 | **Governmental bodies for Environmental protection** | 02 |
| | **Total Hours** | 28 |

**Suggested Text books / Reference books:**

1. Basics of Environmental Studies by U K Khare, 2011 Published by Tata McGraw Hill
2. Environmental Science A Global Concern by William P. Cunningham and Mary Ann CunninghamPublished by Tata Mc Graw Hill

**Suggested Theory distribution:**

The suggested theory distribution as per Bloom's taxonomy is as per follows. This distribution serves asguidelines for teachers and students to achieve effective teaching-learning process.

| Distribution of Theory for course delivery and evaluation | | | | | |
|---|---|---|---|---|---|
| Remember | Understand | Apply | Analyze | Evaluate | Create |
| 30% | 30% | 30% | 5% | 5% | 0% |

# Subject Code: 01CT0106

## Subject Name: Introduction to R and R Studio

## B. Tech. Year – I (Semester II)

**Objective:**

R Programming will help graduates to be competent in Data Manipulation with R programming, Datavisualization, advance analytics topics like regressions, data mining using R Studio. You will work on real life projects and assignments to master data analytics.

**Credits Earned:** 01 Credit

**Course Outcomes:** After completion of this course, student will be able to:

1. Learn Data Science concepts of R and functioning of R-Calculator
2. Learn to create Pie charts, plots and vectors
3. Performing sorting, analyze variance and the cluster
4. ODBC Tables reading, linear and logistic regression
5. Understand database connectivity
6. Understand the applications of machine learning and various prediction models using R

**Pre-requisite of course:** NA

**Teaching and Examination Scheme:**

<table>
<tr><td colspan="3" rowspan="2">Teaching Scheme (Hours)</td><td rowspan="3">Credits</td><td colspan="3">Theory Marks</td><td colspan="2">Tutorial / Practical Marks</td><td rowspan="3">Total Marks</td></tr>
<tr><td>E</td><td colspan="2">I</td><td>V</td><td>T</td></tr>
<tr><td>Theory</td><td>Tutorial</td><td>Practical</td><td>ESE</td><td>IA</td><td>CSE</td><td>Viva</td><td>Term Work</td></tr>
<tr><td>00</td><td>00</td><td>02</td><td>01</td><td>00</td><td>00</td><td>00</td><td>25</td><td>25</td><td>50</td></tr>
</table>

**Contents:**

| Unit | Topics | Hours |
|---|---|---|
| 1 | **Introduction to R and R Studio**<br>Evolution of R, Features of R, R environment set up, installation of R Studio, Introduction to R Studio | 02 |
| 2 | **Basics of R language**<br>Basic Syntax of R, R command Prompt, R script file, comments, R-data types, vectors, Lists, Matrices, Arrays, Factors, Data Frames, Variables | 02 |
| 3 | **Operators in R**<br>Arithmetic Operators, Logical Operators, Relational Operators, Assignment Operators, Miscellaneous Operators | 02 |
| 4 | **R-Decision and Control Loop Statements**<br>if condition, if else condition, switch condition, repeat loop, while loop, for loop, break statement, Next statement | 02 |
| 5 | **Flavors in R**<br>Functions in R, R-Strings, String Manipulations, R-vectors, R-Lists, R-Matrices, R-arrays, R-factors, R-data frames, R-Packages, R-Data Reshaping, R-Excel Files | 04 |
| 6 | **Data Representation using R**<br>R-Pie Chart, R-Bar Chart, R-Histograms R-Line Graphs, R-Scatterplots | 03 |
| 7 | **Statistical Analysis using R**<br>Mean, median and Mode, Linear Regression, Multiple Regression, Logistic Regression, Normal Distribution, Binomial Distribution, Poisson Distribution, Analysis of Covariance, Time Series Analysis, R-Decision Tree, R-Random Forest | 09 |
| | **Total Hours** | 24 |

**Suggested Text books / Reference books:**

1. R Cookbook, Paul Teetor, Pub: Penram International.
2. The Art of R Programming: A Tour of Statistical Software Design, Norman Matloff
3. R for Data Science, Garrett Grolemund and Hadley Wickham
4. Hands-On Programming with R: Write Your Own Functions and Simulations, Garrett Grolemund

**Suggested Theory distribution:**

The suggested theory distribution as per Bloom's taxonomy is as per follows. This distribution serves asguidelines for teachers and students to achieve effective teaching-learning process.

| Distribution of Theory for course delivery and evaluation | | | | | |
|---|---|---|---|---|---|
| Remember | Understand | Apply | Analyze | Evaluate | Create |
| 10% | 15% | 20% | 20% | 15% | 20% |

**Suggested List of Experiments:**

Minimum 12 experiments to be performed during the semester

1. Installation of R studio and understand different sections
2. Explore various Data types in R
3. Explorer various data structures vectors, Lists, Matrices, Arrays, Factors and Data Frames in R
4. Understand distinct Arithmetic Operators, Logical Operators and Relational Operators
5. Use Assignment Operators and Miscellaneous Operators for various types of operations
6. Understand and apply conditional statements in R
7. Use different types of loops for various operations
8. Create functions for given requirements
9. Learn additional special functions for arrays, factors, data frames, and Data Reshaping
10. Understand package and install it with various methods
11. Read data file like csv, xls and access and modify data
12. Plot various types of graphs for various data set
13. Calculate various statistical parameters like mean, median and mode for data
14. Understand Normal Distribution, Binomial Distribution and Poisson Distribution and identify it fordata
15. Advance topics like Time Series Analysis, Decision Tree, and Random Forest

**Supplementary Resources:**

1. https://www.r-project.org/about.html
2. https://www.tutorialspoint.com/r/index.htm
3. https://www.computerworld.com/article/2497143/business-intelligence/business-intelligence- beginner-s-guide-to-r-introduction.html
4. https://www.udemy.com/r-basics/learn/v4/overview
5. https://intellipaat.com/r-programming-certification-training/#course-content

**Marwadi University**
**Faculty of Technology**
**Department of Information and Communication Technology**

## Subject Code: 01MA1151

## Subject Name: Matrix algebra and vector calculus

## B. Tech. Year – I (Semester II)

**Objective:**

This subject aims to provide fundamentals of matrix algebra and vector calculus. The topics deliveredin the paper are essential for almost all science and engineering disciplines.

**Credits Earned:** 05 Credits

**Course Outcomes:** After completion of this course, student will be able to:

1. Explain the linear dependence of vectors of different vector space.
2. Apply the concept of Eigen values and vectors in various field of engineering like control theory, vibration analysis, quantum mechanics etc.
3. Understand role of mathematical modeling in taking care of different issues related to heat transfer, mechanics, momentum, etc.
4. Understand the key role of vector integral calculus in finding flux in vector field, finding potential function, etc.
5. Determine convergence of improper integrals and explain special functions like Beta, Gama and error functions.
6. Apply Gauss elimination to solve linear system of equations.

**Pre-requisite of course:** NA

**Teaching and Examination Scheme:**

| Teaching Scheme (Hours) | | | Credits | Theory Marks | | | Tutorial / Practical Marks | | Total Marks |
|---|---|---|---|---|---|---|---|---|---|
| | | | | E | I | | V | T | |
| Theory | Tutorial | Practical | | ESE | IA | CSE | Viva | Term Work | |
| 04 | 02 | 00 | 05 | 50 | 30 | 20 | 25 | 25 | 150 |

**Contents:**

| Unit | Topics | Hours |
|---|---|---|
| 1 | **Vector space**<br>Vector space, Linear independence of vectors, Basis and dimension of vectorspace, Inner product spaces and their properties. | 08 |
| 2 | **Matrix Algebra - I**<br>Rank and nullity of a matrix, Determination of rank by row operation, Triangularization of matrices by Gauss-elimination process, Computing inverseof a matrix by Row operations, Consistency of system of linear equations. | 08 |
| 3 | **Matrix Algebra-II**<br>Determinant and their properties, Cofactors of $n \times n$ determinant, Eigen valuesand eigen vector of matrix, Cayley - Hamilton theorem, Quadratic and Canonical forms, special matrices and their properties. | 08 |
| 4 | **Vector differential calculus**<br>Recall the concept of vector algebra, Scalar and vector functions, gradient of a scalar point functions, Divergence and Curl of a vector point function, Physical meaning of gradient, divergence and curl, directional derivatives, Conservative vector fields, Irrotational and Solenoidal function. | 10 |
| 5 | **Vector Integral calculus**<br>Line integrals, Path Independence of Line Integrals, Concept of surface integrals, Green's theorem, Stoke's theorem and Divergence theorem. | 10 |
| 6 | **Improper integrals**<br>Improper integrals of type I and type – II, Convergence of Improper integrals,Beta, Gamma and error functions with properties. | 10 |
| | **Total Hours** | 54 |

**Suggested Text books / Reference books:**

1. M. D. Weir et al: Thomas' Calculus, 11th Ed., Pearson Eduaction, 2008.
2. Stewart James: Calculus Early Transcendental, 5th Ed., Thomson India, 2007
3. Wylie & Barrett: Advanced Engineering Mathematics, McGraw-Hill pub.
4. Greenberg M D: Advanced Engineering Mathematics, 2nd ed., Pearson
5. Erwin Kreyszig , Advanced Engineering Mathematics, 9/e, John Wiley, INC
6. H. K. Dass, Advanced Engineering Mathematics, S Chand Publishing.

**Suggested Theory distribution:**

The suggested theory distribution as per Bloom's taxonomy is as per follows. This distribution serves asguidelines for teachers and students to achieve effective teaching-learning process.

| Distribution of Theory for course delivery and evaluation | | | | | |
|---|---|---|---|---|---|
| Remember | Understand | Apply | Analyze | Evaluate | Create |
| 20% | 25% | 30% | 15% | 10% | 0% |

**Supplementary Resources:**

1. http://mathworld.wolfram.com/
2. http://en.wikipedia.org/wiki/Math

**Marwadi University**
**Faculty of Technology**
**Department of Information and Communication Technology**

## Subject Code: 01CT0105

## Subject Name: Object Oriented Programming

## B. Tech. Year – I (Semester II)

**Objective:**

1. To gain knowledge about basic Java language syntax and semantics to write Java programs anduse concepts such as variables, conditional and iterative execution methods etc.
2. To understand the fundamentals of object-oriented programming in Java, including definingclasses, objects, invoking methods etc and exception handling mechanisms
3. To understand the principles of inheritance, packages and interfaces
4. To understand Multithreading and I/O files in Java
5. To understand the fundamental of AWT, SWING and Graphics based window
6. To understands Collection of classes and basic java utensils packages

**Credits Earned:** 04 Credits

**Course Outcomes:** After completion of this course, student will be able to:

1. Use Object Oriented Programming concepts for problem solving.
2. Apply OOP principles to create java application programs and proper program structuring.
3. Ensure design stability for various applications- by applying exception handling and inheritance
4. Implement multithreading, Interfaces and class collection with the help of Utensils packageand Construct GUI and I/O based window application.
5. Analyze the various techniques of OOP to reduce programming complexity.

**Pre-requisite of course**: Basic knowledge of C

**Teaching and Examination Scheme:**

| Teaching Scheme (Hours) | | | Credits | Theory Marks | | | Tutorial / Practical Marks | | Total Marks |
|---|---|---|---|---|---|---|---|---|---|
| | | | | E | I | | V | T | |
| Theory | Tutorial | Practical | | ESE | IA | CSE | Viva | Term Work | |
| 03 | 00 | 02 | 04 | 50 | 30 | 20 | 25 | 25 | 150 |

**Contents:**

| Unit | Topics | Hours |
|---|---|---|
| 1 | **Introduction to object-oriented programming**<br>Object oriented paradigm, object and classes, data abstraction and encapsulation, inheritance, polymorphism, dynamic binding, benefits and application of OOP. | 03 |
| 2 | **Java evaluation and overview**<br>Java evaluation: Java History, Java features, difference with other language, javawith internet, www and web browsers, Java environment, JDK Java overview: Java program structure, java program implementation on various IDE's like NetBeans and Eclipse, Byte Code and JVM. | 02 |
| 3 | **Strings**<br>String class, String Buffer class, Operations on string, Command line argument, Use of Wrapper Class. | 02 |
| 4 | **Object, Classes and Methods**<br>Introduction to class, objects, members data and member functions, declaration of fields and methods, accessing class members, constructors and destructors, method overloading, static members, Inheritance, method overriding, final variable, final member, final class, finalizer methods, Abstract method and class, Visibility modifiers in classes. | 06 |
| 5 | **Interfaces (Multiple Inheritance)**<br>Introduction to interface, declaration of interface, extending interface, implementing interface, accessing interface variables. | 04 |
| 6 | **Java Packages**<br>Introduction and declaration of Packages in Java, creating and accessing package, adding class to a package, static import. | 02 |
| 7 | **Errors and Exception Handling in Java**<br>Types of Errors, Exceptions, syntax of exception handling code, single and multiple catch statements, importance and execution of throws and Finallystatement, Built in Exception, Custom exception, Throwable Class. | 04 |

| | | |
|---|---|---|
| 8 | **Collection Framework**<br>Collection Framework, Collection interface, Set and List interfaces, Map interface Generics in the Collection Framework | 03 |
| 9 | **Multithreaded Programming**<br>Introduction to thread, Creating and Extending thread class, stopping and blocking thread class, Life cycle of thread, thread exception, thread priority, Synchronization, implementing "Runnable" interface, Introduction to JavaBeansand Network Programming | 05 |
| 10 | **Managing I/O file in Java**<br>Concept of Stream and Stream classes, Byte Stream, Input/output Stream, Characters Stream, Reader Stream, Writer Stream, File Class, File Input Stream,File Output Stream, Input Stream Reader, Output Stream Writer | 03 |
| 11 | **GUI**<br>Comparing AWT and swing features, AWT Components, Overview of the AWT components, Component properties, Graphics context, Containers, Container class, Layout Managers, Top-level containers, Window class, Decorated windowsFrame and Dialog, Panel class, Events, Event Delegation Model, AWT Events, Adapter classes, Swing and MVC, J component, J option Pane, Showing Message,Confirm and Input Dialogs | 08 |
| | **Total Hours** | 42 |

**Suggested Text books / Reference books:**

1. Programming with Java A Primer, E.Balaguruswamy, Fourthedition, Mc Grawhill.
2. The Complete Reference, Java 2, Herbert Schild, Tata McGraw-Hill
3. Java Fundamentals A comprehensive introduction, Herbert Schildt, Dale Skrien, McGraw HillEducation.
4. Object Oriented Modeling and Design with UML, Michael Blaha and James Rambaugh, Pearson

**Suggested Theory distribution:**

The suggested theory distribution as per Bloom's taxonomy is as per follows. This distribution serves asguidelines for teachers and students to achieve effective teaching-learning process.

| Distribution of Theory for course delivery and evaluation | | | | | |
|---|---|---|---|---|---|
| Remember | Understand | Apply | Analyze | Evaluate | Create |
| 15% | 15% | 30% | 15% | 10% | 15% |

**Suggested List of Experiments:**

Minimum 12 experiments to be performed during the semester

1. Use eclipse or Netbean platform and acquaint with the various menus, create a test project, adda test class and run it see how you can use auto suggestions, auto fill. Try code formatter and code refactoring like renaming variables, methods and classes. Try debug step by step with a small program ofabout 10 to 15 lines which contains at least one if else condition and a for loop.
2. Write a Java program that works as a simple calculator. Use a grid layout to arrange buttons for the digits and for the +, -,*, % operations. Add a text field to display the result. Handle any possible exceptions like divide by zero.
3. Develop an applet that displays a simple message
4. Develop an Applet that receives an integer in one text field & compute its factorial value & returnsit in another text filed when the button "Compute" is clicked
5. Write a program that creates a user interface to perform integer divisions. The user enters two numbers in the text fields, Num1 and Num2. The division of Num1 and Num2 is displayed in the Result field when the Divide button is clicked. If Num1 or Num2 were not an integer, the program would throw a NumberFormatException. If Num2 were Zero, the program would throw an Arithmetic Exception Displaythe exception in a message dialog box
6. Write a java program that implements a multi-thread application that has three threads. First thread generates random integer every 1 second and if the value is even, second thread computes the square of the number and prints. If the value is odd, the third thread will print the value of cube of the number.
7. Write a java program that connects to a database using JDBC and does add, deletes, modify and retrieve operations
8. Write a java program that simulates a traffic light. The program lets the user select one of three lights: red, yellow, or green with radio buttons. On selecting a button, an appropriate message with "stop"or "ready" or "go" should appear above the buttons in a selected color. Initially there is no message shown.

9. Write a java program to create an abstract class named Shape that contains two integers and anempty method named printArea(). Provide three classes named Rectangle, Triangle and Circle such that each one of the classes extends the class Shape. Each one of the classes contain only the method printArea( ) that prints the area of the given shape.
10. Suppose that a table named Table.txt is stored in a text file. The first line in the file header and the remaining lines correspond to row in the table. The elements are separated by commas. Write a Javaprogram to display the table using labels in grid layout.
11. Write a Java program that handles all mouse events and shows the event name at the center of the window when a mouse event is fired. (Use adapter classes)
12. Write a java program that loads names and phone numbers from a text file where the data is organized as one line per record and each field in a record are separated by a tab (\t).it takes a name or phone number as input and prints the corresponding other value from the hash table(hint: use hash tables)
13. Implement the above program with database instead of a text file.
14. Write a java program that takes tab separated data (one record per line) from a text file and inserts them into a database
15. Write a java program that prints the meta-data of a given table.
16. Write a Java program that prints all real solutions to the quadratic equation ax 2 +bx+c = 0. Readin a, b, c and use the quadratic formula. If the discriminate b2 -4ac is negative, display a message stating that there are no real solutions?
17. The Fibonacci sequence is defined by the following rule. The first 2 values in the sequence are 1,
1. Every subsequent value is the sum of the 2 values preceding it. Write a Java program that uses bothrecursive and non-recursive functions to print the nth value of the Fibonacci sequence?
18. Write a Java program that prompts the user for an integer and then prints out all the primenumbers up to that Integer?
19. Write a Java program that checks whether a given string is a palindrome or not. Ex: MADAM is apalindrome?
20. Write a Java program for sorting a given list of names in ascending order?
21. Write a Java program to multiply two given matrices?
22. Write a Java program that reads a line of integers and then displays each integer and the sum of all integers. (use StringTokenizer class)?
23. Write a Java program that reads on file name from the user, then displays information about whether the file exists, whether the file is readable, whether the file is writable, the type of file and the length of the file in bytes?
24. Write a Java program that reads a file and displays the file on the screen, with a line number before each line?
25. Write a Java program that displays the number of characters, lines and words in a text.

**Supplementary Resources:**

1. https://ocw.mit.edu/courses/electrical...and.../6...programming.../lecture-14/
2. https://beginnersbook.com/2013/04/oops-concepts/
3. www.oracle.com/technetwork/java/oo-140949.html
4. nptel.ac.in/courses/106106147/3

**Marwadi University**
**Faculty of Technology**
**Department of Information and Communication Technology**

## Subject Code: 01CR0103

## Subject Name: Value Education

## B. Tech. Year – I (Semester II)

**Objective:**

This course shall enrich students’ value system, creativity, competence and confidence. It will enhance the softer aspects of life skills of students through the games, activities, group interactionsand videos.

**Credits Earned:** 02 Credits

**Course Outcomes:** After completion of this course, student will be able to:

1. Understand importance of role of Values in developing self
2. Inculcate right values, ethics, attitudes, manners and behaviors for life
3. Respond and relate with expectations, competitions and power of networking
4. Apply the values in order to live a positive, healthy and productive life
5. Understand the significance of having appropriate attitude and balance towards work life as well as personal life.

**Pre-requisite of course:** NA

**Teaching and Examination Scheme:**

| Teaching Scheme (Hours) | | | Credits | Theory Marks | | | Tutorial / Practical Marks | | Total Marks |
|---|---|---|---|---|---|---|---|---|---|
| | | | | E | I | | V | T | |
| Theory | Tutorial | Practical | | ESE | IA | CSE | Viva | Term Work | |
| 02 | 00 | 00 | 02 | 00 | 00 | 00 | 50 | 50 | 100 |

**Contents:**

| Unit | Topics | Hours |
|---|---|---|
| 1 | **Personality Attributes**<br>Experiencing worth of important personality attributes i.e Taking Initiatives,Thinking on the feet etc through Games | 02 |
| 2 | **Values of Honesty and Integrity as corner stone in one's career and Life**<br>Experiencing incidence and case studies related to Honesty, Integrity and HumanValues in work set up. | 02 |
| 3 | **Value of Creativity in one's career and Life**<br>Building an attitude of creativity, thinking out of the box and inculcate virtue ofexploration and innovation in various aspects of life. | 02 |
| 4 | **Values to self-sustenance in difficult times and failures**<br>To Understand failure as stepping stone towards success, its inevitability andearning life lessons which makes an individual well equipped to deal with uncertainties of life. | 02 |
| 5 | **Role of emotions in one's professional life**<br>Importance of building sound EQ with IQ, Understanding the causes and effectsof emotions in life. | 02 |
| 6 | **Workplace values 1 – Manners**<br>Understanding workplace as a second home and source of livelihood, inculcatespirit of belongingness towards work and exhibit sound manners that projects work place with dignity | 02 |
| 7 | **Workplace values 2 – People, Policy and organization**<br>Understanding the importance of policies and people, ideal code of conduct at Workplace, building rapport with colleagues, sound behaviors with various stakeholders within the organization | 02 |
| 8 | **Value for students' life 1 - Power of Positivity**<br>Importance of optimism in life, developing right kind of attitude towards self- career and others. Power of generating right kind of thoughts that translates inright actions and behaviors. | 02 |

| | | |
|---|---|---|
| 9 | **Value for students' life 2 - Healthy Lifestyle**<br>Importance of fitness in life and career. Importance of regular exercising an taking up a sport. Focusing upon eating and sleeping habits that result in physical performance as body is considered to be the temple of soul. | 02 |
| 10 | **Value for students' life 3 – Create First Impression**<br>Understanding the importance of making right impressions while in public, how to speak/introduce self, basic understanding of dress code, voice tone and bodylanguage | 02 |
| 11 | **Understanding hazards of Social Networking sites**<br>Developing sound habits, breaking bad habits, understanding hazards of badhabits and excess of social media in life. | 02 |
| 12 | **Creating Value through Social Networking sites (Linked-In and Quora)**<br>To ensure that technology is used to build bridges and not the barriers, focusingupon the career and importance of associating with right content in the virtual world. (LinkedIn, Quora, GD communities, India Bix, Bodhi Booster) | 02 |
| 13 | **Performance Values 1- How to avoid Procrastination**<br>Value and Importance of Time, Cause and effect of procrastination, How tomaximize the day, Importance of setting up to –do lists and task lists | 02 |
| 14 | **Performance Values 2- How to manage Pressure Situations (Exams and Evaluations)**<br>**Handling anxi**ety, Value of planning and smart work, ensuring right state of mindand tips for a successful show. | 02 |
| | **Total Hours** | 28 |

**Suggested Text books / Reference books:**

1. Creating Values in Life: Personal, Moral, Spiritual, Family and Social Values – By Ashok Gulla
2. Teaching Your Children Values – By Linda and Richard Eyre
3. The Book of Virtues for Young People – William J. Bennett
4. The Monk who sold His Ferrari – By Robin Sharma
5. Seven habits of Highly Effective People – By Dr. Stephen R Covey
6. Stop Worrying & Start Living – By Dale Carnegie
7. Eat that Frog – By Brian Tracy

**Suggested Theory distribution:**

The suggested theory distribution as per Bloom’s taxonomy is as per follows. This distribution serves asguidelines for teachers and students to achieve effective teaching-learning process.

| Distribution of Theory for course delivery and evaluation | | | | | |
|---|---|---|---|---|---|
| Remember | Understand | Apply | Analyze | Evaluate | Create |
| 20% | 20% | 30% | 15% | 10% | 5% |

**Marwadi University**
**Faculty of Technology**
**Department of Information and Communication Technology**

## Subject Code: 01MA0231

## Subject Name: Discrete Mathematics and Graph Theory

## B. Tech. Year – II (Semester III)

**Objective:**

Engineering Mathematics is one of the very useful tool for learning Technology, Engineering and Sciences. In this course Learners will come across a number of standard concepts which helps themto solve core real world problems. This course is aimed to cover a variety of different concepts in Graph Theory. Theorems will be stated and proved formally using various Mathematical rules.
Various graphs algorithms will also be discussed along with detail analysis.

**Credits Earned:** 05 Credits

**Course Outcomes:** After completion of this course, student will be able to:

1. Understand graphs, Logic and Lattices.
2. Apply abstract concept of Predicate in design of computing machines, data structures forprogramming languages.
3. Apply concept of Boolean algebra in switching theory and building basic electronic circuits.
4. Apply concepts of Kruskal's algorithm to find the shortest possible distance between twoobjects.
5. Apply concepts of graph theory in data mining and networking.

**Pre-requisite of course:** NA

**Teaching and Examination Scheme:**

| Teaching Scheme (Hours) | | | Credits | Theory Marks | | | Tutorial / Practical Marks | | Total Marks |
|---|---|---|---|---|---|---|---|---|---|
| | | | | E | I | | V | T | |
| Theory | Tutorial | Practical | | ESE | IA | CSE | Viva | Term Work | |
| 04 | 02 | 00 | 05 | 50 | 30 | 20 | 25 | 25 | 150 |

**Contents:**

| Unit | Topics | Hours |
|---|---|---|
| 1 | **Logic and Predicates**<br>Introduction, Logical expressions and Operators, Predicates, Rules of quantifiers,Rules of Inference for predicates and propositions. | 08 |
| 2 | **Lattices**<br>Different types of Relations, Partially ordered set, Hasse diagram, Lattice as Partially ordered set, Properties of lattices, Lattice as an algebraic system, Concept of Duality | 09 |
| 3 | **Boolean Algebra**<br>Introduction to Boolean algebra and properties, Sub-Boolean algebra, Atoms and anti-atoms, Boolean Expression and It's equivalences, Minterms and Maxterms, Values of Boolean expressions, Canonical forms, Karnaugh map | 09 |
| 4 | **Graphs and Trees**<br>Introduction to graph theory, degree and incidence, walks, paths, circuits, Reachability in Graphs , Hamilton Graphs and Euler Graphs, Introduction to Acyclic Graph(Tree) and its properties, Binary tree, Spanning Tree and MinimalSpanning Tree. | 09 |
| 5 | **Representation Graph using Matrix**<br>Edge and vertex connectivity, Separability, Fundamental cycles and cut sets Graph Isomorphism : 1-Isomorphic and 2-Isomorphic Graphs, Matrix form ofgraphs, Adjacency and Incidence matrix, Dijkstra's Algorithm. | 08 |
| 6 | **Planar and Non-planar Graphs**<br>Planar and Non-planar Graphs, Stereographic Graph embedding on a sphere, Kurtowski's first and second graphs, Euler's formula, Detection of planarity andelementary reduction. | 09 |
| | **Total Hours** | 52 |

**Suggested Text books / Reference books:**

1. Rosen Kenneth: Discrete Mathematics and its Applications. McGraw Hill Publication- New Delhi.
2. Stanat and McAlister: Discrete Mathematics for Computer Science, PHI
3. Narsingh Deo: Graph Theory with Applications to Engineering and Computer Science, PHI, 1974.
4. B.Kolman and R.C. Busby: Discrete Mathematical Structures for Computer Science, Prantice Hall,New-Delhi.
5. J.P. Tremblay and Manohar: Discrete Mathematical Structures with Application to ComputerScience, McGraw Hill Publication- New Delhi.
6. S. Malik and M. K. Sen: Discrete Mathematics, Cengage Learning India Pvt. Ltd.

**Suggested Theory distribution:**

The suggested theory distribution as per Bloom's taxonomy is as per follows. This distribution serves asguidelines for teachers and students to achieve effective teaching-learning process.

| Distribution of Theory for course delivery and evaluation | | | | | |
|---|---|---|---|---|---|
| Remember | Understand | Apply | Analyze | Evaluate | Create |
| 20% | 20% | 30% | 15% | 10% | 5% |

**Supplementary Resources:**

1. www.tutorialspoint.com/graph_theory
2. www.ied.edu.hk/has/phys/de/de-ba.htm

## Subject Code: 01CT0301

## Subject Name: Computer Organization and Architecture

## B. Tech. Year – II (Semester III)

**Objective:**

To conceptualize the concepts of organizational and architectural issues of a digital computer. Further, analyze performance issues in processor and memory design of a digital computer. Also, understanding various data transfer techniques in digital computer and to analyze processor performance improvement using instruction level parallelism.

**Credits Earned:** 04 Credits

**Course Outcomes:** After completion of this course, student will be able to:

1. To apply knowledge of the processor's internal registers and operations by use of a PC based microprocessor simulator.
2. Understand and describe the basics of various architectural units of the Computer System.
3. Apply the knowledge of combinational and sequential logical circuits to mimica simple computer architecture.
4. List and specify the various features of microprocessor, memory and I/O devices including concepts of system bus.
5. To write assembly language programs and download the machine code that will provide solutions to real-world control problems.
6. Recognize the importance of parallelism and stall in computer architecture.

**Pre-requisite of course:** Digital Electronics

**Teaching and Examination Scheme:**

| Teaching Scheme (Hours) | | | Credits | Theory Marks | | | Tutorial / Practical Marks | | Total Marks |
|---|---|---|---|---|---|---|---|---|---|
| | | | | E | I | | V | T | |
| Theory | Tutorial | Practical | | ESE | IA | CSE | Viva | Term Work | |
| 03 | 00 | 02 | 04 | 50 | 30 | 20 | 25 | 25 | 150 |

**Contents:**

| Units | Topics | Hours |
|---|---|---|
| 1 | **Introduction to Computer Architecture**<br>Basic computer data types, Instruction codes, Instruction cycle, Computer registers, computer instructions, Timing and Control, Memory-Reference Instructions, Input-output and interrupt, Complete computer description, Design of Basic computer | 06 |
| 2 | **Introduction to Computer Organization**<br>Instruction codes, Computer registers, Computer instructions, Timing and Control,Instruction cycle, Memory-Reference Instructions, Input-output and interrupt, Complete computer description. | 05 |
| 3 | **Fundamentals of Micro programmed Control**<br>Control Memory, Address sequencing, Micro program Example, design of controlUnit | 04 |
| 4 | **Concepts of Central Processing Unit**<br>Introduction, General Register Organization, Stack Organization, Instruction format, Addressing Modes, data transfer and manipulation, Program Control,Reduced Instruction Set Computer (RISC) | 07 |
| 5 | **Computer Arithmetic**<br>Introduction, Addition and subtraction, Multiplication Algorithms (Booth Multiplication Algorithm), Division Algorithms, Floating Point Arithmetic operations, Decimal Arithmetic Unit. | 07 |
| 6 | **Introduction to Pipeline**<br>Flynn's taxonomy, Parallel Processing, Pipelining, Arithmetic Pipeline, Instruction, Pipeline, RISC Pipeline | 04 |
| 7 | **Input-Output Organization**<br>Input-Output Interface, Asynchronous Data Transfer, Modes Of Transfer, DMA, Input-Output Processor (IOP), Priority Interrupt, CPUIOP Communication, SerialCommunication. | 05 |
| 8 | **Memory Organization**<br>Memory Hierarchy, Main Memory, Auxiliary Memory, Associative Memory,Cache Memory, Virtual Memory. | 04 |
| | **Total Hours** | 42 |

**Suggested Text books / Reference books:**

1. M. Morris Mano, Computer System Architecture, Pearson
2. Andrew S. Tanenbaum and Todd Austin, Structured Computer Organization, Sixth Edition, PHI
3. M. Murdocca & V. Heuring, Computer Architecture & Organization, WILEY
4. John Hayes, Computer Architecture and Organization, McGraw Hill

**Suggested Theory distribution:**

The suggested theory distribution as per Bloom's taxonomy is as per follows. This distribution serves asguidelines for teachers and students to achieve effective teaching-learning process.

| Distribution of Theory for course delivery and evaluation | | | | | |
|---|---|---|---|---|---|
| Remember | Understand | Apply | Analyze | Evaluate | Create |
| 20% | 20% | 30% | 15% | 10% | 5% |

**Suggested List of Experiments:**

1 Introduction to 8085 Microprocessor Trainer board with explanation of necessary hardware connection with microprocessor.

2 Data Transfer (Copy) Operations

A. Write the data 41h into register C and copy it to Accumulator
B. Load Register H with 34h and Register L with ABh.
C. Copy 32h in all the Registers.
D. Load accumulator with the content of memory whose address is D000h using three different techniques.

Exchange the content of memory location D000h and D001h using direct addressing and indirect addressing.

3 Arithmetic Operations

A. .Load Register B and C with 55h and 66h. Add Register B, C and store the result in Register D.
B. Add two 16 bit numbers with and without using DAD.
   a. (HL+BC and store the answer in HL)
C. Add the content of memory location D000h, D001h and store the result at memory locations D040h and D041H.
D. Transfer the array(3 byte) of data starting from D000h to the locations starting from D050h by memory pointer with and without LDA/STA.
E. Subtract two 16 bit numbers. (HL-BC and store answer in HL)

4
A. 1.Assume register B holds 93h and the accumulator holds 15h.illustrate the result of instruction ORA B, XRA B and CMA.
B. 2.Load the data byte 8EH in register D and F7H in register E. Mask the higher order bits (D7-D4) from both the data bytes.

5 Write an assembly language program to generate time delay using following threedifferent approaches.

No need to generate specific delay. You can load the value of your choice.

A. 1.Using a simple Register
B. 2.Using Register Pair
C. 3.Using loop within a loop

6 Write an assembly language program to count from 0 to 9(modulo 10 counter) with some delay between each count. Also display the count at output port 00H. At the count of 9 the counter should reset to 0 and repeat the sequence continuously.

7 Write an assembly language program to clear all the flag bits in flag register. Use the concept of PUSH and POP instruction to demonstrate this task.
Load the accumulator with 00H. Logically OR the accumulator with itself to set zero flag and display flag bits on port 01H.

8 Write an assembly language program to convert a BCD number into Binary.
Assume any two digit number of your choice as an input BCD number.

9 Write an assembly language program to convert a binary number into un-packed BCD number.Assume any binary number available in memory.

10 Write an assembly language program to convert a packed BCD number into seven segment code and display. Use common cathode type seven segment display. Assume the packed BCDnumber is available in memory.

11 Write an assembly language program to

A. Multiply two 8-bit numbers stored in Register A & Register B.
B. Divide two 8-bit numbers stored in Register A & Register B.

12 Write an assembly language program to

A. Find out largest number from given array stored at 5 consecutive memory locationsstarting from C030H and store the result to memory location C040h.
B. Find out smallest number from given array stored at 5 consecutive memory locations
starting from C030H and store the result to memory location C040h.

**Supplementary Resources:**

1. https://www.javatpoint.com/computer-organization-and-architecture-tutorial
2. https://www.geeksforgeeks.org/computer-organization-and-architecture-tutorials/ 3. https://nptel.ac.in/courses/106/103/106103068/
4. https://tutorialspoint.dev/computer-science/computer-organization-and-architecture
5. https://www.studytonight.com/computer-architecture/

Marwadi University
Faculty of Technology
Department of Information and Communication Technology

# Subject Code: 01CT0303

## Subject Name: Introduction to Communication Engineering

## B. Tech. Year – II (Semester III)

**Objective:**

This course explores the fundamentals of electronic communication systems it provides the basic knowledge of Analog and Digital transmission, multiplexing, Transmission medium and reception. Italso provides a brief overview of satellite and fiber optics communication.

**Credits Earned:** 04 Credits

**Course Outcomes:** After completion of this course, student will be able to:

1. Understand various concepts of Signals, data communication, networking, switching techniques, transmission media and communication systems
2. Compare various analog to analog, analog to digital, digital to analog and digital to digitalmodulation techniques
3. Analyze various concepts and methods for enhancement of channel capacity
4. Analyze performance parameters of radio receiver
5. Understand concepts of optical and satellite communication system

**Pre-requisite of course:**

Basic electronics, Digital Electronics, and Basic Mathematics

**Teaching and Examination Scheme:**

| Teaching Scheme (Hours) | | | Credits | Theory Marks | | | Tutorial / Practical Marks | | Total Marks |
|---|---|---|---|---|---|---|---|---|---|
| | | | | E | I | | V | T | |
| Theory | Tutorial | Practical | | ESE | IA | CSE | Viva | Term Work | |
| 03 | 00 | 02 | 04 | 50 | 30 | 20 | 25 | 25 | 150 |

**Contents:**

| Unit | Topics | Hours |
|---|---|---|
| 1 | **Introduction to Electronic Communication** Significance of Human Communication, Communication systems, Types of electronic Communication, Modulation and Multiplexing, The electromagnetic Spectrum, A survey of Communication Applications. | 04 |
| 2 | **Introduction to Data Communication** Data Communication, Networks, The internet, Protocols and Standards. | 02 |
| 3 | **Data and Signals** Analog and Digital, Periodic analog signals, Digital Signals, Transmission Impairment, Data rate limits, Performance. | 04 |
| 4 | **Digital and Analog Transmission** Digital to Digital conversion, Analog to Digital conversion, Transmission modes,Digital to Analog conversion, Analog to Analog conversion. | 04 |
| 5 | **Multiplexing and Spreading** Frequency division multiplexing, Wavelength division multiplexing, Time division multiplexing Spread Spectrum. | 04 |
| 6 | **Radio Receiver** Tuned circuit, Filters, Classification of Noise, Functions of radio receivers, Typesof Receiver, working of super heterodyne radio receivers, tuning ranges, tracking, sensitivity and gain, image rejection, spurious responses, Adjacent channel selectivity, Automatic gain control, Automatic Frequency control. | 07 |
| 7 | **Transmission Media** Guided media- Twisted Pair Cable, Co-axial cable, Fiber optic cable, Unguidedmedia- Radio waves, Microwaves, Infrared | 03 |
| 8 | **Switching Network** Circuit switched network, Datagram networks, Virtual circuit networks. | 03 |
| 9 | **Introduction to telecommunication system** Telephone network, Dial-up modems, Digital subscriber line, Cable TV networks. | 03 |
| 10 | **Introduction to satellite communication system** Satellite orbits, Three categories of satellite, Satellite communication systems,Satellite application, Global Positioning System (GPS). | 05 |
| 11 | **Introduction to Optical Communication** Optical Principles, Optical Communication systems, Advantages and applicationof optical fiber. | 03 |
| | **Total Hours** | 42 |

**Suggested Text books / Reference books:**

1. Principles of Electronic Communication Systems by Louis E. Frenzel (3rd Edition), Tata-McGrawHill.
2. Data Communication and Networking by Behrouz A Forouzan ( 4th Edition), Tata-McGraw Hill.
3. Introduction to Data and Network Communications by Michael A. Miller, Cengage Learning.
4. Satellite Communication, by Dennis Roddy, TataMcGraw Hill.
5. Optical Fiber Communication by John M. Senior (PHI/Pearson)

**Suggested Theory distribution:**

The suggested theory distribution as per Bloom's taxonomy is as per follows. This distribution serves asguidelines for teachers and students to achieve effective teaching-learning process.

| Distribution of Theory for course delivery and evaluation | | | | | |
|---|---|---|---|---|---|
| Remember | Understand | Apply | Analyze | Evaluate | Create |
| 15% | 30% | 25% | 20% | 5% | 5% |

**Suggested List of Experiments:**

Minimum 12 experiments to be performed during the semester

1. To obtain Frequency response of Series tuned circuit.
2. To obtain Frequency response of Parallel tuned circuit.
3. To obtain Frequency response of High pass filter.
4. To obtain Frequency response of Low pass filter.
5. To obtain Frequency response of Band passes filter.
6. To obtain Frequency response of Band stop filter.
7. To perform voice and Data communication using satellite communication.
8. To setting up analog and digital link using fiber optic trainer.
9. To perform AM reception using superheterodyne receiver.
10. To build and test FM receiver.
11. Fourier analysis of Sinusoidal, Square and Triangular wave.
12. To perform various line codes for a given digital bit stream.
13. To observe the structure of various wired medium and give comparative analysis for the same.
14. To perform TDM of analog signals.

**Supplementary Resources:**

1. www. mhhe.com/frenzel/ecs3e
2. https://nptel.ac.in/courses/117/102/117102059/

https://www.tutorialspoint.com/principles_of_communication/principles_of_communication_introduction.htm

# Subject Code: 01CR0302

## Subject Name: Professional Ethics

## B. Tech. Year – II (Semester III)

**Objective:**

This course will enable the budding engineers and managers to effectively resolve the ethical issuesthey will face in their professional lives.

**Credits Earned:** 01 Credit

**Course Outcomes:** After completion of this course, student will be able to:

1. Express the basics of human values.
2. Articulate human values and grow as responsible human beings in the society
3. Develop ethical conduct and deliver their professional duties.
4. Analyze ethical confusions and contradictions to bring harmony at thought, behaviour andaction level

**Pre-requisite of course:** NA

**Teaching and Examination Scheme:**

<table>
<tr><th colspan="3" rowspan="2">Teaching Scheme (Hours)</th><th rowspan="3">Credits</th><th colspan="3">Theory Marks</th><th colspan="2">Tutorial / Practical Marks</th><th rowspan="3">Total Marks</th></tr>
<tr><th>E</th><th colspan="2">I</th><th>V</th><th>T</th></tr>
<tr><th>Theory</th><th>Tutorial</th><th>Practical</th><th>ESE</th><th>IA</th><th>CSE</th><th>Viva</th><th>Term Work</th></tr>
<tr><td>01</td><td>00</td><td>00</td><td>01</td><td>00</td><td>00</td><td>00</td><td>50</td><td>50</td><td>100</td></tr>
</table>

**Contents:**

| Unit | Topic<br>s | Hour<br>s |
|---|---|---|
| 1 | **Over view and basic concepts**<br>The concept of terminology of morals and morality, ethics, values, spirituality andstakeholder will enable students to have clarity about the concepts which are important for individuals and organizations. | 02 |
| 2 | **Profession and Professionalism**<br>Introduction to Profession and Professionalism will cultivate the ability to relateto ethical concepts and ethical problems in specific professions and professionalism | 02 |
| 3 | **Ethical Theories**<br>Understand variety of Moral Issues and Examples of Moral Dilemmas and Resolving Moral Dilemmas Conflict to enable the students to differentiate between right and wrong. | 02 |
| 4 | **Responsibilities and rights of professional.**<br>Professional Rights & Responsibilities will impart clarity on Loyalty, Confidentiality, Respect for Authority, Accountability and its importance. Issues related to Pride of Profession, Pride of Employer, Gifts and Bribes, Whistle- blowing, Discrimination, Vishakha Guidelines and Sexual Harassment of Women at Workplace (Prevention, Prohibition And Redressal) Act 2013 | 03 |
| 5 | **Ethics in Engineering Profession**<br>Ethics in Engineering Profession will bring clarity about the Roles of Engineerssuch as Engineers as Managers and Other Roles Played by Engineers. | 01 |
| 6 | **Ethical Codes**<br>Need for Ethical Codes will enable students to understand the prominence ofethical codes and become benchmarks against which individual and organizational performance can be measured. Codes from Other Profession- Advertising Standards Council of India, Corporate Codes-Tata Group of Companies will give them the profound knowledge of ethical codes. | 01 |
| 7 | **GLOBAL ISSUES**<br>Intellectual Property Rights will bring out the broader ethical issues surrounding intellectual property rights. Roles of Media, Positive Aspects of Media, Negative Aspects of Media, Accountability of Media, Regulation of Media Factors in Media Ethics, Advertising Ethics, Corporate Social Responsibility- Concept ISO and CSR, Scenario CSR Rules in India Manufacturing and Marketing of Computers Software,Cybercrimes, Data Stealing, Embezzlement, Hacking. | 03 |
| | **Total Hours** | 14 |

**Suggested Text books / Reference books:**

1. Professional Ethics by- R. Subramanian
2. Engineering Ethics &Human Values by: M.Govindarajan , S. Natarajan &V.S.Senthilkumar PHILearning Pvt. Ltd.

**Suggested Theory distribution:**

The suggested theory distribution as per Bloom's taxonomy is as per follows. This distribution serves asguidelines for teachers and students to achieve effective teaching-learning process.

| Distribution of Theory for course delivery and evaluation | | | | | |
|---|---|---|---|---|---|
| Remember | Understand | Apply | Analyze | Evaluate | Create |
| 20% | 25% | 35% | 10% | 10% | 0% |

**Supplementary Resources:**

1. https://ethics.iit.edu/teaching/professional-ethics
2. https://harappa.education/harappa-diaries/professional-ethics-and-professionalism
3. https://www.physio-pedia.com/Professional_Ethics_Course
4. https://onlinecourses.swayam2.ac.in/ntr19_ge06/preview
5. https://www.udemy.com/course/value-education-and-professional-ethics/
6. https://www.coursera.org/learn/ethics-technology-engineering

## Subject Code: 01CT0302

## Subject Name: Signals and Systems

## B. Tech. Year – II (Semester III)

**Objective:**

1. To understand classification of signals and systems
2. To learn applications of mathematical tools like Laplace Transform, Fourier Transform and Z-Transform in analysis of signals and systems
3. To understand the importance of different domain representation of signals and systems

**Credits Earned:** 04 Credits

**Course Outcomes:** After completion of this course, student will be able to:

1. Understand about various types of signals, classify them, analyze them, and perform various operations on them.
2. Understand about various types of systems, classify them, analyze them and understand their response behaviour.
3. Appreciate use of transforms in analysis of signals and system.
4. Carry simulation on signals and systems for observing effects of applying various properties and operations.
5. Create strong foundation of signal processing to be studied in the subsequent semester

**Pre-requisite of course:**

Basic knowledge of differentiation, integration, differential equations and difference equations

**Teaching and Examination Scheme:**

| Teaching Scheme (Hours) | | | Credits | Theory Marks | | | Tutorial / Practical Marks | | Total Marks |
|---|---|---|---|---|---|---|---|---|---|
| | | | | E | I | | V | T | |
| Theory | Tutorial | Practical | | ESE | IA | CSE | Viva | Term Work | |
| 03 | 00 | 02 | 04 | 50 | 30 | 20 | 25 | 25 | 150 |

**Contents:**

| Unit | Topics | Hours |
|---|---|---|
| 1 | **Continuous time and discrete time signals and systems**<br>Signal Definition and Examples, Classification of Signals, Signal Operations, Elementary Signals, Sampling of continuous time signals, Sampling theorem, Reconstruction of a signal from its samples, Aliasing , Concept of quantization and quantization error, Concept of Analog to Digital Conversion and Digital to Analog conversion, System Definition, Classification, Examples, Signal processing concept. | 09 |
| 2 | **Analysis of Continuous Time Signals and Systems**<br>Time domain representation and convolution integral of continuous time LTI systems, Unit impulse response, Properties of continuous time LTI systems, Stability and causality, Linear constant co-efficient of differential equation, Review of Laplace Transform. | 08 |
| 3 | **Analysis of discrete time signals and systems**<br>Time domain representation and convolution sum of discrete time LTI systems, Unit impulse (sample) response, Computation of convolution sum and unit impulse response, Interconnections and Properties of discrete time LTI systems,Linear constant co-efficient difference equation representation, Homogeneous and particular solution, Z-transform, region of convergence (ROC), properties ofROC, Properties of z-transform, Poles and Zeros, Inverse z-transform -Power Series expansion and Partial fraction expansion, Solution of difference equationusing Z-transform, Convolution and LTI system analysis using Z-transform. | 14 |
| 4 | **Frequency domain analysis**<br>Determination of Fourier series representation of continuous time periodic signals – Trigonometric and Complex Exponential Fourier series representation. Important properties of Fourier series. Continuous time Fourier transform with examples, Properties of the continuous time Fourier transform, Parseval's relation, Convolution in time and frequency domains. Application to analysis of continuous time LTI systems, Relationship between Laplace and continuous time Fourier transform, Fourier series representation of discrete time periodic signals and important properties, Discrete Time Fourier Transform, Properties of Discrete Time Fourier Transform, Discrete time system analysis using Discrete Time Fourier Transform, Frequency response of discrete time systems, Effect of periodicity and discretization on spectra. | 11 |
| | **Total Hours** | 42 |

**Suggested Text books / Reference books:**

1. AlanV.Oppenheim, Alan S.Willsky with S.HamidNawab, Signals & Systems, Pearson Education.
2. John G.Proakis and DimitrisG.Manolakis, Digital Signal Processing, Principles, Algorithms and Applications, PHI.
3. Signal and Systems By Anand Kumar, 3rd Edition, PHI
4. M.J.Roberts, Signals and Systems Analysis using Transform method and MATLAB, TMH.
5. B. P. Lathi, "Signal Processing and Linear System", Berkeley Cambridge Press.
6. Matthew N. O. Sadiku, Warsame Hassan Ali, "Signals and Systems: A Primer with MATLAB", CRCPress.

**Suggested Theory distribution:**

The suggested theory distribution as per Bloom's taxonomy is as per follows. This distribution serves asguidelines for teachers and students to achieve effective teaching-learning process.

| Distribution of Theory for course delivery and evaluation | | | | | |
|---|---|---|---|---|---|
| Remember | Understand | Apply | Analyze | Evaluate | Create |
| 20% | 20% | 35% | 15% | 5% | 5% |

**Suggested List of Experiments:**

Minimum experiments to be performed during the semester

1. Introduction to MATLAB and Generation of Elementary signals.
2. Generation of discrete time signals and plot them in MATLAB.
3. Observing the effects of sampling rate conversion (lower sampling rate and higher sampling rate)on signal.
4. Discretization using different sampling rate and observing aliasing effect.
5. Performing various operations on the signal using computational software.
6. Write a program to analyze discrete time LTI System.
7. Find Poles, Zeros and gain from a given transfer function and plot it in Z-domain using softwaretool.
8. Find the Fourier series representation of a periodic signal and observe Gibbs phenomenon.
9. Observe frequency domain analysis of discrete time signal using software tool.
10. Check linearity of continuous time LTI system.
11. Check Time variance/Time invariance property of LTI system.
12. Obtain impulse response of system by Simulink.

13. Design of sample and hold circuits.
14. Design of anti-aliasing filter.
15. Write a MATLAB code to compress/expand image.
16. Design of FIR filter

**Supplementary Resources:**

1. https://ocw.mit.edu/resources/res-6-007-signals-and-systems-spring-2011
2. https://www.tutorialspoint.com/signals_and_systems/index.htm
3. https://nptel.ac.in/courses/117/101/117101055

# Subject Code: 01CT0309

# Subject Name: Programming with Python

# B. Tech. Year – II (Semester III)

**Objective:**

1. To describe the core syntax and semantics of Python programming language.
2. To discover the need for working with the strings and functions.
3. To illustrate the process of structuring the data using lists, dictionaries, tuples and sets.
4. To infer the Object-oriented Programming concepts in Python.
5. To develop the ability to write GUI and database applications in Python

**Credits Earned:** 01 Credit

**Course Outcomes:** After completion of this course, student will be able to:

1. To write, test, and debug simple Python programs.
2. To implement Python programs with conditionals and loops.
3. Use functions for structuring Python programs.
4. Represent compound data using Python lists, tuples, and dictionaries.
5. Read and write data from/to files and database in Python using GUI.

**Pre-requisite of course:**
Basic knowledge of Programming, Object Oriented Concepts

**Teaching and Examination Scheme:**

| Teaching Scheme (Hours) | | | Credits | Theory Marks | | | Tutorial / Practical Marks | | Total Marks |
|---|---|---|---|---|---|---|---|---|---|
| | | | | E | I | | V | T | |
| Theory | Tutorial | Practical | | ESE | IA | CSE | Viva | Term Work | |
| 00 | 00 | 02 | 01 | 0 | 0 | 0 | 25 | 25 | 50 |

**Contents:**

| Unit | Topics | Hours |
|---|---|---|
| 1 | **Introduction:**<br>Introduction to Python programming language, Data and Expressions: Literals, Variables and Identifiers, Operators, Expressions and Data Types, Control Structures, Boolean Expressions | 5 |
| 2 | **Statements and List:**<br>Selection Control, Iterative Control, Lists: List Structures, Lists in Python, Iterating over Lists in Python, | 4 |
| 3 | **Dictionaries and Sets:**<br>Dictionary, Set and Tuple in Python | 3 |
| 4 | **Functions:**<br>Program routes, Calling Value Returning Functions, Calling Non-value Returning Functions, Parameter Passing, Keyword and Default Arguments in Python. | 4 |
| 5 | **Modules and OOP:**<br>Python Modules, Classes and OOP, Exception Handling, String Processing and Regular Expression | 5 |
| 6 | **GUI Programming:**<br>Introduction to GUI Programming, Controls, Event Handling | 4 |
| 7 | **File Handling and Database Connectivity:**<br>File Handling: Opening, Reading and Writing Text Files, Database Connectivity with Python | 3 |
| | **Total Hours** | 28 |

**Suggested Text books / Reference books:**

1. Mark Lutz , “Learning Python”, O Reily, 4th Edition, 2009, ISBN: 978-0596158064
2. Mark Lutz , “Programming Python” , O Reily, 4th Edition, 2010, ISBN 978-0596158118
3. Tim Hall and J-P Stacey , “Python 3 for Absolute Beginners” , 2009, ISBN : 9781430216322
4. Magnus Lie Hetland , “Beginning Python: From Novice to Professional”, 2nd Edition, 2009, ISBN:978159059982
5. C. Dierbach, “Introduction to Computer Science Using PYTHON: A Computational Problem-Solving Focus” (1 ed.), Wiley, 2015. ISBN 978-0470555156.
6. Yashavant Kanetkar, “Let Us Python” (1 ed.), BPB Publishers, 2019. ISBN 978-9388511568.
7. Allen B. Downey, “Think Python: How to Think Like a Computer Scientist” (2 ed.), O’Reilly, 2015. ISBN 978-9352134755.
8. Martin C. Brown, “Python: The Complete Reference” (1 ed.), McGraw-Hill, 2001. ISBN 978-9387572942.

**Suggested Theory distribution:**

The suggested theory distribution as per Bloom’s taxonomy is as per follows. This distribution serves as guidelines for teachers and students to achieve effective teaching-learning process.

| Distribution of Theory for course delivery and evaluation | | | | | |
|---|---|---|---|---|---|
| Remember | Understand | Apply | Analyze | Evaluate | Create |
| 15% | 20% | 25% | 15% | 15% | 10% |

**Suggested List of Experiments:**

Minimum 12 experiments to be performed during the semester

1. Write a program to demonstrate different number datatypes in python.
2. Write a program to perform different arithmetic operations on numbers in python.
3. Write a program to create, concatenate and print a string and accessing sub string from a given string.
4. Write a python script to print the current date in following format “Sun August 01 10:10:10 IST 2021”
5. Write a python program to create, append and remove lists in python. Develop programs to understand the control structures of python.
6. Write a program to demonstrate working with tuples in python.
7. Write a program to demonstrate working with dictionaries in python.
8. Write a python program to find largest of three numbers.
9. Write a python program to convert temperature to and from Celsius to Fahrenheit.
10. Write a python program to print prime numbers less than given number.
11. Write a python program to find factorial of a number using recursion
12. Write a python program to that accepts length of three sides of a triangle as inputs.
13. The program should indicate whether or not the triangle is a right angled triangle (use Pythagorean theorem)
14. Write a python program to define a module to find Fibonacci Numbers and import the module to another program.
15. Write a python program to define a module and import a specific function in that module to another program.
16. Write a python Program to call data member and function using classes and objects.
17. Write a program to read 3 subject marks and display pass or failed using class and object.
18. Write a program to validate PAN card number and Email ID.
19. Write a GUI program to create Tic-tac-toe in python
20. Write a script named copyfile.py. This script should prompt the user for the names of two text files. The contents of the first the second file.
21. Write a program that inputs a text file. The program should print all of the unique words in the file in alphabetical order.
22. Write a GUI program to implement CRUD operation on Student record. (rollno, name, percentage)

**Supplementary Resources:**

1. https://docs.python.org/3/tutorial/
2. https://www.learnpython.org/
3. https://nptel.ac.in/courses/106/106/106106182/

**Marwadi University**
**Faculty of Technology**
**Department of Information and Communication Technology**

## Subject Code: 01CT0308

## Subject Name: Data Structure using C++

## B. Tech. Year – II (Semester III)

**Objective:**

1. To teach efficient storage mechanisms of data for an easy access.
2. To design and implementation of various basic and advanced data structures.
3. To introduce various techniques for representation of the data in the real world.
4. To develop application using data structures.
5. To teach the concept of protection and management of data.
6. To improve the logical ability

**Credits Earned:** 04 Credits

**Course Outcomes:** After completion of this course, student will be able to:

1. Implement Object oriented concepts in C++.
2. Differentiate linear and non-linear data structures like stacks, queues, linked list etc
3. Choose appropriate data structure as applied to specified problem definition.
4. Demonstrate operations like searching, insertion, deletion, traversing mechanism etc. on various data structures through programming
5. Select appropriate sorting and searching algorithm based on problem definition in order to get optimum solution
6. Compare and contrast the benefits of dynamic and static data structures implementations

**Pre-requisite of course:**
Basic knowledge of C language, Object Oriented Concepts

**Teaching and Examination Scheme:**

| Teaching Scheme (Hours) | | | Credits | Theory Marks | | | Tutorial / Practical Marks | | Total Marks |
|---|---|---|---|---|---|---|---|---|---|
| | | | | E | I | | V | T | |
| Theory | Tutorial | Practical | | ESE | IA | CSE | Viva | Term Work | |
| 03 | 00 | 02 | 04 | 50 | 30 | 20 | 25 | 25 | 150 |

**Contents:**

| Unit | Topics | Hours |
|---|---|---|
| 1 | **Introduction of C++**<br>Introduction, Data types, Expression and control statements Iteration statements in C++, Arrays and String, Functions, Structures, Class, Object, Friend Function, Static variables and Functions in class, Constructors and Destructors, Inheritance in C++, Types of Inheritance, Pointers, Virtual Functions, Polymorphism, Abstract classes, Templates in C++, Exception Handling in C++ | 08 |
| 2 | **Linked List**<br>Linked List as an ADT, Linked List Vs. Arrays, and Memory Allocation & De-allocation for a Linked List, Linked List operations, Types of Linked List, Implementation of Linked List, Application of Linked List polynomial, sparse matrix | 08 |
| 3 | **Stack**<br>The Stack as an ADT, Stack operation, Array Representation of Stack, Link Representation of Stack, Application of stack – Recursion, Polish Notation | 04 |
| 4 | **Queues**<br>The Queue as an ADT, Queue operation, Array Representation of Queue, Linked Representation of Queue, Circular Queue, Priority Queue, & Dequeue, Application of Queues – Johnsons Algorithm, Simulation | 04 |
| 5 | **Trees**<br>Basic trees concept, Binary tree representation, Binary tree operation, Binary tree traversal, Binary search tree (BST) implementation, Thread Binary tree, The Huffman Algorithm, Expression tree, Introduction to Multiway search tree and its creation (AVL, B-tree, B+ tree), AVL tree balancing; B-tree; Application of trees. | 06 |
| 6 | **Graphs**<br>Basic concepts, Graph Representation, Graph traversal (DFS & BFS) | 04 |
| 7 | **Sorting**<br>Sort Concept, Shell Sort, Radix sort, Insertion Sort, Quick Sort, Merge sort, Heap Sort, | 04 |
| 8 | **Searching**<br>List Search, Linear Index Search, Index Sequential Search Hashed List Search, Hashing Methods, Collision Resolution (One way and Two way); | 04 |
| | **Total Hours** | 42 |

**Suggested Text books / Reference books:**

1. Data structures and Algorithms in C++, Michael T.Goodrich, R.Tamassia and .Mount, Wiley student edition, John Wiley and Sons.
2. Data Structures, Algorithms and Applications in C++, Sartaj Sahani, 2nd Edition.
3. Introduction to Data Structure and its Applications Jean-Paul Tremblay, P. G. Sorenson
4. Data Structures Using C & C++, Rajesh K. Shukla, Wiley- India.
5. Data Structures, Adapted by: GAV PAI, Schaum's Outlines
6. Object Oriented Programming with C++, E.Balaguruswamy, TMH, 6th Edition, 2013.
7. C++: The Complete Reference- Schildt, McGraw-Hill Education (India)

**Suggested Theory distribution:**

The suggested theory distribution as per Bloom's taxonomy is as per follows. This distribution serves as guidelines for teachers and students to achieve effective teaching-learning process.

| Distribution of Theory for course delivery and evaluation | | | | | |
|---|---|---|---|---|---|
| Remember | Understand | Apply | Analyze | Evaluate | Create |
| 15% | 20% | 25% | 15% | 15% | 10% |

**Suggested List of Experiments:**

Minimum 12 experiments to be performed during the semester

1. Implementations of Linked Lists menu driven program.
2. Implementation of different operations on linked list – copy, concatenate, split, reverse, count no. of nodes etc.
3. Representation of Sparse matrix using multilinked structure. Implementation of sparse matrix multiplication.
4. Implementation of polynomials operations (addition, subtraction) using Linked List.
5. Implementations of Linked Lists menu driven program (stack and queue)
6. Implementations of Double ended queue using Linked Lists.
7. Implementation of Priority queue program using Linked Lis
8. Implementations of stack menu driven program
9. Implementation of multitask in one array.
10. Implementations of Infix to Postfix Transformation and its evaluation program.
11. Implementations of Infix to Prefix Transformation and its evaluation program.
12. Simulation of recursion
13. Implementations of circular queue menu driven program
14. Implementations of double ended queue menu driven program
15. Implementations of queue menu driven program
16. Implementation of Priority queue program using array.
17. Implementation of Johnsons Algorithm
18. Implementation of Simulation Problem

19. Implementations of Binary Tree menu driven program
20. Implementation of Binary Tree Traversal program.
21. Implementation of construction of expression tree using postfix expression.
22. Implementations of Huffman code construction
23. Implementations of BST program
24. Implementation of various operations on tree like – copying tree, mirroring a tree,
25. counting the number of nodes in the tree, counting only leaf nodes in the tree.
26. Implementations of B-tree menu driven program
27. Implementations of B+ tree program
28. Implementation of Preorder traversal of a threaded binary tree.
29. Implementations of AVL Tree menu driven program
30. Implementations of Shell sort, Radix sort and Insertion sort menu driven program
31. Implementations of Quick Sort, Merge sort and Heap Sort menu driven program
32. Implementations of searching methods (Index Sequential, Interpolation Search) menu driven program
33. Implementation of hashing functions with different collision resolution techniques
34. Implementations of Graph menu driven program (DFS & BSF)

**Supplementary Resources:**

1. http://www.nptelvideos.in/2012/11/programming-and-data-structure.html
2. http://www.nptelvideos.in/2012/11/data-structures-and-algorithms.html
3. http://www.geeksforgeeks.org/data-structures/
4. https://www.hackerrank.com/domains/data-structures/arrays
5. Data Structures And Algorithms Made Easy -To All My Readers By Narasimha Karumanchi

## Subject Code: 01CT0409

## Subject Name: Operating System

## B. Tech. Year – II (Semester IV)

**Objective:**
Student will understand Modern Operating System and their principles. The course will cover theory as well as practice aspects of a subject through scheduled lectures and labs, course will cover details of processes, CPU scheduling, memory management, file system, storage subsystem, and input/output management.

**Credits Earned:** 04 Credits

**Course Outcomes:** After completion of this course, student will be able to:
1. Understanding the role of operating system with its function and services
2. Compare Various Algorithm used for CPU Scheduling, Memory management and Disk Scheduling Algorithm.
3. Apply Various Concepts related with Deadlock to solve Problems.
4. Analyze Protection and Security Mechanism in Operating System.
5. Analyze and illustrate shell commands and scripts that can manipulate text based data either in files or data streams.

**Pre-requisite of course:**
Data structures like stack, queue, linked list, tree, graph, hashing, file structures, any structured programming language

**Teaching and Examination Scheme:**

| Teaching Scheme (Hours) | | | Credits | Theory Marks | | | Tutorial / Practical Marks | | Total Marks |
|---|---|---|---|---|---|---|---|---|---|
| | | | | E | I | | V | T | |
| Theory | Tutorial | Practical | | ESE | IA | CSE | Viva | Term Work | |
| 03 | 00 | 02 | 04 | 50 | 30 | 20 | 25 | 25 | 150 |

**Contents:**

| Unit | Topics | Hours |
|---|---|---|
| 1 | **Operating Systems**<br>Operating Systems Overview- Overview and Functions of operating systems, protection and security, distributed systems, operating systems structures, services, system calls and their working. History and generation of operating system. | 04 |
| 2 | **Process and Threads**<br>Process and Threads - Process concepts, threads, scheduling-criteria, algorithms, and their evaluation. Process Scheduling, Thread scheduling, case studies UNIX. Linux. Windows | 08 |
| 3 | **Concurrency Control (IPC)**<br>Process synchronization, critical- section problem. classic problems of synchronization, Software Solutions for synchronization problem. Hardware Solutions for synchronization problem. Synchronization and their applications. [Understanding of Semaphore – Mutex – Monitor – Event Counters] | 10 |
| 4 | **Memory Management**<br>Memory: Swapping, contiguous memory allocation, paging, page table, segmentation, virtual memory, demand paging, page- replacement, Allocation of frames, Virtual Memory: Basics of Virtual Memory – Hardware and control structures – Locality of reference, Page fault, Working Set, Dirty page/Dirty bit – Demand paging (Concepts only) – Page Replacement policies : Least Recently used (LRU) Optimal (OPT) , Second Chance (SC), First in First Out (FIFO), , Not recently used (NRU). | 15 |
| 5 | **Principles of deadlock**<br>Deadlock - system model, deadlock and its characterization with example, deadlock prevention techniques with example, detection and avoidance of a deadlock, methods to get recovery form deadlock. | 06 |
| 6 | **File system Interface**<br>File system Interface- the concept of a file, Access Methods. Directory structure. File system mounting, file protection and sharing mechanism. File System implementation- File system structure, file/directory implementation, efficiency and performance, file allocation methods, free-space management. | 04 |
| 7 | **Mass-storage structure & I/O systems**<br>Mass-storage structure- RAID structure, Disk structure, disk attachment, disk scheduling, swap-space management. stable-storage implementation. overview of Mass-storage structure. Tertiary storage structure. I/O systems- Hardware, application l/o interface, kernel I/O subsystem, | 04 |

| | | |
|---|---|---|
| | Transforming I/O requests to Hardware operations. STREAMS, performance. | |
| 8 | **Protection & Security**<br>Protection - Protection. Goals of Protection, Principles of Protection. Domain of protection Access Matrix, Implementation of Access Matrix. Access control, Revocation of Access Rights. Capability- Based systems, Language - Based Protection, Security -Problems, program threats, system and network threats cryptography as a security tool, user authentication, implementing security defenses, fire walling to protect systems and networks, computer -security classifications | 03 |
| | **Total Hours** | 54 |

**Suggested Text books / Reference books:**

1. Operating System Concepts- Abraham Silberchatz, Peter B. Galvin, Greg Gagne, 8th edition.
2. Operating Systems - Internals and Design Principles. Stallings, 6th Edition-2009. Pearson education.
3. Operating systems- A Concept based Approach-D.M.Dhamdhere. 3rd Edition. TMH
4. Modern Operating Systems, Andrew S Tanenbaum 3rd edition PHI.
5. Principles of Operating Systems, B.L.Stuart. Cengage learning, India Edition.
6. Operating Systems. A.S. Godboie.2nd Edition, TMH

**Suggested Theory distribution:**

The suggested theory distribution as per Bloom's taxonomy is as per follows. This distribution serves as guidelines for teachers and students to achieve effective teaching-learning process.

| Distribution of Theory for course delivery and evaluation | | | | | |
|---|---|---|---|---|---|
| Remember | Understand | Apply | Analyze | Evaluate | Create |
| 20% | 25% | 25% | 15% | 10% | 5% |

**Suggested List of Experiments:**

Minimum 12 experiments to be performed during the semester

1. Hands on Activity for OS Installation.
2. Study of Basic commands to understand the system and working of Linux.
3. Write a script to reverse a number and string given by user.
4. Write a script to find the smallest of three numbers as well as largest among three numbers.
5. Write script that prints names of all sub directories present in the current directory.
6. Write a script to reverse the contents of a file.
7. Write a script to check entered string or a number is palindrome or not
8. Write a menu driven shell script for Copy a file, remove a file, Move a file in Linux

9. Shell Script to make a menu driven calculator using case in UNIX / Linux / Ubuntu.
10. Write a script to display the digits which are in odd position in a given 6 digit number in Linux
11. Write a script to translate the string from capital letters to small and small letters to capital using awk command.
12. Write a script to do the sorting of given numbers (use command line argument).
13. Write a program for process creation using C. (Use of gcc compiler).

**Supplementary Resources:**

1. http://williamstallings.com/OS/Animation/Animations.html
2. http://nptel.ac.in/courses/106106144/
3. http://nptel.ac.in/courses/106108101/
4. http://codex.cs.yale.edu/avi/os-book/OS9/slide-dir

## Subject Code: 01CT0408

## Subject Name: Internet and Web Technology

## B. Tech. Year – II (Semester IV)

**Objective:**
To acquire knowledge and skills for creation of web site considering both client and server-side programming. To gain ability to develop responsive web applications. Increasing use of Internet and web encourage everyone to use web solution. Web technology is the bridge between end-user devices like computer/mobile communication with each other. To create dynamic web site and web portal it involves the use of web language like HTML, CSS, JavaScript and PHP with CodeIgniter framework. This subject will attempt to give you a basic understanding of various aspects of web technologies.

**Credits Earned:** 04 Credits

**Course Outcomes:** After completion of this course, student will be able to:
1. Understand basis functioning of Internet by studying its architecture.
2. Apply different types of style sheets and their properties
3. Apply client side and server-side scripting techniques as per requirements
4. Analyze design pattern-based approaches and frameworks of PHP.
5. Create dynamic web-based solution based on user requirements.

**Pre-requisite of course:**
Programming Fundamentals

**Teaching and Examination Scheme:**

<table>
<tr><th colspan="3" rowspan="2">Teaching Scheme (Hours)</th><th rowspan="3">Credits</th><th colspan="3">Theory Marks</th><th colspan="2">Tutorial / Practical Marks</th><th rowspan="3">Total Marks</th></tr>
<tr><th>E</th><th colspan="2">I</th><th>V</th><th>T</th></tr>
<tr><th>Theory</th><th>Tutorial</th><th>Practical</th><th>ESE</th><th>IA</th><th>CSE</th><th>Viva</th><th>Term Work</th></tr>
<tr><td>03</td><td>00</td><td>02</td><td>04</td><td>50</td><td>30</td><td>20</td><td>25</td><td>25</td><td>150</td></tr>
</table>

**Contents:**

| Unit | Topics | Hours |
|---|---|---|
| 1 | **Internet Basics**<br>Introduction, Concept of Internet- History of Internet, Protocols of Internet, World Wide Web, URL, Web Server, Web Browser, Internet Connectivity, Internet Network, Services on internet, Current Trends on Internet, Concept of WWW, HTTP Response and Request, Features of Web 2.0 | 05 |
| 2 | **HTML and CSS**<br>Basics of HTML, HTML tags and attributes, Meta tags, Character entities, hyperlink, table, lists, images, forms, divs, XHTML, Browser Architecture and website structure, Overview and features of HTML 5, Need for CSS, basic syntax and structure, background images, colors and properties, manipulating texts, fonts, borders and boxes, margin, padding, lists, positioning using CSS, Gradients, Shadow effects, transformation, transition and animations, etc. CSS flex, media queries. Overview of CSS, CSS2 and features of CSS3. | 10 |
| 3 | **Java Script**<br>Client-side scripting with JavaScript, variables, functions, conditions, loops and repetition, Pop up boxes. Advance JavaScript: JavaScript and objects, JavaScript own objects, the DOM and web browser environments, Manipulation using DOM, forms and validations, DHTML: Combining HTML, CSS and JavaScript, Events and buttons Introduction to jQuery, jQuery syntax, selectors, events, effects, jQuery HTML, Access / Manipulate web browser elements using jQuery. | 06 |
| 4 | **XML**<br>Introduction to XML, uses of XML, simple XML, XML key components, DTD and Schemas, Using XML with application. Transforming XML using XSL and XSLT | 03 |
| 5 | **PHP**<br>Introduction and basic syntax of PHP, decision and looping with examples, PHP and HTML, Arrays, Functions, Browser control and detection, string, Form processing, Files, Advance Features: Cookies and Sessions, Object Oriented Programming with PHP | 04 |
| 6 | **PHP and MySQL**<br>Basic commands with PHP examples, Connection, to server, creating database, selecting a database, listing database, listing table names, creating a table, inserting data, altering tables, queries, deleting database, deleting data and tables, PHP my admin and database bugs | 05 |
| 7 | **Latest Trends in PHP** | 04 |

| | | |
|---|---|---|
| | Overview of Laravel, Laravel Application Structure, Introduction to WordPress, WordPress Dashboard, Overview of Joomla, Joomla Architecture, Application of Joomla | |
| 8 | **PHP with CodeIgniter**<br>Overview, Application Architecture, MVC Framework, Configuration, Working with Database, Libraries, File uploading, Form validation. | 05 |
| | **Total Hours** | 42 |

**Suggested Text books / Reference books:**

1. Black Book, HTNL 5, Dreamtech Press
2. Black Book, Web Technologies, Dreatech Press
3. Ralph Moseley and M.T. Savaliya, Developing Web Applications, Wiley-India
4. Cody Lindley, jQuery Cookbook, O'Reilly Media
5. Ryan Benedetti, Roman Cranley, Head First jQuery – A Brain- Friendly Guide, O' Reilly Media

**Suggested Theory distribution:**

The suggested theory distribution as per Bloom's taxonomy is as per follows. This distribution serves as guidelines for teachers and students to achieve effective teaching-learning process.

| Distribution of Theory for course delivery and evaluation | | | | | |
|---|---|---|---|---|---|
| Remember | Understand | Apply | Analyze | Evaluate | Create |
| 5% | 25% | 30% | 20% | 10% | 10% |

**Suggested List of Experiments:**

1. Design wireframe for your semester project based on web design principles
2. Create table using HTML tags.
3. Formatting web pages with CSS [Create semester project website's inner pages]
4. Create Home Page for any Website which contains image slider, header and footer and navigation menu bar.
5. Browser interaction and form validation (Web browser environments, forms and validation, image sliders) [Image slider plugins of jQuery, Client-side validation of Registration & Login page to be created in semester project website].
6. Use the on () method to attach a click event handler to all <p> elements using jQuery.
7. Choose the correct conditional (ternary) operator to alert "Too young" if age is less than 18, otherwise alert "Old enough" using JavaScript.
8. Introduction to PHP (Starting to script on server side, Arrays, function, validations) [Server-side validations for Registration and Login of semester project website]
9. Advance PHP (Management of session and cookies) [Implement Admin login/logout functionality and cookie wherever required]
10. Create PHP Form which demonstrate Insert, Update, Delete and Select operation with database. (Take required data from user).

11. PHP with mysql connectivity (Forms, Advance PHP and database handling) [Semester Project]
12. CodeIgniter framework of PHP (Use framework in Management Portal for semester project website]

**Supplementary Resources:**

1. http://nptel.ac.in
2. http://www.w3schools.com/
3. http://getbootstrap.com/
4. http://www.tutorialspoint.com/
5. https://www.phptpoint.com/
6. https://www.codeigniter.com/

## Subject Code: 01CT0407

## Subject Name: Database Management System

## B. Tech. Year – II (Semester IV)

**Objective:**
To know how huge data is managed by each and every application is modern technologies. To store and retrieve data in efficient manner, how query language is useful will be helpful. This course will give deep knowledge about data storage and querying functionalities used in real life applications.

**Credits Earned:** 04 Credits

**Course Outcomes:** After completion of this course, student will be able to:

1. Understand the basic concepts of relational data model, entity-relationship model, relational database design, relational algebra, normalization and SQL
2. Solve the given problem using Relational Algebra, Relational Calculus, SQL and PL/SQL
3. Analyze basic data storage schemes and real-life database applications
4. Apply efficient query optimization techniques to solve different problems
5. Perform PL/SQL programming using concept of Cursor Management, Error Handling, Package and Triggers

**Pre-requisite of course:**
The proper understanding of data structures and algorithms will help you to understand the DBMS quickly.

**Teaching and Examination Scheme:**

| Teaching Scheme (Hours) | | | Credits | Theory Marks | | | Tutorial / Practical Marks | | Total Marks |
|---|---|---|---|---|---|---|---|---|---|
| | | | | E | I | | V | T | |
| Theory | Tutorial | Practical | | ESE | IA | CSE | Viva | Term Work | |
| 03 | 00 | 02 | 04 | 50 | 30 | 20 | 25 | 25 | 150 |

**Contents:**

| Unit | Topics | Hours |
|---|---|---|
| 1 | **Introduction to DBMS**<br>Introduction to Database Management Systems, Types of DBMS, Implementation of DBMS in storage and querying, Applications of DBMS | 03 |
| 2 | **Relational Database Management Systems**<br>Introduction to relational model: Architecture of Relational database, Database Schema, Schema Diagram, Introduction and use of keys in schema designing. Structure Query Language (SQL): Introduction, CRUD Operations and Functions. | 04 |
| 3 | **Database Design and E-R Model**<br>Design Process and Introduction of E-R model, Constraints and Attributes Characteristics, Features of E-R Diagrams and Design issues, Other notations for modeling with different aspects of database design | 06 |
| 4 | **Functional Dependencies**<br>Theoretical overview of types of functional dependencies: Trivial and Non-trivial, Multilevel dependencies, Algorithms for decomposition using multilevel dependencies. | 05 |
| 5 | **Normalization**<br>Purpose of normalization, Introduction and definition of normalization, Normalization techniques: 1NF, 2NF, 3NF, BCNF, 4NF, Introduction and implementation of 5NF (Beyond the syllabus) | 04 |
| 6 | **Data Indexing and Querying**<br>Data Indexing: Basic concepts for B+ tree index files, Multiple key access Querying: Overview, measures of query cost, selection operation, sorting, join, evaluation of expressions, transformation of relational expressions, estimating statistics of expression results, evaluation plans, materialized views | 04 |
| 7 | **Transactional DBMS**<br>Introduction to transaction using DBMS, ACID properties (Atomicity, Consistency, Isolation, Durability), Isolated transactions, use of isolated transaction applications using SQL | 04 |
| 8 | **Concurrency and Recovery in Transaction Model**<br>Locking mechanism, solution to concurrency related problems, deadlock, two-phase locking protocol, Deadlock, Concurrency handling protocols and schemes, Transactional Recovery Algorithms, System recovery, Two- Phase Commit protocol, Recovery and Log-based recovery, concurrent executions of transactions and related problems | 04 |
| 9 | **Security**<br>Introduction, Discretionary access control, Mandatory Access Control, Data Encryption | 02 |

| | | |
|---|---|---|
| 10 | **PL/SQL concepts**<br>SQL Concepts: SELECT, FROM and WHERE Clause; Insert and DELETE operations, Functions; NULL functions, Aggregators, Arithmetic and Logical Operators; Joins: Inner joins, Outer Joins, Cross joins. PL SQL: Cursors, Stored Procedures, Stored Function, Database Triggers | 04 |
| 11 | **Emerging areas in DBMS**<br>Introduction to parallel and distributed databases, NoSQL databases and applications. | 02 |
| | **Total Hours** | 42 |

**Suggested Text books / Reference books:**

1. Database System Concepts, Abraham Silberschatz, Henry F. Korth & S. Sudarshan, McGraw Hill.
2. An introduction to Database Systems, C J Date, Addition-Wesley.
3. Understanding SQL by Martin Gruber, BPB
4. Oracle – The complete reference – TMH /oracle press
5. SQL – PL/SQL by Ivan Bayross

**Suggested Theory distribution:**

The suggested theory distribution as per Bloom's taxonomy is as per follows. This distribution serves as guidelines for teachers and students to achieve effective teaching-learning process.

| Distribution of Theory for course delivery and evaluation | | | | | |
|---|---|---|---|---|---|
| Remember | Understand | Apply | Analyze | Evaluate | Create |
| 15% | 15% | 40% | 10% | 10% | 10% |

**Suggested List of Experiments:**

Minimum 12 experiments to be performed during the semester

1. Introduction to tool [Basic information of tool
2. Database creation using SQL
3. CRUD operation in database using SQL
4. NULL functions in SQL queries
5. Query practicing for insert and delete operations on table.
6. Implementation of Mathematical operators' queries using SQL
7. Use of keys with CRUD operation.
8. Implementation of Functions and Operators in SQL.
9. Implementation of various join operations queries.
10. GROUP BY clause and relational algebraic operation implementation.
11. Implementation of Subqueries in SQL queries
12. Implementation procedures and triggers using SQL.

13. Overview of Query optimization with basic examples.
14. Transactional query processing.
15. Application based query practicing.

**Supplementary Resources:**

1. https://www.geeksforgeeks.org/dbms
2. http://nptel.iitm.ac.in/video.php?subjectId=106106093
3. http://holowczak.com/oracle-sqlplus-tutorial
4. http://www.roseindia.net/programming-tutorial/Database- Tutorialsiv.
5. http://www.w3schools.com/sql
6. http://beginner-sql-tutorial.com/sql.htm

**Marwadi University**
**Faculty of Technology**
**Department of Information and Communication Technology**

# Subject Code: 01CT0404

## Subject Name: Analog and Digital Communication

## B. Tech. Year – II (Semester IV)

**Objective:**

This course explores the fundamentals of electronic communication systems it provides the knowledge of various analog and digital modulation and demodulation techniques used in communication system. Comparison of various techniques will enable the student to select mostappropriate technique for the application

**Credits Earned:** 04 Credits

**Course Outcomes:** After completion of this course, student will be able to:

1. To understand basics of analog and digital communication techniques.
2. To learn working of AM-FM Transmitters and receivers.
3. To facilitate the understanding of the baseband and carrier modulation.
4. To understand the effect and performance of communication systems in presence of noise.
5. Analyze Communication System based on different Modulation & Demodulation Techniquesand analyze performance.

**Pre-requisite of course:**

Basic electronics, Digital Electronics, Basic Mathematics and Introduction to communication engineering

**Teaching and Examination Scheme:**

| Teaching Scheme (Hours) | | | Credits | Theory Marks | | | Tutorial / Practical Marks | | Total Marks |
|---|---|---|---|---|---|---|---|---|---|
| | | | | E | I | | V | T | |
| Theory | Tutorial | Practical | | ESE | IA | CSE | Viva | Term Work | |
| 03 | 00 | 02 | 04 | 50 | 30 | 20 | 25 | 25 | 150 |

**Contents:**

| Unit | Topic<br>s | Hour<br>s |
|---|---|---|
| 1 | **Linear Modulation: Amplitude modulation**<br>Concept of amplitude modulation, Double Sideband suppressed carrier modulation, Single side band suppressed carrier modulation, Generation of AM-Chopper circuit, Balanced modulator, Modulation by multitone modulating signal. Independent Side band, Theme example- VSB transmission of Analog andDigital Television. | 07 |
| 2 | **Angle modulation**<br>Concept of instantaneous frequency and phase modulation, sinusoidal FM and its time domain representation, spectral components of angle modulated signals, power in sinusoidal FM and modulation index, Carson's rule, Multitone wideband FM, Generation of Wideband FM from Narrow band FM , Generation of WBFM by Armstrong method. | 05 |
| 3 | **Noise in communication systems**<br>Classification of noise, Signal to noise ratio (SNR), Noise factor and noise figure,Equivalent input noise generators, Noise temperature, Narrow band noise, PSDof in-phase and quadrature noise, Noise performance in AM, FM, Digital baseband and carrier communication systems, Concept of optimum threshold detection, matched filter, correlation receiver, optimum binary receiver, bit error rate (BER). | 04 |
| 4 | **Base Band Modulation**<br>Base band system, sampling theorem, Sampling and signal reconstruction, Aliasing, Types of sampling, Quantization, PCM, Companding, DPCM, ADPCM,Delta modulation, Adaptive delta modulation. Theme Example- Digitization ofvideo and MPEG. | 09 |
| 5 | **Digital Modulation Techniques**<br>Modulation techniques for ASK, QASK, FSK, M-ary FSK, BPSK, DPSK, QPSK, M-aryPSK, QAM. Comparison of Noise performance of various PSK and FSK systems.<br>Theme Example- Orthogonal Frequency Division Multiplexing (OFDM). | 09 |
| 6 | **Linear Modulation: Amplitude modulation**<br>Concept of amplitude modulation, Double Sideband suppressed carrier modulation, Single side band suppressed carrier modulation, Generation of AM-Chopper circuit, Balanced modulator, Modulation by multitone modulating signal. Independent Side band, Theme example- VSB transmission of Analog andDigital Television. | 08 |
| | **Total Hours** | 42 |

**Suggested Text books / Reference books:**

1. Electronic Communications by Kennedy McGraw Hill Publication.
2. Electronic Communications by Dennis Roddy & John Coolen IV Edition PHI.
3. Communication Systems: Analog and Digital by R. P. Singh and B. D. Sapre, Tata-McGraw Hill
4. Modern Digital and Analog Communication Systems, B. P. Lathi, (3rd Edition), Oxford Publication
5. Principles of Communication Systems, Taub & Schilling, (2nd Edition), Tata McGraw HillPublication.

**Suggested Theory distribution:**

The suggested theory distribution as per Bloom's taxonomy is as per follows. This distribution serves asguidelines for teachers and students to achieve effective teaching-learning process.

| Distribution of Theory for course delivery and evaluation | | | | | |
|---|---|---|---|---|---|
| Remember | Understand | Apply | Analyze | Evaluate | Create |
| 10% | 25% | 25% | 20% | 10% | 10% |

**Suggested List of Experiments:**

Minimum 12 experiments to be performed during the semester

1. To observe amplitude modulation waveforms for different modulation index.
2. To observe frequency modulation waveform and to measure peak frequency deviation.
3. To observe frequency spectrum of AM and FM waveforms.
4. To understand block diagram of AM receiver and observe signals at different stages.
5. To understand block diagram of FM receiver and observe signals at different stages.
6. To Study and Perform sampling theorem and reconstruction.
7. To perform TDM-PCM Transmission and Reception.
8. Experiment on Companding techniques
9. To study Delta Modulation.
10. To transmit and receive digital signal using Amplitude shift keying.
11. To transmit and receive digital signal using Frequency Shift Keying.
12. 12 To transmit and receive digital signal using Phase Shift Keying (BPSK and QPSK)
13. Simulation of various analog and digital modulation and demodulation techniques
14. Simulation of effect of noise in communication systems

**Supplementary Resources:**

1. https://www.tutorialspoint.com/digital_communication/digital_communication_analog_to_digi tal.html
2. https://www.classcentral.com/course/swayam-analog-communication-13893
3. https://www.udemy.com/course/analog-communication/

Marwadi University
Faculty of Technology
Department of Information and Communication Technology

# Subject Code: 01CT0403

## Subject Name: Microcontroller and Interfacing

## B. Tech. Year – II (Semester IV)

**Objective:**

This course introduces the architecture, assembly language and C language programming of ATmega32 AVR family microcontroller. It gives a hands-on training of interfacing external sensors andactuators with microcontroller. The course objective is to introduce the basic concepts of small and medium scale embedded system design using microcontroller and to develop assembly and C language programming skills for real time applications of Microcontroller.

**Credits Earned:** 04 Credits

**Course Outcomes:** After completion of this course, student will be able to:

1. Acquire basic knowledge of microcontroller and utilize real time software and hardware forembedded systems using AVR Atmega-32 microcontroller.
2. Understand architecture of Atmega-32, its pin configuration, data-types, instruction set,addressing modes and advance communication protocols like SPI, I2C etc.
3. Develop assembly and C language programs for ADC, EEPROM, PWM and Timer by applyingvarious instructions like data transfer, ALU, Branch, subroutine etc.
4. Analyse I/O peripherals like LCD, Keyboard, Relay, Sensor, Motor etc. by interfacing it with AVRmicrocontroller.
5. Evaluate minor microcontroller-based projects that solves real world problems.

**Pre-requisite of course:**

Basics of Digital Logic Design, Microprocessor architecture and basics of C programming

**Teaching and Examination Scheme:**

| Teaching Scheme (Hours) | | | Credits | Theory Marks | | | Tutorial / Practical Marks | | Total Marks |
|---|---|---|---|---|---|---|---|---|---|
| | | | | E | I | | V | T | |
| Theory | Tutorial | Practical | | ESE | IA | CSE | Viva | Term Work | |
| 03 | 00 | 02 | 04 | 50 | 30 | 20 | 25 | 25 | 150 |

**Contents:**

| Unit | Topics | Hours |
|---|---|---|
| 1 | **Introduction to microcontroller**<br>Microprocessor and Microcontroller difference, RISC and CISC programmer's model, Criterial for selecting microcontroller | 04 |
| 2 | **Introduction to AVR microcontroller**<br>Overview of AVR family, AVR Microcontroller architecture, status register, Special function registers, RAM, ROM & EEPROM space, On-Chip peripherals, ATmega32 pin configuration & function of each pin, Fuse bits of AVR. | 07 |
| 3 | **AVR assembly language programming**<br>AVR data types and assembler directives, addressing modes of AVR, Data transfer, Arithmetic, Logic and Compare, Rotate and Shift, Branch and Call instructions, AVR studio setup for assembly language programming, AVR I/O Port Programming, Time delay loop, Look-up table, Bit addressability, MACROs, Intel HEX file. | 08 |
| 4 | **AVR programming in C**<br>AVR Data types, AVR I/O port programming, Timer programming, Input capture and Wave Generator, PWM programming External Interrupt programming, ADC programming, EEPROM programming. | 08 |
| 5 | **Serial communication protocols**<br>UART protocol, I2C protocol, SPI protocol, Serial Port programming using polling and interrupt, I2C Programming, SPI Programming | 07 |
| 6 | **Peripheral interfacing**<br>LCD and Keyboard Interfacing, Relay interfacing, Stepper and DC Motor control, DS1307 RTC Interfacing, LM35 Temperature sensor interfacing, MAX7219 display controller interfacing, | 08 |
| | **Total Hours** | 42 |

**Suggested Text books / Reference books:**

1. The AVR Microcontroller and Embedded Systems Using Assembly and C, By Muhammad AliMazidi, Sarmad Naimi and Sepehr Naimi, Pearson Education.
2. Programming and Customizing the AVR Microcontroller, By Dhananjay Gadre, McGraw HillEducation
3. AVR ATmega32 data sheet

**Suggested Theory distribution:**

The suggested theory distribution as per Bloom's taxonomy is as per follows. This distribution serves asguidelines for teachers and students to achieve effective teaching-learning process.

| Distribution of Theory for course delivery and evaluation | | | | | |
|---|---|---|---|---|---|
| Remember | Understand | Apply | Analyze | Evaluate | Create |
| 25% | 20% | 30% | 5% | 5% | 15% |

**Suggested List of Experiments:**

Minimum 12 experiments to be performed during the semester

1. Installation of AVR STUDIO and familiarization of ATMega32 AVR Development Board.
2. Hands-on experimentation of ATMega32 GPIO programming in Assembly and C.
3. Hands-on experimentation of ATMega32 Timer to generate accurate delay using polling inAssembly and C.
4. Hands-on experimentation of ATMega32 Timer to generate accurate delay using Interrupt inAssembly and C.
5. Hands-on experimentation of ATMega32 Timer to generate waveforms in Assembly and C
6. Hands-on experimentation of Seven Segment Display interfacing with ATMega32 in Assembly andC.
7. Hands-on experimentation of 16x2 LCD interfacing with ATMega32 in Assembly and C.
8. Hands-on experimentation of ATMega32 UART programming in Assembly and C.
9. Hands-on experimentation of 4x4 matrix keyboard interfacing with ATMega32 in Assembly and C
10. Hands-on experimentation of ATMega32 on-chip ADC for interfacing analog sensors in C.
11. Hands-on experimentation of DC motor interfacing and speed/direction control with ATMega32in C.

12. Hands-on experimentation of Stepper motor interfacing with ATMega32 in C.
13. Hands-on experimentation of DS1307 RTC Interfacing with ATMega32 in C using I2C protocol.
14. Hands-on experimentation of MAX7219 LED matrix driver Interfacing with ATMega32 in C using SPI protocol.
15. Design Frequency Counter which displays frequency of unknown pulse on 16x2 LCD using ATMega32 on-chip Timer.
16. Design Pulse period meter which displays ON-time of unknown pulse on 16x2 LCD using ATMega32 on-chip Timer
17. Design Bluetooth controlled 2-ch variable frequency square wave generator using ATMega32 UART and on-chip Timer.
18. Design 4 Channel Data Logger which measures Voltage between 0-5V on 4 ADC Channels of ATMega32 and transmit it to Host PC at every 1 second where it stored in excel sheet with timestamp for future analysis.

**Supplementary Resources:**

1. http://nptel.ac.in/courses/106108100/7
2. http://nptel.ac.in/courses/Webcourse-contents/IIT-KANPUR/microcontrollers/micro/ui/TOC.htm
3. https://swayam.gov.in/course/4446-microprocessors-and-microcontrollers
4. https://www.coursera.org/courses?languages=en&query=microcontroller
5. http://www.study-hub.com/avr-microcontroller-programming.html

**Marwadi University**
**Faculty of Technology**
**Department of Information and Communication Technology**

## Subject Code: 01CT0401

## Subject Name: Probability and Statistics

## B. Tech. Year – II (Semester IV)

**Objective:**

To provide a foundation in probability theory and statistical method in order to solve applied problems and to prepare for more advanced courses in probability and statistics.

**Credits Earned:** 04 Credits

**Course Outcomes:** After completion of this course, student will be able to:

1. Understand the needs of probability and distribution
2. Apply the mathematical treatment for random variable and joint probability distribution
3. Draw various graphs for the descriptive statistical analysis for the given data set and develop basic inference sense from it.
4. Apply appropriate probability distribution model, central limit for the given test cases.
5. Perform Test of Hypothesis as well as calculate confidence interval for a population parameter for single sample and two sample cases also Learn non-parametric test such as the Chi-Square test for Independence as well as Goodness of Fit.
6. Perform Statistical analysis study like descriptive statistics, correlation and regression using professional software.

**Pre-requisite of course:**

Differential and Integral Calculus and Basic Integration

**Teaching and Examination Scheme:**

| Teaching Scheme (Hours) | | | Credits | Theory Marks | | | Tutorial / Practical Marks | | Total Marks |
|---|---|---|---|---|---|---|---|---|---|
| | | | | E | I | | V | T | |
| Theory | Tutorial | Practical | | ESE | IA | CSE | Viva | Term Work | |
| 03 | 02 | 00 | 04 | 50 | 30 | 20 | 25 | 25 | 150 |

**Contents:**

| Unit | Topics | Hours |
|---|---|---|
| 1 | **Introduction to Probability**<br>Classical and axiomatic definitions of probability, sample space, probability of anevent, addition rule and conditional probability, multiplication rule, total probability, Bayes' theorm and independence. | 06 |
| 2 | **Random variable**<br>Introduction to the concept, Discrete and continuous random variable: definitions and examples, Probability density function and cumulative distribution functions of continuous random variables, Probability mass functionof discrete random variables, expected values and variance of discrete random variable. | 08 |
| 3 | **Probability distribution**<br>Moments, probability and moment generating functions, Some special probability distributions: Uniform, Exponential, Poisson, geometric, Binomial and Normal distribution. | 06 |
| 4 | **Two – dimensional random variable**<br>Joint distributions – Marginal and Conditional distributions, Covariance, regression, correlation, Independence of random variables. | 06 |
| 5 | **Transformation**<br>Transformation of random variables of two dimensions, Central limit theorem (for independent and identically distributed random variables), convergence in probability. Introduction to statistics, Measure of central tendency (mean, median, mode) and measures of dispersion (standard deviation, mean deviation, range, variance etc.) | 04 |
| 6 | **Estimation**<br>Consistency, Unbiasedness, the method of moments and the method of maximum likelihood estimation, confidence intervals for proportions, confidence intervals for parameters in one sample and two sample problems of normal populations. | 06 |
| 7 | **Testing of Hypotheses**<br>Null and alternative hypotheses, the critical and acceptance regions, two types of error, power of the test, tests for one sample and two sample problems for normal populations, tests for proportions the most powerful test and Neyman-Pearson Fundamental Lemma, Chi square goodness of fit test and its applications. | 06 |
| | **Total Hours** | 42 |

**Suggested Text books / Reference books:**

1. Introduction to Probability and Statistics for Engineers and Scientists, S. M. Ross, Academic Press, 2009.
2. Introduction to Probability and Statistics, J.S. Milton & J. C. Arnold, Cengage Learning, 2008
3. A First Course in Probability, S.M. Ross, Prentice Hall, 2001.
4. Introduction to Probability Theory and Statistical Inference, H.J. Larson, Wiley, 1982.

**Suggested Theory distribution:**

The suggested theory distribution as per Bloom's taxonomy is as per follows. This distribution serves asguidelines for teachers and students to achieve effective teaching-learning process.

| Distribution of Theory for course delivery and evaluation | | | | | |
|---|---|---|---|---|---|
| Remember | Understand | Apply | Analyze | Evaluate | Create |
| 20% | 20% | 30% | 15% | 10% | 5% |

**Suggested List of Tutorial:**

1. Plot different graph using excel.
2. Plot different graph using R and Python.
3. Write a program to generate random numbers for given range and find mean, median and modeusing R/Python.
4. Calculation of deviation, variance, correlation coefficient and code for it.
5. Calculation on basics of probability concepts.
6. Examples on moment, Probability distributions.
7. Calculation of Binomial, Poisson, and Hyper Geometric.
8. Calculation of Gaussian, Standard, Normal distribution, Confidence interval and P test.
9. Simulation for continuous and discrete distributions.
10. Calculation on central limit theorem (with simulation).
11. Calculation on hypothesis problems (with simulation).
12. Calculation on chi square goodness fit test.

**Supplementary Resources:**

1. https://www.mathsisfun.com/data/
2. https://nptel.ac.in/courses/111/105/111105041/
3. https://www.coursera.org/browse/data-science/probability-and-statistics
4. https://ocw.mit.edu/courses/mathematics/18-05-introduction-to-probability-and-statistics- spring-2014/

**Marwadi University**
**Faculty of Technology**
**Department of Information and Communication Technology**

## Subject Code: 01CT1510

## Subject Name: Applied Linear Algebra

## B. Tech. Year – III (Semester V)

**Objectives:** Linear Algebra is the study of vector spaces and linear transformations on vector spaces. Linear Algebra is central to both pure and applied mathematics. Techniques from linear algebra are also used in analytic geometry, engineering, physics, natural science, computer science, and the social sciences. Topics include the use and application of matrices in the solution of systems of linear equations, determinants, real n-dimensional vector spaces, abstract vector spaces and their axioms, linear independence, span and bases for vector spaces, linear transformations, eigenvalues and eigenvectors, matrix factorizations, and orthogonality. Computer explorations using MATLAB or Python is an integral component of this course.

**Credits Earned:** 05 Credits

**Course Outcomes:** After completion of this course, student will be able to:

1. Understand the use of matrices in solving linear systems of equations (Understand).
2. Determine the approximate solution of any system of linear equations using projection (Apply).
3. Matrix representations of linear transformations and use them in applied problems (Apply).
4. Applying the concept of eigenvalues, eigenvectors to solve real life problems (Apply).
5. Study and analyze various matrix factorization techniques (Analyze).

**Pre-requisite of course:** Understanding of elementary linear algebra, MATLAB/PYTHON

**Examination Scheme:**

<table>
<tr><th colspan="3" rowspan="2">Teaching Scheme (Hours)</th><th rowspan="3">Credits</th><th colspan="3">Theory Marks</th><th colspan="2">Tutorial / Practical Marks</th><th rowspan="3">Total Marks</th></tr>
<tr><th>E</th><th colspan="2">I</th><th>V</th><th>T</th></tr>
<tr><th>Theory</th><th>Tutorial</th><th>Practical</th><th>ESE</th><th>IA</th><th>CSE</th><th>Viva</th><th>Term Work</th></tr>
<tr><td>4</td><td>0</td><td>2</td><td>5</td><td>50</td><td>30</td><td>20</td><td>25</td><td>25</td><td>150</td></tr>
</table>

**Contents:**

| Unit | Topics | Content Hours |
|---|---|---|
| 1 | **Vectors and vector spaces**<br>Scalars: real numbers, complex numbers, examples of vector spaces, linear independence, span, basis vectors, rank, subspace, the null space of A: solving Ax = 0 and Rx = 0, the Complete Solution to Ax = b | 07 |
| 2 | **Linear Transformations**<br>Matrix representation, change of basis, products of linear maps, null space, range, fundamental subspaces, rank-nullity theorem, invertibility, isomorphism, operators,invertible linear maps, change of basis for a linear map/operator, simplifying linear operators by changing basis | 14 |
| 3 | **Eigenvalues and eigenvectors of linear operators**<br>Characteristic polynomial, eigenvalues/eigenvectors, generalized eigenvectors/eigenspaces, multiplicity, trace, determinant, similarity transformation, diagonalization, determinant, applications of eigen values: convolution and DFT, stability, finding expressions for A^k - fibonacci, counting paths in graphs, google search - popularity measures in a network | 14 |
| 4 | **Projection and least squares**<br>Projection to a subspace, distance from a subspace and projection least squares solution to a linear equation, application: MMSE estimation application: linear regression in machine learning | 08 |
| 5 | **Inner Product Spaces**<br>Inner products, vector norms, matrix norms, norms induced by inner products, orthogonality, orthonormality, gram-schmidt procedure, orthogonal complements, orthogonal projection, Cauchy-Schwartz inequality. | 06 |
| 6 | **Singular value decompositions**<br>Singular values and singular vectors, singular value decomposition, application: MIMO communications, low-rank approximations, recommendation systems | 07 |
| | **Total Hours** | **56** |

**Suggested Text books / Reference books:**

1. Gilbert Strang, Introduction to Linear Algebra Fifth Edition (2016), Wellesley-Cambridge Press
2. Stephen Boyd and Lieven Vandenberghe, Introduction to Applied Linear Algebra – Vectors, Matrices, and Least Squares First Edition (2018), Cambridge University Press
3. Sheldon Axler, Linear Algebra Done Right third edition (2015), Springer
4. Gilbert Strang, Linear Algebra for Everyone, First Edition (2020), Wellesley-Cambridge Press
5. Gilbert Strang, Linear Algebra and Learning from Data, First Edition (2019), Wellesley-Cambridge Press

**Suggested Theory distribution:**

The suggested theory distribution as per Bloom's taxonomy is as per follows. This distribution serves as guidelines for teachers and students to achieve effective teaching-learning process.

| Distribution of Theory for course delivery and evaluation | | | | | |
|---|---|---|---|---|---|
| Remember | Understand | Apply | Analyze | Evaluate | Create |
| 10% | 10% | 40% | 20% | 10% | 10% |

**Suggested List of Experiments:**

1. Solving the maze using set of vectors to reach from start to end using restricted movements
2. Image Filtering using Convolution operation
3. Image Rotation using Matrix operations
4. Encryption and Decryption of secret messages using cryptography
5. Correct or recover the codes that have been tampered with while transmission or processing
6. Determining the word representation based on embeddings of different words using word2vec
7. Solving the system of Linear Equations for exact solution
8. Solving the system of Linear Equations for Approximate solution
9. Using QR decomposition for solving linear equations
10. Find the equation of hypothesis to fit the set of datapoints
11. Obtain the linearly transformed image/structure of a given image/structure
12. Application of Radiography images using Projection
13. Calculating the matrix-power using matrix diagonalization
14. Ranking algorithm in search engines using eigenvalues
15. Dimensionality Reduction using Eigenvalues and Eigenvectors
16. Finding the Fibonacci series using eigenvalues and eigenvectors
17. Image compression using Matrix Factorization
18. Content Based Filtering Recommendation system using Singular Value Decomposition
19. Merging multiple images using linear algebra to look as natural image

**Instructional Method:**

1. The course delivery method will depend upon the requirement of content and need of students. The teacher in addition to conventional teaching method by black board, may also use any of tools such as demonstration, role play, Quiz, brainstorming, MOOCs etc.
2. The internal evaluation will be done on the basis of continuous evaluation of students in the laboratory and class-room.
3. Practical examination will be conducted at the end of semester for evaluation of performance of students in laboratory.
4. Students will use supplementary resources such as online videos, NPTEL videos, e-courses, Virtual Laboratory

**Supplementary Resources:**

1. https://math.mit.edu/~gs/linearalgebra/
2. https://web.stanford.edu/~boyd/vmls/
3. https://clas.ucdenver.edu/mathematical-and-statistical-sciences/applied-linear-algebra-preliminary-exam-syllabus
4. http://www.cs.lewisu.edu/~harsyram/Linear_Algebra_Note_Packet_2020.pdf

## Subject Code: 01CT0507

## Subject Name: Advanced Microprocessor

## B. Tech. Year – III (Semester V)

**Objectives:** This course introduces the ARMv7 and ARMv7 CortexM architecture, Instruction set, assembly language and C language programming of ARMv7 CortexM core-based Microcontroller. It gives a hands-on training of evaluate various on chip peripherals and interfacing external sensors and actuators with Cortex-M based microcontroller. The course objective is to introduce the basic concepts medium scale embedded system design using ARMv7 CortexM based microcontroller and to develop assembly and C language programming skills for real time applications of ARMv7 CortexM based microcontroller.

**Credits Earned:** 05 Credits

**Course Outcomes:** After completion of this course, student will be able to:

1. Understand ARMv7 and ARMv7 CortexM Architecture (Understand).
2. Develop real time software and hardware for embedded systems using Cortex M Microcontroller (Create).
3. Write and debug C programs for Cortex-M Microcontroller (Apply).
4. Effectively utilize on chip peripherals such as timers, serial communications, analog-to-digital converters & pulse width modulation for low power applications (Apply).
5. Implement advance communication protocol like I2C and SPI on Cortex-M Microcontroller (Apply).
6. Effectively utilize ARMv7 and ARMv7 CortexM based microcontroller to solves real world problems (Apply).

**Pre-requisite of course:** Basics of Digital Logic Design, Microprocessor architecture, and basics of C programming

**Teaching and Examination Scheme:**

| Teaching Scheme (Hours) | | | Credits | Theory Marks | | | Tutorial / Practical Marks | | Total Marks |
|---|---|---|---|---|---|---|---|---|---|
| | | | | E | I | | V | T | |
| Theory | Tutorial | Practical | | ESE | IA | CSE | Viva | Term Work | |
| 4 | 0 | 2 | 5 | 50 | 30 | 20 | 25 | 25 | 150 |

**Contents:**

| Unit | Topics | Contact Hours |
|---|---|---|
| 1 | **Introduction to embedded systems**<br>Hardware Components of Embedded System, Instruction Set Architecture | 6 |

| | | |
|---|---|---|
| 2 | **ARMv7 architecture**<br>Basic architecture of the ARM7core, Registers, Current Program Status Register (CPSR), Operating States, Operating Modes, Programming Model, Interrupt and Exception Handling, ARM Instruction Set, Migration to Cortex Series, ARM architecture v7 profile, ARMv7-M architecture, Operating States and Operating Modes, Programming Model. | 12 |
| 3 | **ARMv7 instruction set**<br>Instruction Set: Tables with all categories of instructions with descriptions. Load/Store instructions with addressing modes, Thumb instruction set, CMSIS. | 12 |
| 4 | **Peripheral Programming in C for Cortex M based Microcontroller**<br>Cortex M Microcontroller Architecture and Its memorymap, GPIO Programming, WDT Programming, Interrupt Programming, LPM Programming, ADC, PWM and DMA Programming | 14 |
| 5 | **Serial communication protocols**<br>UART protocol, I2C protocol, SPI protocol, Serial Port Programming, I2C Programming, SPI Programming | 10 |
| | **Total Hours** | 54 |

**Suggested Text books / Reference books:**

1. Muhammad Ali Mazidi, Sarmad Naimi and Sepehr Naimi, TI ARM Peripherals Programming and Interfacing Using C Language, Pearson Education.
2. Jonathan W. Valvano, Embedded Systems: Introduction to Arm® Cortex™-M Microcontrollers, 5th edition, ISBN: 978-1477508992.
3. Embedded System Design Using TIVA, TI University Program, Learning Material.

**Suggested Theory distribution:**

The suggested theory distribution as per Bloom’s taxonomy is as per follows. This distribution serves as guidelines for teachers and students to achieve effective teaching-learning process.

| Distribution of Theory for course delivery and evaluation | | | | | |
|---|---|---|---|---|---|
| Remember | Understand | Apply | Analyze | Evaluate | Create |
| 20% | 20% | 30% | 15% | 10% | 5% |

**Suggested List of Experiments:** Minimum 14 experiments to be performed during the semester

1. Installation of CCS and familiarization of ARMv7 Development Board.
2. Hands-on experimentation of GPIO programming in C on ARMv7 development board.
3. Hands-on experimentation of Timer to generate accurate delay in C on ARMv7 developmentboard.
4. Hands-on experimentation of Hibernation and Wakeup by RTC programming in C on ARMv7 development board.
5. Hands-on experimentation of ADC programming in C on ARMv7 development board.
6. Hands-on experimentation of PWM programming in C on ARMv7 development board.
7. Hands-on experimentation of UART Transmit programming in C on ARMv7 development board.
8. Hands-on experimentation of UART Receive programming in C on ARMv7 development board.
9. Hands-on experimentation of UART Transmit and Receive programming in C on ARMv7development board.
10. Hands-on experimentation of interfacing 16x2 LCD and programming in C with ARMv7development board.
11. Hands-on experimentation of interfacing SIM800L GSM/GPRS and programming in C withARMv7 development board.
12. Hands-on experimentation of interfacing HC-05 Serial Bluetooth and programming in C withARMv7 development board.
13. Hands-on experimentation of MPU6050 Accelerometer & Gyroscope Interfacing in C usingI2C protocol with ARMv7 development board.
14. Hands-on experimentation of MAX7219 LED matrix driver Interfacing in C using SPI protocol with ARMv7 development board.
15. Design Mini project based on CortexM based Microcontroller utilizing minimum 3 on-chipperipherals and minimum 2 external sensors/actuators to solve a real-world problem.

**Supplementary Resources:**

1. https://www.ti.com/seclit/ml/ssqu015/ssqu015.pdf
2. https://university.ti.com/en/faculty/teaching-materials-and-classroom-resources/embedded-learning-materials

## Subject Code: 01GS0501

## Subject Name: Cognitive Aptitude 1

## B. Tech. Year – III (Semester V)

**Objectives:** This course shall enrich students' preparedness for the upcoming competitive exams, entrance test, and/or placements. It will enhance the numerical skills of the students through the group interactions, practice sessions, and videos.

**Credits Earned:** 00 Credits

**Course Outcomes:** After completion of this course, student will be able to:

1. Develop thinking skills by practicing on complex numerical computations (Apply).
2. Inculcate smart approach in numerical problem solving (Analyze).
3. Apply the concepts in both competitive exams and placement drives (Apply).
4. Solve real-life problems requiring interpretation and comparison of complex numeric summaries (Analyze).
5. Create and use visual displays of data (Apply).

**Pre-requisite of course:** NA

**Teaching and Examination Scheme:**

| Teaching Scheme (Hours) | | | Credits | Theory Marks | | | Tutorial / Practical Marks | | Total Marks |
|---|---|---|---|---|---|---|---|---|---|
| | | | | E | I | | V | T | |
| Theory | Tutorial | Practical | | ESE | IA | CSE | Viva | Term Work | |
| 2 | 0 | 0 | 0 | 00 | 00 | 00 | 00 | 00 | 00 |

**Contents:**

| Unit | Topics | Contact Hours |
|---|---|---|
| 1 | Introduction of Quantitative Aptitude | 01 |
| 2 | **Simplification (Word Problems):** Expressions and Equations, Tactics of solutions, Linear Equations, Solving Linear Equations, Word Problems | 02 |
| 3 | **HCF & LCM:** Calculation of HCF and LCM, find smallest & largest numbers divisible by given numbers, Common remainder & difference between number and remainder type, Calculation of LCM & HCF of Fraction Numbers. | 02 |
| 4 | Class Test 1 and doubt solving session | 01 |
| 5 | **Average:** Simple average calculation, Related examples, Combined mean & weighted average, Corrected mean & New mean | 02 |

| | | |
|---|---|---|
| 6 | **Ratio and Proportion:** Ratio & Proportion, Ratio concept and rules & distributing amount in ratio | 02 |
| 7 | Class Test 2 and doubt solving session | 01 |
| 8 | **Partnership:** Partnership, Partnership ratio and profit distribution | 01 |
| 9 | **Mixture and Allegation:** Rule of allegation, Concept of Replacement | 02 |
| 10 | Class Test 3 and doubt solving session | 01 |
| 11 | **Percentage:** Reciprocals & equivalent percentage, Speed techniques of calculating percentage, change of base concept, Multiplying factor concept | 02 |
| 12 | **Profit, Loss & Discount:** Explanation of basic terms, Simple profit & loss concept, Discount & multiple discount concept, Faulty balance & wrong measurement, discount or mark up or mixing impurities, Other combined examples | 01 |
| 13 | Class Test 4 and doubt solving session | 01 |
| 14 | **Simple Interest:** Important formulae & Calculation, Calculation of missing value concept, Difference between SI and CI for various years, Comparison of SI and CI investment concept | 01 |
| 15 | **Compound Interest:** Difference between SI and CI for various years, Comparison of SI and CI investment concept | 01 |
| 16 | Class Test 5 and doubt solving session | 01 |
| 17 | **Data Interpretation:** Study of various charts and Problem related to charts | 02 |
| 18 | **Data Sufficiency:** Yes / No Questions, Value Questions | 01 |
| 19 | Class Test 6 and doubt solving session | 01 |
| 20 | Post Assessment Test and doubt solving session | 02 |
| | **Total Hours** | 28 |

**Suggested Text books / Reference books:**

1. Quantitative Aptitude – By Dr. R. S. Agarwal, S. Chand
2. Quantitative Aptitude – By Abhijit Guha, MC Graw Hills
3. Magical Book On Quicker Maths – By M. Tyra, BSC Publishing Co. Pvt. Ltd.

**Suggested Theory distribution:**

The suggested theory distribution as per Bloom's taxonomy is as per follows. This distribution serves as guidelines for teachers and students to achieve effective teaching-learning process.

| Distribution of Theory for course delivery and evaluation | | | | | |
|---|---|---|---|---|---|
| Remember | Understand | Apply | Analyze | Evaluate | Create |
| 25% | 25% | 25% | 25% | 00% | 00% |

**Supplementary Resources:**

1. www.indiabix.com
2. www.careerbless.com
3. www.sawaal.com
4. www.allindiaexams.com
5. www.freshersworld.com

# Subject Code: 01CT0503

## Subject Name: Computer Networks

## B. Tech. Year – III (Semester V)

**Objectives:** The objective of this course is to understand the significance and concepts of computer networks, to conceptualize and appreciate the layered model for computer networking. The coursealso provides insights to basic protocols and design issues for layered model, leading to design and implementation of protocols related to various networking layers.

**Credits Earned:** 04 Credits

**Course Outcomes:** After completion of this course, student will be able to:

1. Understand the functionality of various protocols, models and networks (Understand).
2. Analyze various flow and error control algorithms (Analyze).
3. Analyze different medium access protocols and network hardware component (Analyze).
4. Compare various static and dynamic routing protocol (Analyze).
5. Understand various transport services, protocols and application layer functionalities (Understand).
6. Built and test various network topologies and routing protocols for various networksscenarios (Apply).

**Pre-requisite of course:** Introduction to Communication Engineering, Analog and Digital Communication

**Teaching and Examination Scheme:**

| Teaching Scheme (Hours) | | | Credits | Theory Marks | | | Tutorial / Practical Marks | | Total Marks |
|---|---|---|---|---|---|---|---|---|---|
| | | | | E | I | | V | T | |
| Theory | Tutorial | Practical | | ESE | IA | CSE | Viva | Term Work | |
| 3 | 0 | 2 | 4 | 50 | 30 | 20 | 25 | 25 | 150 |

**Contents:**

| Unit | Topics | Contact Hours |
|---|---|---|
| 1 | **Introduction**<br>Use of Computer Networks, Network Hardware, Network Software, OSI and TCP/IP Reference Model, Example Networks and standards. | 03 |

| | | |
|---|---|---|
| 2 | **Data Link Layer**<br>Types of error, Error-Detection and correction, Flow and Error Control, Elementary Data link Protocols, Sliding window Protocols, HDLC, Example of data link protocols. | 07 |
| 3 | **Medium Access Control Sub layer**<br>Multiple Access Protocols, LANs Ethernet, Wireless LANs, Local Area Networks, Connecting Devices, Backbone Network, Virtual LANs. | 09 |
| 4 | **Network Layer**<br>Network layer design issues, Routing Algorithms, Congestion Control Algorithms, QoS, Internetworking, Network Layer in the Internet. | 09 |
| 5 | **Transport Layer**<br>The transport Service, Elements of transport protocol, congestion control, Internet transport protocol UDP, TCP. | 10 |
| 6 | **Application Layer**<br>Domain Name System, E-mail, World Wide Web, Multimedia. | 04 |
| | **Total Hours** | **42** |

**Suggested Text books / Reference books:**

1. Andrew S. Tanenbaum, 1st edition, Computer Networks PHI Publication
2. Computer Networking- A Top-Down approach, 5th edition, Kurose and Ross, Pearson
3. Forouzan, Data Communication Networking, Reprint, TMH Publication
4. Forouzan, TCP/IP Protocol suit, Reprint, TMH Publication
5. William Stallings, Data and computer Communication, Reprint, Pearson.

**Suggested Theory distribution:**

The suggested theory distribution as per Bloom's taxonomy is as per follows. This distribution serves as guidelines for teachers and students to achieve effective teaching-learning process.

| Distribution of Theory for course delivery and evaluation | | | | | |
|---|---|---|---|---|---|
| Remember | Understand | Apply | Analyze | Evaluate | Create |
| 25% | 20% | 30% | 15% | 5% | 5% |

**Suggested List of Experiments:**

Minimum 12 experiments to be performed during the semester

1. Briefing of Network Simulator
    a) Introduction, Features and Network supported by NS2
    b) Platform required to run Network Simulator

   c) Backend Environment of Network Simulator
   d) Installation steps of NS-2 in Ubuntu 14.04LTS
2. To perform TCL Script using basic TCL Syntax, looping, conditional check, functions, execution of Mathematical Operations and Execution of Unix Command
3. Introduction to TCL script in which it takes number N from user and prints factorial— use function call.
4. Introduction to TCL script in which it Implement Basic Calculator operation in TCL- use function Call.
5. Simulation of Wired topology of 4 Node
6. Creating Output files for X-graph, analyze and plot received traffic from 3 nodes.
   a) data rate
   b) delay
   c) speed of link
   d) size of data
7. Creating Wireless Simulation on NS to analyze the effects error on one link v/s behavior of Sliding Window Size
8. Introduction to Cisco Packet Tracer and configuring various network devices, hosts & transmission media.
9. Configuration of DHCP Server in Packet Tracer Software and analysis of DHCP messages.
10. Configuration of HTTP Server in Packet Tracer Software and analysis of HTTP request & response messages.
11. Study of basic network commands.
12. Study of Network devices configuration commands.
13. Configure Link State Vector Routing (e.g., OSPF) in Packet Tracer Software.
14. Configure Distance Vector Routing (e.g., RIP) in Packet Tracer Software.
15. Installation of NS3 in Linux and
   a) Program in NS3 to connect two nodes.
   b) Program in NS3 for connecting three nodes considering one node as a central node.
16. Program in NS3 to implement star topology.
17. Program in NS3 to implement a bus topology.

**Supplementary Resources:**

1. https//study-ccna.com/eigrp-overview/
2. https//www.netacad.com/
3. https//www.computernetworkingnotes.com/
4. https//www.isi.edu/nsnam/ns/

## Subject Code: 01CT0517

## Subject Name: Cross Platform Mobile Application Development

## B. Tech. Year – III (Semester V)

**Objectives:** This course facilitates classroom and laboratory learning, letting students learn dart programming language and develop competence and confidence in cross platform mobile application development using flutter. Students will understand the Flutter app development environment and apply advanced features, so the students can independently create and deploy cross platform mobile application.

**Credits Earned:** 05 Credits

**Course Outcomes:** After completion of this course, student will be able to:

1. Demonstrate the basic primitives in Flutter and Dart framework (Apply).
2. Model native platform code using Flutter and Dart (Apply).
3. Examine the use of widgets and user interactions in application development (Analyze).
4. Evaluate application development using the concepts of animation and interactive widgets (Analyze).
5. Construct flutter and dart applications using customized layouts and service interactions (Create)

**Pre-requisite of course:** Basics of programming language, Concepts of OOP

**Teaching and Examination Scheme:**

| Teaching Scheme (Hours) | | | Credits | Theory Marks | | | Tutorial / Practical Marks | | Total Marks |
|---|---|---|---|---|---|---|---|---|---|
| | | | | E | I | | V | T | |
| Theory | Tutorial | Practical | | ESE | IA | CSE | Viva | Term Work | |
| 4 | 0 | 2 | 5 | 50 | 30 | 20 | 25 | 25 | 150 |

**Contents:**

| Unit | Topics | Contact Hours |
|---|---|---|
| 1 | **Introduction to Flutter:** Flutter Framework, Working of Flutter and Dart, installation of Flutter SDK, Using Hot Reload and themes, External packages import, project templates, organizing files and folders.<br>**Introduction to Dart:** Declaring and referencing variables, using operators, flow control statements, using functions and classes, implementing asynchronous programming. | 14 |

| | | |
|---|---|---|
| 2 | **Using common widgets:** Scaffold, AppBar, SafeArea, Container, Text, Buttons, column, row, using images and icons, decorators, form widgets, checking orientation<br>**User Inputs:** Collecting text Inputs, setting text limits, Writing platform native code. | 14 |
| 3 | **Adding Animation to App using Widget:** Using AnimatedContainer, AnimatedCrossfade, AnimatedOpacity, AnimationController, using staggered Animations, using CurveTween<br>**App's Navigation:** Using Navigator, named navigator route, Hero widget, BottomNavigationBar BottomMapBar, TabBar, TabBarView, Drawer<br>**Applying Interactivity:** GestureDetector, Dragable and DragTarget Widget, InkWell and InkResponse gestures Dismissible widget | 14 |
| 4 | **Building layouts: Scrolling Lists:** Card widget, Using ListView and ListTitle,GridView, Stack widget, Customizing CustomScrollView using Slivers<br>**Service interaction:** Working with Future object, working with streams, building, widgets based on stream and futures, handling various types of data: JSON, XML, HTML, Sending HTTP request<br>**Saving data with local persistence:** Reading and Writing files, working with key-value pairs, Supporting multiple locales, Introduction to Firebase and cloud Firestore. | 14 |
| | **Total Hours** | **56** |

**Suggested Text books / Reference books:**

1. Marco L. Napoli, Beginning Flutter: A Hands-on Guide to App Development, John Wiley Sons, 1st Edition, 2020
2. D. Kopec, Dart for Absolute Beginners, Apress, 1st Edition, 2014.
3. Fu Cheng, Flutter Recipes, Apress, 1st Edition, 2019.

**Suggested Theory distribution:**

The suggested theory distribution as per Bloom's taxonomy is as per follows. This distribution serves as guidelines for teachers and students to achieve effective teaching-learning process.

| Distribution of Theory for course delivery and evaluation | | | | | |
|---|---|---|---|---|---|
| Remember | Understand | Apply | Analyze | Evaluate | Create |
| 10% | 20% | 25% | 20% | 10% | 15% |

**Suggested List of Experiments:**

1. To install and configure Flutter Environment.
2. To Study basics of Dart language and design basic Flutter App.
3. To design Flutter UI by including common widgets.
4. To create an interactive Form using form widget.
5. To design a layout of Flutter App using layout widgets.
6. To include icons, images, charts in Flutter app.
7. To apply navigation, routing and gestures in Flutter App.
8. To analyze sensor data in Flutter App.
9. To Connect Flutter UI with fireBase database.
10. To test and deploy production ready Flutter App on Android platform.
11. Open Ended Practical [Mini Project]
12. Open Ended Practical [Mini Project]
13. Open Ended Practical [Mini Project]
14. Open Ended Practical [Mini Project]

**Supplementary Resources:**

1. https://flutter.dev/
2. https://developers.google.com/learn/topics/flutter

## Subject Code: 01CT0521

## Subject Name: Creativity, Problem Solving and Innovation

## B. Tech. Year – III (Semester V)

**Objectives:** To develop creative thinking skill in the students using cone of learning components leading to understanding of various strategies for creativity, problem solving and innovation.

**Credits Earned:** 01 Credit

**Course Outcomes:** After completion of this course, student will be competent to:

1. Importance of creativity, problem solving and innovation while addressing science, engineering and social issues (Understand).
2. Demonstrate the ability to contextualize knowledge related to professional engineering practices (Apply).
3. Demonstrate the functioning effectively as an individual and team member (Apply).
4. Ability to engage in life-long learning in the context of technological change (Apply).

**Pre-requisite of course:** Zeal to learn the subject.

**Examination Scheme:**

| Teaching Scheme (Hours) | | | Credits | Theory Marks | | | Tutorial / Practical Marks | | Total Marks |
|---|---|---|---|---|---|---|---|---|---|
| | | | | E | I | | V | T | |
| Theory | Tutorial | Practical | | ESE | IA | CSE | Viva | Term Work | |
| 0 | 0 | 2 | 1 | 00 | 30 | 00 | 20 | 00 | 50 |

**Contents:**

| Unit | Topics | Content Hours |
|---|---|---|
| 1 | **Phase 1**<br>To introduce the subject of the course: this course as a needed skill for your future. Psychology of problem solving; Vertical versus Lateral thinking. | 02 |
| 2 | **Phase 2**<br>Strategy of Questioning; Method of questioning; Importance of asking the right question. Who, what, when, where, why, how? | 02 |
| 3 | **Phase 3**<br>Learning and its importance; Sources of learning; Methods of learning. Purpose and value of education in future creativity in real life. | 02 |
| 4 | **Phase 4**<br>Strategy of Knowing how to see; Making your thought visible; Visualizing | 02 |

| | | |
|---|---|---|
| | thinking; Mapping of mind, Fishbone diagram. | |
| 5 | **Phase 5**<br>Strategy of Thinking Fluency; Generating all possibilities; more the better; Quantity without screening is helpful; SCAMPER technique; Creative or divergent idea generating thinking versus Critical or convergent idea selection thinking. | 02 |
| 6 | **Phase 6**<br>Strategy of Fusing of ideas; Making novel combinations; Connecting the unconnected | 02 |
| 7 | **Phase 7**<br>Strategy of Looking at the other side, looking in other world, finding what you are not looking for and following it up. | 02 |
| 8 | **Phase 8**<br>Strategy of Play, Importance of play; Diversion; Unstructured activities for sheer joy, Activities for joy, Let subconscious figure it out, Various puzzles as play or fun | 02 |
| 9 | **Phase 9**<br>Strategy of Awakening the collaborative spirit, Collaborative thinking, brain storming, Innovation requires collaboration to make it happen. | 02 |
| 10 | **Phase 10**<br>Review Strategies for Creative problem-solving methods, Five building blocks as per Fogler & LeBlanc, Stanford D school approach. | 02 |
| 11 | **Phase 11**<br>Strategy for critical thinking for Choosing, Creative or divergent thinking needs follow up by Critical thinking or Convergent thinking in order to choose the solution for implementation, Kepner-Tregoe (K.T.) method with an example, Edward De Bono CoRT thinking process including PMI (Plus, Minus and Interesting), Also Edward de Bono method of decision making called Six thinking hats. | 02 |
| 12 | **Phase 12**<br>Edward de Bono explaining and teaching his ideas having evolved many years ago consisting as CoRT thinking tool, Lateral thinking and the decision making by Six thinking hats method | 02 |
| 13 | **Phase 13**<br>Strategy for Making; From idea to innovation. | 02 |
| 14 | **Phase 14**<br>Individual presentation for 75 minutes by 15 students (5 minutes per student). | 04 |
| | **Total Hours** | **30** |

**Suggested Text books / Reference books:**

1. Zig Zag, The surprising path to greater creativity by R. Keith Sawyer. 2013.
2. Group Genius by Keith Sawyer, the creative power of Collaboration. 2007.
3. Crackling Creativity, The secrets of creative genius by Michael Michalko 2001.
4. Thinkertoys by Michael Michalko, second edition 2006.
5. De Bono's Thinking Course by Edward De Bono, Revised Edition 1994.
6. Six Thinking Hats by Edward De Bono Revised and updated edition 1999.
7. Lateral thinking, Creativity Step by Step by Edward De Bono. 1973.
8. How to Mind Map by Tony Buzan. 2002.
9. Mapping Inner Space by Nancy Margulies with Nusa Maal. Second edition.2002.
10. The Myths of Innovation by Scott Berkun. Expanded and revised edition 2010.
11. The art of Innovation by Tom Kelly with Jonathan Littman. 2001.
12. Creative Confidence: Unleashing the Creative Potential Within Us All by Tom Kelly and David Kelly. 2013.
13. A Whack on the side of the head by Roger von Oech. Revised edition 1998.
14. A Kick in the seat of the pants by Roger von Oech.1986.
15. They all laughed by Ira Flatow. 1992.
16. Imagine, How creativity works by Jonah Lehrer. 2012.
17. 101 Creative problem-solving techniques by James m Higgins.1994.
18. Creative approach to problem solving by Scott G Isaksen, K Brian Dorval, Donald J Treffinger. 2000.
19. Creative problem solving An Introduction by Donald J. Treffinger, Scott G Isaksen and K. Brian Stead Dorval. 4th edition, 2006.
20. Strategies for creative problem solving by H. Scott Fogler & Steven E. LeBlanc. Second edition 2008.
21. Game storming by Dave Gray, Sunni Brown and James Macanufo.2010.
22. Creating minds by Howard Gardner. 1993.
23. Creativity –Flow and Psychology of Discovery and Invention by Mihaly Csikzentmihalyi.1996.
24. Aha! Insight by Martin Gardner. 1978.
25. The Ultimate Lateral & Critical Thinking Puzzle book by Paul Sloane, Des MacHale & M. A. DiSpezio. 2002.
26. Test your Lateral Thinking IQ by Paul Sloane. 1994.
27. Intriguing Lateral Thinking Puzzles by Paul Sloane & Des MacHale.1996.

## Subject Code: 01CT0512

## Subject Name: Design and Analysis of Algorithm

## B. Tech. Year – III (Semester V)

**Objectives:** Obtaining efficient algorithms is very important in modern computer engineering as the world wants applications to be time and space and energy efficient. This course enables to understand and analyze efficient algorithms for various applications.

**Credits Earned:** 04 Credits

**Course Outcomes:** After completion of this course, student will be able to:

1. Compare various algorithm design techniques for developing algorithms by evaluating the asymptotic complexities and time-space trade-off. (Understand)
2. Develop different algorithms using various methods like dynamic and Greedy methods. (Apply)
3. Select appropriate pattern matching algorithm to develop model for substring, subsequence, DNA matching, etc. (Apply)
4. Distinguish between Polynomial, Non-Polynomial complete and Hard problems (Analyse)
5. Evaluate various graph algorithms for sparse and dense network structures (Evaluate)

**Pre-requisite of course:** Proficiency in any programming language, Data Structures, Discrete Mathematics.

**Teaching and Examination Scheme:**

| Teaching Scheme (Hours) | | | Credits | Theory Marks | | | Tutorial / Practical Marks | | Total Marks |
|---|---|---|---|---|---|---|---|---|---|
| | | | | E | I | | V | T | |
| Theory | Tutorial | Practical | | ESE | IA | CSE | Viva | Term Work | |
| 3 | 0 | 2 | 4 | 50 | 30 | 20 | 25 | 25 | 150 |

**Content:**

| Unit | Topics | Content Hours |
|---|---|---|
| 1 | **Introduction to Design and Analysis of Algorithms:** What is an algorithm, Mathematics for Algorithmic Sets, Functions and Relations, Vectors and Matrices, Linear Inequalities and Linear Equations. | 2 |
| 2 | **Asymptotic Analysis of Algorithm:** The efficient algorithm, Average, Best- and worst-case analysis, Amortized analysis, Asymptotic Notations (Big Oh, Big Theta, Big Omega), Master Method, Sorting Algorithms and their analysis, Sorting in linear time: Bucket sort, Radix sort and Counting sort | 06 |
| 3 | **Divide and Conquer** Introduction, Recurrence and different methods to solve recurrence, multiplying large Integers Problem, Problem Solving using divide and conquer algorithm - Binary Search, Max-Min problem, Sorting (Merge Sort, Quick Sort), Matrix Multiplication, Exponential | 06 |
| 4 | **Dynamic Programming:** Introduction, Elements of Dynamic Programming, The Principle of Optimality, Problem Solving using Dynamic Programming – Calculating the Binomial Coefficient, Making Change Problem, Assembly Line-Scheduling, Knapsack problem, Matrix chain multiplication, Longest Common Subsequence | 06 |
| 5 | **Greedy Algorithm** General Characteristics of greedy algorithms, Elements of greedy strategy, Problem solving using - Activity selection problem, Fractional Knapsack Problem, Job Scheduling Problem. | 04 |
| 6 | **Graph Algorithms** Representation of Undirected & Directed Graph, Traversing Graphs, Depth FirstSearch, Breath First Search, Topological sort, Strongly Connected components. Single pair shortest path and Minimum Spanning trees (Kruskal's algorithm, Prim's algorithm) using greedy approach, All Points Shortest path using DynamicProgramming | 06 |
| 7 | **Backtracking and Branch and Bound:** Introduction, The Eight queens' problem, Knapsack problem, Travelling Salesman problem, Minmax principle | 04 |
| 8 | **String Matching:** Introduction, The naive string-matching algorithm, The Rabin-Karp algorithm, String Matching with finite automata | 04 |
| 9 | **Introduction to NP-Completeness:** The class P and NP, Polynomial reduction, 2-CNF Satisfiability, -CNF Satisfiability, NP- Completeness Problem, NP-Hard Problems. Travelling Salesman problem, Hamiltonian problem | 04 |
| | **Total Hours** | **42** |

**Suggested Text books / Reference books:**

1. Thomas H. Cormen, Charles E. Leiserson, Ronald L. Rivest and Clifford Stein, Introduction to Algorithms, forth edition, The MIT Press
2. Gills Brassard and Paul Bratley, Fundamental of Algorithmics, first edition, Prentice-Hall International
3. Introduction to Design and Analysis of Algorithms, Anany Levitin, third edition (2021), Pearson.
4. Design and Analysis of Algorithms, Dave and Dave, first edition (2007),Pearson.

**Suggested Theory distribution:**

The suggested theory distribution as per Bloom's taxonomy is as per follows. This distribution serves as guidelines for teachers and students to achieve effective teaching-learning process.

| Distribution of Theory for course delivery and evaluation | | | | | |
|---|---|---|---|---|---|
| Remember | Understand | Apply | Analyze | Evaluate | Create |
| 10% | 10% | 40% | 20% | 10% | 10% |

**Suggested List of Experiments:**

1. Implementation and Time analysis of sorting algorithms
2. Bubble sort, Selection sort, Insertion sort, Merge sort and Quicksort
3. Implementation and Time analysis of linear and binary search algorithm.
4. Implementation of max-heap sort algorithm
5. Implementation and Time analysis of factorial program using iterative and recursive method
6. Implementation of a knapsack problem using dynamic programming.
7. Implementation of chain matrix multiplication using dynamic programming.
8. Implementation of making a change problem using dynamic programming
9. Implementation of a knapsack problem using greedy algorithm
10. Implementation of Graph and Searching (DFS and BFS).
11. Implement prim's algorithm.
12. Implement Kruskal's algorithm.
13. Implement LCS problem.
14. To implement following string-matching algorithms and analyze time complexities: a. Naïve b. Rabin Karp c. Knuth Morris Pratt
15. Write a program for Floyd-Warshal algorithm.
16. Write a program for travelling salesman problem.
17. Write a program for Hamiltonian cycle problem.
18. To implement Huffman coding and analyze its time complexity.
19. Write a program for Strassen's Matrix Multiplication.

**Instructional Method:**

1. The course delivery method will depend upon the requirement of content and need of students. Theteacher in addition to conventional teaching method by black board, may also use any of tools such as demonstration, role play, Quiz, brainstorming, MOOCs etc.
2. The internal evaluation will be done on the basis of continuous evaluation of students in the laboratory and class-room.
3. Practical examination will be conducted at the end of semester for evaluation of performance of students in laboratory.
4. Students will use supplementary resources such as online videos, NPTEL videos, e-courses, Virtual Laboratory

**Supplementary Resources:**

1. http://www.personal.kent.edu/~rmuhamma/Algorithms/algorithm.html
2. http://nptel.ac.in/courses/106101060/
3. http://www.comp.nus.edu.sg/~cs5234/Links/Course-Links.htm
4. https://www.coursera.org/learn/algorithm-design-analysis
5. http://www.codeskulptor.org/docs.htmlhttp://www.geeksforgeeks.org
6. http://www.algolist.net
7. http://www.cprogramming.com
8. http://www.codingunit.com

# Subject Code: 01CT0513

## Subject Name: Digital Signal and Image Processing

## B. Tech. Year – III (Semester V)

**Objective:** The objective of the course is to provide understanding of discrete time signals and systems. Students learn to apply time, space and frequency domain operations, design of digital filters, apply image processing algorithms and understand DSP processors.

**Credits Earned:** 04 Credits

**Course Outcomes:** After completion of this course, student will be able to:

1. Understand the concepts of discrete time signals and systems. (Understand)
2. Formulate mathematical formulas for discrete processing functions. (Analyze)
3. Analyze discrete signals using different time, space and frequency domain algorithms and compare their performance. (Analyze)
4. Apply signal and image processing algorithms for suitable applications. (Apply)
5. Design discrete-time systems such as digital filters. (Apply)

**Pre-requisite of course:** Signals and Systems, Linear Algebra

**Teaching and Examination Scheme:**

| Teaching Scheme (Hours) | | | Credits | Theory Marks | | | Tutorial / Practical Marks | | Total Marks |
|---|---|---|---|---|---|---|---|---|---|
| | | | | E | I | | V | T | |
| Theory | Tutorial | Practical | | ESE | IA | CSE | Viva | Term Work | |
| 3 | 0 | 2 | 4 | 50 | 30 | 20 | 25 | 25 | 150 |

**Contents:**

| Unit | Topics | Contact Hours |
|---|---|---|
| 1 | **Introduction:** A review of continuous and discrete time signals and systems, representing an image, spatial and gray level resolution, aliasing, zooming and shrinking an image, relationship between pixels | 4 |
| 2 | **Time and space domain operations:** Correlation, convolution, gray level transformations, Histogram processing, spatial filtering, non-linear spatial filters | 7 |
| 3 | **Frequency domain operations:** Z transform, Fourier transform, frequency analysis of discrete- time signals, Discrete fourier transform and its properties, Fast Fourier transform and its applications, linear filtering approach to compute FFT, The Goertzel algorithm, The Chirp-z algorithm, two dimensional DFT and its inverse, smoothing and sharpening frequency domain filters, Homomorphic filtering | 11 |

| | | |
|---|---|---|
| 4 | **Implementation of discrete-time systems:** Block diagram and signal flow diagram representations of linear constant-coefficient difference equations, structures for FIR systems, structures for IIR systems, state space analysis and structures | 4 |
| 5 | **Design of digital filters:** Digital filters, FIR filters, design of linear phase FIR filers: using windowing method, using frequency sampling method, using optimal FIR filter design method, design of IIR filers from analog filters, design of digital low pass, band pass, band stop, high pass Butterworth filter | 8 |
| 6 | **Morphological image processing:** Dilation, erosion, opening, closing, hit-or miss transformation, boundary extraction, region filling, convex hull, thinning, thickening, skeletons, pruning | 4 |
| 7 | **DSP processors:** Importance of DSP processors, hardware units, VLIW architecture, pipelining, applications of DSP | 4 |
| | **Total Hours** | **42** |

**Suggested Text books / Reference books:**

1. John G. Proakis and Dimitris G. Manolakis, “Digital Signal Processing: Principles, Algorithm & Application”, 4th edition, Pearson
2. Alan V. Oppenhiem, Ronald W. Schafer, John R Buck, “Discrete Time Signal Processing”, 2nd edition, Person
3. Rafael C. Gonzalez and Richard E. Woods, "Digital Image Processing", 3rd edition, Prentice-Hall, 2008
4. B. Venkataramani, M. Bhaskar “Digital Signal Processors: Architecture, Programming and Applications”, 2nd edition, Tata McGraw-Hill
5. V. Udayashankara, “Modern Digital Signal Processing”, 2nd edition, PHI

**Suggested Theory distribution:**

The suggested theory distribution as per Bloom’s taxonomy is as per follows. This distribution serves as guidelines for teachers and students to achieve effective teaching-learning process.

| Distribution of Theory for course delivery and evaluation | | | | | |
|---|---|---|---|---|---|
| Remember | Understand | Apply | Analyze | Evaluate | Create |
| 10% | 20% | 25% | 15% | 10% | 20% |

**Suggested List of Experiments:** Minimum 14 experiments to be performed during the semester

1. Simulate discrete time sequences.
2. Simulate linear convolution and circular convolution on discrete time signals.
3. Simulate cross correlation and autocorrelation on discrete time signals.
4. Design Butterworth and Chebyshev filter using bilinear transformation method.
5. Design FIR filter with windowing method.
6. Perform FFT and IFFT on discrete time signal.
7. Perform gray level operations images.
8. Generate Histogram of images, apply Histogram equalization and Histogram matching on it.
9. Simulate smoothing and sharpening operation on images using spatial filters.
10. Apply non-linear filters on images and investigate its application in noise-removal.
11. Simulate smoothing and sharpening operations on images using frequency domain filters.
12. Simulate dilation, erosion, opening and closing operation on images.
13. Simulate Hit or Miss Transformation on images.
14. Simulate Boundary Extraction on images.
15. Study audio data acquisition using DSK6713 board.

**Supplementary Resources:**

1. https://nptel.ac.in/courses/117102060
2. https://nptel.ac.in/courses/108106151
3. https://nptel.ac.in/courses/117105135

# Subject Code: 01CT0516

## Subject Name: Engineering Electrodynamics

## B. Tech. Year – III (Semester V)

**Objective:** The objectives of this course are to understand the basics of electromagnetic theories, the antenna parameters and its various applications. This course includes the basic of microwave engineering theories for wave propagation and application of the electromagnetic theory for antenna design to understand the advance optical antenna concepts and its applications and design various types of antenna for different communication application.

**Credits Earned:** 05 Credits
**Course Outcomes:** After completion of this course, student will be able to:

1. Build up a basic understanding in several applied electromagnetic topic and to gain knowledge in cutting-edge research areas in electrodynamics (Understand).
2. Build up a basic understanding in electromagnetics and antenna theories (Understand).
3. Create basic antenna structures for various applications (Apply).
4. Analysis and implementation of optical antenna (Analyze).

**Pre-requisite of course:** NA

**Teaching and Examination Scheme**

| Teaching Scheme (Hours) | | | Credits | Theory Marks | | | Tutorial / Practical Marks | | Total Marks |
|---|---|---|---|---|---|---|---|---|---|
| | | | | E | I | | V | T | |
| Theory | Tutorial | Practical | | ESE | IA | CSE | Viva | Term Work | |
| 4 | 0 | 2 | 5 | 50 | 30 | 20 | 25 | 25 | 150 |

**Content:**

| Unit | Topics | Content Hours |
|---|---|---|
| 1 | **Fundamental of electrodynamics**<br>Maxwell's equations, boundary conditions, vector and scalar potentials, reciprocity theorem, huygens' principle, polarization, snell's law, brewster angle, total internal reflection, constitutive equations, drude dispersion model, group/phase velocity | 16 |

| | | |
|---|---|---|
| 2 | **Antenna theory and design**<br>Antenna parameters, directivity, gain, input impedance, wire antennas, monopoles dipoles helices, aperture theory, horns and reflector antennas, phasedarrays, friis transmission formula, receiving properties of antenna. | 12 |
| 3 | **Microwave engineering**<br>Parallel plate / rectangular waveguides, attenuation of modes, waveguide excitation waveguide dispersion, transmission lines, microwave circuit. | 10 |
| 4 | **Computational Electromagnetics.**<br>Finite difference time domain, absorbing boundary condition, perfectly matchedlayers, periodic boundaries, finite element method | 08 |
| 5 | **Graphene and Plasmonics Nano Antenna**<br>Graphene and other 2D materials, fundamentals of optical nano antenna, linear antennas, nonlinear antennas, application | 08 |
| | **Total Hours** | **56** |

**Suggested Text book/Main Reference:**

1. C.A. Balanis, Antenna Theory: Analysis and Design, 3rd edition, WILEY Interscience.
2. J D Kraus, Antennas and Wave Propagation 5th edition, McGraw Hill Education.
3. David. M Pozar, Microwave Engineering, 4th edition, Wiley.
4. David. M Pozar, Principles of Electromagnetics, Matthew N.O. Sadiku, 6th Edition, Oxford University Press.
5. Mario Agio, Optical Antennas, 1st editions, Cambridge University Press.

**Suggested Theory distribution:**

The suggested theory distribution as per Bloom's taxonomy is as per follows. This distribution serves asguidelines for teachers and students to achieve effective teaching-learning process:

| Distribution of Theory for course delivery and evaluation | | | | | |
|---|---|---|---|---|---|
| Remember | Understand | Apply | Analyze | Evaluate | Create |
| 30% | 30% | 15% | 5% | 5% | 15% |

**Suggested List of Experiments:**

**Perform the following exercises with SPICE tool.**

1. Design and simulate rectangular waveguide for GHz frequency.
2. Design and simulate 90-degree rectangular waveguide for GHz frequency.
3. Design and simulate Hybrid Tee for GHz frequency.
4. Design and simulate Microstrip patch antenna.
5. Design and simulate Spiral patch antenna.

6. Perform the experiment for deriving radiation pattern and S parameter for Wire antennas.
7. Perform the experiment for deriving radiation pattern and S parameter for Yagi uda antennas.
8. Perform the experiment for deriving radiation pattern and S parameter for dipole antennas.
9. Prove the reciprocity theorem for antenna.
10. Design and simulate 1D FDTD simulation code with perfectly matched layer.
11. Identify the design of the antenna for your mobile phone.
12. Design and simulate the antenna for fulfilling the communication task of mobile communication.
13. Design and simulate 2D FDTD simulation code with perfectly matched layer.
14. Design 50-ohm transmission line.

# Subject Code: 01CT0515

## Subject Name: Information and Web Security

## B. Tech. Year – III (Semester V)

**Objective:** To provide knowledge regarding working of information and web security mechanisms with by considering security issues and to learn the insights of information assurance techniques in area of information and web security.

**Credits Earned:** 05 Credits

**Course Outcomes:** After completion of this course, student will be able to:

1. Analyze common threats, attack and mechanism, deal with them (Analyze).
2. Apply various Symmetric and asymmetric key Algorithms (Apply).
3. Apply the concepts of Hash function, digital signature and digital certificates (Apply).
4. Understand security concepts for web development (Understand).
5. Identify the various security hazards related to web applications and need of security measures (Analyze).

**Pre-requisite of course:** Internet & Web Technology

**Teaching and Examination Scheme:**

| Teaching Scheme (Hours) | | | Credits | Theory Marks | | | Tutorial / Practical Marks | | Total Marks |
|---|---|---|---|---|---|---|---|---|---|
| | | | | E | I | | V | T | |
| Theory | Tutorial | Practical | | ESE | IA | CSE | Viva | Term Work | |
| 04 | 00 | 02 | 05 | 50 | 30 | 20 | 25 | 25 | 150 |

**Contents:**

| Unit | Topics | Hours |
|---|---|---|
| 1 | **Introduction To Information Security:** Overview of internet security, Firewalls, Internet security, Management concepts and information privacy and copyright issues, Basics of asymmetric cryptosystems. | 02 |
| 2 | **Conventional Encryption & Number Theory:** Conventional encryption model, Steganography, Classical encryption techniques (Substitution and Transposition techniques), Prime and relative prime numbers, Modular arithmetic, Euler's theorem, Euclid's algorithm, Discrete logarithmic, Modular arithmetic, The Euclidean algorithm, Finite field of the form, Extended Euclidean algorithm. | 07 |

| | | |
|---|---|---|
| 3 | **Black Cipher Method:** Stream ciphers and block ciphers, Block cipher structure, Data encryption standard (DES) with example, Strength of DES, Blowfish, RC5, Cast-128, RC2, Design principles of block cipher, AES with structure, Traffic confidentiality, Random number generation, Key distribution | 08 |
| 4 | **Advanced symmetric cipher:** Multiple encryption and triple DES, Electronic code book, Cipher block chaining mode, Cipher feedback mode, Output feedback mode, Counter mode | 06 |
| 5 | **Public Key Cryptography:** Public key cryptosystems with applications, Requirements and cryptanalysis, RSA algorithm, Its computational aspects and security, Diffie-hillman key exchange algorithm, Man-in-Middle attack | 06 |
| 6 | **Message authentication and hash functions:** Authentication requirement, Functions, Message authentication code, Hash functions, Security of hash functions and macs, MD5 message digest algorithm, Secure hash algorithm, Hmac | 07 |
| 7 | **Introduction to Web Security:** IP security overview, Architecture, Authenticationheader, Key management, pretty good privacy, S/Mime and types, Web security requirement, SSL and transport layer security, Secure electronic transactions, Firewall design principles, Types of firewalls. Web Threat Model, Authenticated Sessions, Code Origin Policies, Cross-site Scripting, Cross-Site Request Forgery, JavaScript Hijacking, Web Service Security, Website Vulnerability Scanner. | 06 |
| 8 | **Web Application Security &Vulnerability:** Web Application Security, How Does Web Application Security Work, Web Application Lifecycle Maintenance, Importance of Web Application Security, What Makes Web Application Vulnerable, Web Application Vulnerabilities, Broken Access Control, Broken Authentication and Session Management, Buffer Overflows, Cross Site Scripting Flaws, Denial of Service, Improper Error Handling, Insecure Configuration Management, Insecure Storage, SQL Injection Flaws, Unvalidated Input, Defensive Measures | 10 |
| 9 | **E-Commerce Security:** Overview of online Security issues, Security for client computers, Communication channel security, Security for server computers | 04 |
| | **Total Hours** | **56** |

**Suggested Text books / Reference books:**

1. William Stallings, “Cryptography and Network Principles and Practice”, Third and Fourth Edition, Pearson Publication.

2. Faiyaz Ahamad, “Cyber Law and Information Security”, Dreamtech Publications.
3. Mukhopadhyay and Forouzan, “Cryptography & Network Security”, McGraw-Hill.
4. Atul Kahate, “Cryptography and Network Security”, 2nd Edition, TMH.

**Suggested Theory distribution:**

The suggested theory distribution as per Bloom’s taxonomy is as per follows. This distribution serves as guidelines for teachers and students to achieve effective teaching- learning process.

| Distribution of Theory for course delivery and evaluation | | | | | |
|---|---|---|---|---|---|
| Remember | Understand | Apply | Analyze | Evaluate | Create |
| 5% | 25% | 30% | 25% | 10% | 5% |

**Suggested List of Experiments:** Minimum 14 experiments to be performed during the semester

1. Write code to implement Substitution cipher and Transposition cipher.
2. Write code to implement DES.
3. Write code to implement AES.
4. Write code to implement Diffie-hillman key exchange algorithm
5. Write code to implement RSA algorithm.
6. Write code to implement MD5 message digest algorithm
7. Write code to implement Dictionary Attack and Brute Force Attack.
8. Installation of Wire shark, tcpdump, etc and observe data transferred in client server communication using UDP/TCP and identify the UDP/TCP datagram.
9. Installation of rootkits and study about the variety of options.
10. Perform an Experiment to Sniff Traffic using ARP Poisoning.
11. Demonstrate intrusion detection system using any tool (snort or any other s/w).
12. Demonstrate how to provide secure data storage, secure data transmission and for creating digital signatures.
13. Installation and overview of Burpsuite Tools in Kali Linux.
14. Perform SQL injection
15. Perform Cross-site scripting and Cross-site request forgery (CSRF)
16. Demonstrate Information disclosure vulnerabilities
17. Configure NGINX and Apache webserver in Linux with https protocol
18. Configure Fail2ban with NGINX to protect the web server.

**Supplementary Resources:**

1. Black Book, “Web Technologies”, Dreamtech Press (2012).
2. Black Book, “HTML 5”, Dreamtech Press.
3. Developing Web Applications in PHP and AJAX, McGraw-Hill (2010).
4. P.J. Deitel & H.M. Deitel, “Internet and World Wide Web How to program”, Pearson, 4th Edition.
5. https://portswigger.net/web-security/all-labs#sql-injection
6. https://portswigger.net/web-security/all-labs#cross-site-scripting

7. https://portswigger.net/web-security/all-labs#cross-site-request-forgery-csrf
8. https://portswigger.net/web-security/all-labs#information-disclosure

## Subject Code: 01CT1509

## Subject Name: Linux Administration

## B. Tech. Year – III (Semester V)

**Objectives:** To impart knowledge and skills on various practical and theoretical aspects of Linux operating system (OS) basics and Linux OS based server configuration, management and administration.

**Credits Earned:** 05 Credits

**Course Outcomes:** After completion of this course, student will be able to:

1. Understand Linux utilities to create and manage simple file processing operations and Linux boot processing (Understand).
2. Apply Command line in Linux to manage user, user groups, system management, volume management, and troubleshooting application, scheduling task and system level issue (Apply).
3. Illustrate client server applications with appropriate security (Apply).
4. Configure various services of Linux such like DNS, Apache web server, virtualization (Apply).
5. Evaluate various shell Scripting (Analyze).

**Pre-requisite of course:** Basics of Operating System

**Teaching and Examination Scheme:**

<table>
<tr><th colspan="3" rowspan="2">Teaching Scheme (Hours)</th><th rowspan="3">Credits</th><th colspan="3">Theory Marks</th><th colspan="2">Tutorial / Practical Marks</th><th rowspan="3">Total Marks</th></tr>
<tr><th>E</th><th colspan="2">I</th><th>V</th><th>T</th></tr>
<tr><th>Theory</th><th>Tutorial</th><th>Practical</th><th>ESE</th><th>IA</th><th>CSE</th><th>Viva</th><th>Term Work</th></tr>
<tr><td>4</td><td>0</td><td>2</td><td>5</td><td>50</td><td>30</td><td>20</td><td>25</td><td>25</td><td>150</td></tr>
</table>

**Content:**

| Unit | Topics | Content Hours |
|---|---|---|
| 1 | **Introduction And Installation**<br>Linux introduction and file system - Basic Features, Advantages, Installing requirement, Basic Architecture of Unix/Linux system, Kernel, Shell. Linux File System - Boot block, How Linux access files, storage files, Linux standard directories, Download, install, update, and manage software packages from Red Hat and yum package repositories. | 07 |
| 2 | **Management of Files Using Command Lines**<br>Introduction to BASH, Command-line shortcuts, File Types, Ownership and Permissions, File management and manipulation, Moving users & its directories, Miscellaneous Tools, Editors, Create and Edit text files with vim (open, edit, and save text files) Commands for files and directories cd, ls, cp, md, rm, mkdir, rmdir, pwd, file, more, less, creating and viewing files using cat, file comparisons – cmp& comm, View files, disk related commands, checking disk free spaces, regular expressions with grep | 07 |
| 3 | **Managing Users and Groups**<br>Creating and managing user/s and group commands, User management tools, Users and Access Permissions, Updating users and group attributes, PAM (Pluggable Authentication Modules) | 06 |
| 4 | **Booting and shutting down**<br>Boot Loaders, the init process, rc scripts, enabling and disabling services, Booting in recovery mode | 05 |
| 5 | **File Systems**<br>Makeup of file systems, managing file systems, adding a new disk, Volume Management, Creating file systems. | 04 |
| 6 | **Core System Services**<br>The init Daemon, xinetd and inetd, The Logging Daemon, Configuring Logging Daemon, The CRON program | 05 |
| 7 | **Compiling the Linux Kernel**<br>Kernel concepts, Finding Kernel Source Code, Building the Kernel, Patching the Kernel | 05 |
| 8 | **DNS**<br>Installing DN S Server, Configuring DNS server, DNS records types, setting up BIND database file, The DNS Toolbox, Configuring DNS clients. | 05 |
| 9 | **Apache Web Server**<br>HTTP Protocol, Installing Apache HTTP Server, starting up and shutting down Apache, Testing Apache Installation, Configuring Apache, Troubleshooting Apache. | 06 |
| 10 | **Virtualization** | 06 |

| | | |
|---|---|---|
| | Virtualization Implementation, Kernel based Virtual Machines (KVM), 06 Containers, Docker, Kubernetes | |
| | **Total Hours** | 56 |

**Suggested Text books / Reference books:**

1. Steve Shah and Wale Soyinka "Linux Administration: A Begineer's Guide", 4th Edition, Tata McGraw-Hill Publishing Company Limited, New Delhi, ISBN: 978- 0072262599
2. Susan Lauber, Philip Sweany, Rudolf Kastl and George Hacker, "REDHAT System Administration-1 Student Work book", REDHAT Inc. 2014

**Suggested Theory distribution:**

The suggested theory distribution as per Bloom's taxonomy is as per follows. This distribution serves as guidelines for teachers and students to achieve effective teaching-learning process.

| Distribution of Theory for course delivery and evaluation | | | | | |
|---|---|---|---|---|---|
| Remember | Understand | Apply | Analyze | Evaluate | Create |
| 15% | 15% | 40% | 10% | 10% | 10% |

**Suggested List of Experiments:**

1. Linux introduction & Installation of Linux-Operating system.
2. Software package management, mount and unmount the disks, devices
3. File Handling Commands
4. User Handling Commands
5. Group Handling Commands
6. Startup and Shutdown Commands
7. Installation and Configuration of DNS server
8. Installation and Configuration of Apache Server
9. Building and patching Linux Kernel.
10. Write a command with syntax & usage and execute the advance filters such as grep, egrep, fgrep.
11. Write a command with syntax & usage then execute the ps command, process management commands: & nohub, kill, nice.
12. Write a command with syntax & usage then execute the communication commands.
13. To execute device pattern using Meta character to match each of the following.
14. File Moment Using Command Line Arguments
15. Configuring different servers (FTP, SSH, NFS, NTP Time Server, DHCP, Samba)

**Supplementary Resources:**

1. https://www.tutorialspoint.com/linux_admin/index.htm
2. https://linode.com/docs/tools-reference/linux-system-administration- basics/
3. opensourceforu.com/2016/07/introduction-linux-system-administration/https://www.linuxfoundation.org

**Marwadi University**
**Faculty of Technology**
**Department of Information and Communication Technology**

## Subject Code: 01CT0519

## Subject Name: Machine learning

## B. Tech. Year – III (Semester V)

**Objectives:** Machine Intelligence concern with designing and developing of algorithms that allow machines, essentially computers, to evolve realistic or human like behavior based on the empirical data available. This course aims to discuss the building blocks of machine intelligence. The focus would be on how to develop algorithms that can automatically learn and recognize the complex pattern from the available date to make an intelligent decision which will be accepted to the users. Students are expected to learn the fundamental issues involved in designing algorithms for machine intelligence and pursue more insight towards understanding various machine learning algorithms.

**Credits Earned:** 05 Credits

**Course Outcomes:** After completion of this course, student will be able to:
1. Apply the fundamentals of probability theory and algebra to perceive the gist of supervisedmachine learning algorithms (Apply)
2. Understand and apply unsupervised algorithm for clustering (Understand)
3. Apply the concepts of dimensionality reduction, regularization and optimization in differentreal-world problems (Apply)
4. Evaluate various machine learning algorithms with appropriate evaluation metrices (Analyze)
5. Demonstrate training and testing of basic neural network models like CNN, RNN, LSTM, etc.(Apply)
6. Implement appropriate machine learning algorithms for the given case study (Evaluate)

**Pre-requisite of course:** Programming using Python, Linear Algebra, Probability

**Teaching and Examination Scheme:**

| Teaching Scheme (Hours) | | | Credits | Theory Marks | | | Tutorial / Practical Marks | | Total Marks |
|---|---|---|---|---|---|---|---|---|---|
| | | | | E | I | | V | T | |
| Theory | Tutorial | Practical | | ESE | IA | CSE | Viva | Term Work | |
| 4 | 0 | 2 | 5 | 50 | 30 | 20 | 25 | 25 | 150 |

**Contents:**

| Unit | Topics | Contact Hours |
|---|---|---|
| 1 | **Introduction to machine learning**<br>Machine Learning Languages, Types, and Examples, Applications of Machine Learning, Machine Learning vs Statistical Modelling, Supervised vs Unsupervised Learning, Difference between Detection, Prediction and Generation | 3 |

| | | |
|---|---|---|
| 2 | **Data Understanding**<br>Basic types of data, exploring structure of data, plotting and exploring numerical data, categorical data, Data Quality and Remediation, data preprocessing | 3 |
| 3 | **Performance measures**<br>Importance of performance measurement, confusion matrix, Training Data Set, Testing Data Set, Validation Data Set, Overfitting, Underfitting, Bias, Variance | 3 |
| 4 | **Basics of Feature Engineering**<br>Feature, Feature engineering, Feature transformation, feature extraction, Feature selection, Feature relevance and redundancy, correlation | 4 |
| 5 | **Supervised Learning Techniques**<br>Linear Regression, Logistic Regression, Polynomial Regression, K-Nearest Neighbour, Decision Tree, Random Forest, Support Vector Machine, naïve Bayes | 8 |
| 6 | **Unsupervised Learning Techniques**<br>K-Means Clustering, Hierarchical Clustering, Density-Based Clustering | 7 |
| 7 | **Dimensionality Reduction & Collaborative Filtering**<br>Advantages of dimensionality reduction, Dimensionality Reduction using PCA, LDA techniques, Collaborative Filtering & Its Challenges | 4 |
| 8 | **Statistical Machine Learning**<br>Concentration inequalities and generalization bounds, plugin classifiers, Feature maps and the "kernel trick", Theory of generalization, least-squares, Ridge and Lasso regularization, Gaussian Mixture Model, Gradient Boosting Machines | 8 |
| | **Introduction to Artificial Neural Networks**<br>Artificial Neuron Model, Operations of Artificial Neuron, Types of Neurons Activation Function, ANN Architectures, Classification Taxonomy of ANN – Connectivity, Learning Strategy (Supervised, Unsupervised, Reinforcement), Learning Rules, Single Layer and Multi-Layer Feed Forward Networks | 6 |
| 9 | **Introduction to Deep Learning**<br>Basic building blocks of deep neural network, Convolutional Neural Network, Recurrent Neural Network, Long, Short-Term Memory | 8 |
| | **Total Hours** | **54** |

**Suggested Text books / Reference books:**

1. E Alpaydin, Introduction to Machine Learning, 2010, MIT Press
2. S. Marsland, Machine Learning: an algorithmic perspective, 2009, CRC Press
3. R. O. Duda, P. E. Hart and D. G. Stork, Pattern Classification, second edition, Wiley
4. P. A. Devijver and J. Kittler, Pattern Recognition: A Statistical Approach, 1982, Prentice Hall
5. Ian Goodfellow, Yoshua Bengio and Aaron Courville, Deep Learning, 2016, MIT Press

**Suggested Theory distribution:**

The suggested theory distribution as per Bloom's taxonomy is as per follows. This distribution serves as guidelines for teachers and students to achieve effective teaching-learning process.

| Distribution of Theory for course delivery and evaluation | | | | | |
|---|---|---|---|---|---|
| Remember | Understand | Apply | Analyze | Evaluate | Create |
| 15% | 20% | 30% | 20% | 10% | 5% |

**Suggested List of Experiments:**

1. To implement single variable Linear Regression
2. To implement multiple variable Linear Regression
3. To implement Logistic Regression and evaluate the performance
4. To implement Polynomial Linear Regression
5. To implement Naïve Bayes Algorithm
6. To implement Support Vector Machine
7. To implement K-Nearest Neighbor
8. To implement K-Means Clustering Algorithm
9. To implement DBScan Algorithm
10. To implement Hierarchical Algorithm
11. To implement Dimensionality Reduction using PCA
12. To implement Single layer Perceptron Learning algorithm
13. To implement Multi-layer Perceptron Learning algorithm
14. To implement different activation functions on dataset
15. To implement Kernel-Based Image Filtering technique
16. To implement the LSTM algorithm on recurrent neural network
17. To implement Convolutional neural Network Algorithm

**Instructional Method:**

1. The course delivery method will depend upon the requirement of content and need of students. The teacher in addition to conventional teaching method by black board, may also use any of tools such as demonstration, role play, Quiz, brainstorming, MOOCs etc.
2. The internal evaluation will be done on the basis of continuous evaluation of students in the laboratory and class-room.
3. Practical examination will be conducted at the end of semester for evaluation of performance of students in laboratory.
4. Students will use supplementary resources such as online videos, NPTEL videos, e-courses, Virtual Laboratory.

**Supplementary Resources:**

1. https://www.coursera.org/learn/machine-learning
2. https://in.udacity.com/course/machine-learning--ud262
3. https://www.udemy.com/machinelearning/
4. https://cognitiveclass.ai/courses/machine-learning-with-python/
5. https://cognitiveclass.ai/courses/machine-learning-r/
6. https://www.edx.org/learn/machine-learning

**List of simulation software / IDEs:**

1. PyCharm
2. Google Colab
3. Jupyter Notebook

# Subject Code: 01CT0518

## Subject Name: .Net Technology

## B. Tech. Year – III (Semester V)

**Objective:** .Net Technologies are blend of technologies supported by Microsoft .Net Framework, that allows user to create various applications. Students will be able to work with various technologies provided by Microsoft .NET platform.

**Credits Earned:** 05 Credits

**Course Outcomes:** After completion of this course, student will be able to:

1. Understand the use of C# basics, Objects and Types, Inheritance and .NET framework developed by Microsoft (Understand).
2. Develop and implement applications with C# (Apply).
3. Analyze the Component Services, Threading, Remoting, Windows services, web services (Analyze).
4. Design the functional web application using the concepts of .NET, various server controls, State management, MVC Architecture and application security (Apply).
5. Design, develop and deploy web application (Create).

**Pre-requisite of course:** Object oriented concepts, Programming fundamentals

**Teaching and Examination Scheme:**

| Teaching Scheme (Hours) | | | Credits | Theory Marks | | | Tutorial / Practical Marks | | Total Marks |
|---|---|---|---|---|---|---|---|---|---|
| | | | | E | I | | V | T | |
| Theory | Tutorial | Practical | | ESE | IA | CSE | Viva | Term Work | |
| 04 | 00 | 02 | 05 | 50 | 30 | 20 | 25 | 25 | 150 |

**Contents:**

| Unit | Topics | Hours |
|---|---|---|
| 1 | **Introduction To .Net Framework:** Introduction to .NET Framework Architecture, Program Execution in .NET, CLR structure, MSIL, CLS, CTS, Namespaces, Assemblies the Common Language Implementation, creating strong named assemblies, putting DDL in GAC, Garbage Collection, DLL Hell, Side by Side Execution, Debugging. | 02 |

| | | |
|---|---|---|
| 2 | **The Basics and Console Applications in C#:** c data types, declaring variables and constants, Type, Conversion, Boxing and Unboxing, Array, Structure, String Manipulation, String Builder, Decision making statements, Conditional Loops, Switch Case., Name Spaces - Constructor and Destructors, Function Overloading &Inheritance, Operator Overloading, Modifiers - Property and Indexers, Attributes & Reflection API, when to use Console Applications - Generating Console Output, Processing Console Input | 06 |
| 3 | **Advance C#:** Attributes, Reflection, Delegates, Events, Threading, Collections, File IO | 04 |
| 4 | **Building GUI with C#:** Working with C# windows applications, Working with common form controls. Visual Inheritance, Creating MDI Form, Event Handling | 08 |
| 5 | **Working with SQL server:** Introduction to SQL server, Different types of queries, SQL index, SQL views, stored procedure, cursor | 04 |
| 6 | **ASP.NET:** Introduction to ASP.NET, Working with Web and HTML Controls,Using Rich Server Controls, Login controls, Overview of ASP.NET Validation Controls, Using the Simple Validations, Using the Complex Validators Accessing Data using ADO.NET, Using the Complex Validators Accessing Data usingADO.NET, Configuration Overview. | 06 |
| 7 | **Managing State:** Preserving State in Web Applications and Page-Level State, Using Cookies to Preserve State, ASP.NET Session State, Storing Objects in Session State, Configuring Session State, Setting Up an Out-of-Process State Server, Storing Session State in SQL Server, Using Cookie less Session IDs, Application State Using the Data List and Repeater Controls, Overview of List-Bound Controls,Creating a Repeater Control and Data List Control | 06 |
| 8 | **ASP.NET MVC:** Controller, Model, View, Layout, Partial Views, Razor Language, jQuery Ajax, Entity Framework, routing mechanism, Web API | 12 |
| 9 | **Introduction to .NET Core:** Controllers, views, models, layout, Introduction to entity framework core, Routing, Web api, Dependency injection | 06 |
| 10 | **Deployment of web app:** Deploy web app locally and accessing in local environment from multiple devices | 02 |
| | **Total Hours** | **56** |

**Suggested Text books / Reference books:**

1. Christian Nagel, Professional C# .Net, Wrox Publication
2. Matthew Macdonald and Robert Standefer, ASP.NET Complete Reference, TMH
3. Vijay Mukhi, C# The Basics, BPB Publications
4. Kurt Nomark, Object-Oriented Programming in C#, First edition 2010.

**Suggested Theory distribution:**

The suggested theory distribution as per Bloom's taxonomy is as per follows. This distribution serves as guidelines for teachers and students to achieve effective teaching- learning process.

| Distribution of Theory for course delivery and evaluation | | | | | |
|---|---|---|---|---|---|
| Remember | Understand | Apply | Analyze | Evaluate | Create |
| 10% | 20% | 25% | 25% | 10% | 10% |

**Suggested List of Experiments:**

1. Create a windows form with the following controls Textbox, Radio button, Check box, Command Button
2. Write a program for Menu option.
3. Create a program to connect with database and manipulate the records in the database using ADO .NET
4. Create a program to implement the concepts of OOPS for creating class, inheritance
5. Create a program to perform input validation using procedure.
6. Write a program to open a file and using I/O operations write contents into a file andread the contents from the file.
7. Create a window form using HTML controls.
8. Create a program to perform validation using validation controls.
9. Create a program in ASP .NET to connect with the database using ADODB connectivity and manipulate the records.
10. Write a program to store the employee details using class and methods in C# .NET
11. Write a program to Handle Exceptions
12. Write a program to create a form with Basic control in C#. NET.
13. Write a API which can be consumed from any other languages I.e. Android / iOS / php / java etc.
14. Write a program to generate daily different offers to attract customers for online shopping portal.

**Supplementary Resources:**

1. http://www.c-sharpcorner.com
2. http://www.csharphelp.com/index.html
3. http://www.codeproject.com
4. http://telerikacademy.com
5. https://msdn.microsoft.com

## Subject Code: 01CT0508

## Subject Name: Optical Communication

## B. Tech. Year – III (Semester V)

**Objective:** To introduce the students to various optical fiber modes, configurations and various signal degradation factors associated with optical fiber and to study about various optical sources and optical detectors and their use in the optical communication system, optical amplifiers, fiber network elements, basic optical components, and techniques of fiber optic measurement

**Credits Earned:** 05 Credits

**Course Outcomes:** After completion of this course, student will be able to:

1. Learn basic elements of optical fiber transmission link, fiber modes and physics of fiber structure configurations and fiber losses (Understand).
2. Compare the various type of the optical source and optical detectors (Analyze).
3. Analyze the optical system performance with optical transmitter, receiver, amplifier,splitter and other optical devices (Analyze).
4. To analyze and design optical fiber link with encapsulation of different system components and optical parameter measurement devices (Analyze).
5. To analyze and integrate fiber optical network components in variety of networking schemes, SONET/ SDH and operational principles WDM (Analyze).

**Pre-requisite of course:** Fundamentals of signals, Modulation techniques and Fundamental concept oflights from physics

**Teaching and Examination Scheme:**

| Teaching Scheme (Hours) | | | Credits | Theory Marks | | | Tutorial / Practical Marks | | Total Marks |
|---|---|---|---|---|---|---|---|---|---|
| | | | | E | I | | V | T | |
| Theory | Tutorial | Practical | | ESE | IA | CSE | Viva | Term Work | |
| 04 | 00 | 02 | 05 | 50 | 30 | 20 | 25 | 25 | 150 |

**Content:**

| Unit | Topics | Content Hours |
|---|---|---|
| 1 | **Overview of Optical fiber Communications**<br>Electromagnetic spectrum, Optical Spectral bands, Evolution of fibre optic system, Multiplexing Techniques, Elements of an optical fibre transmission link with the functional description of each block, WDM concepts, transmission widows, advantages of optical fibre link over conventional copper systems, applications of fibre optic transmission systems. | 10 |
| 2 | **Optical Fibers**<br>Structures, Waveguide and Fabrication: Optical laws and definitions, optical fiber modes and configurations, Mode theory, Step Index and Graded Index (GI) fibers, single mode and graded index fibers, Derivation for numerical aperture, V number and modes supported by step index fiber, mode field, Numerical aperture and modes supported by GI fibers, fiber materials, linearly Polarized modes fiber fabrication techniques, and mechanical properties of fibers, fiber optic cables. | 12 |
| 3 | **Signal Degradation in Optical Fibers**<br>Attenuation, signal distortion in optical waveguides, pulse broadening in graded index fiber, Characteristics of Single Mode Fibers, mode coupling, InternationalStandards for optical transmission fibers. | 04 |
| 4 | **Optical Sources and Detectors**<br>Semiconductor Physics background, Light emitting diode (LEDs)-structures, materials, Figure of merits, characteristics & Modulation. Laser Diodes -Modes & threshold conditions, Diode Rate equations, resonant frequencies, structures, characteristics and figure of merits, single mode lasers, Modulation of laser diodes, Spectral width, temperature effects, and Light source linearity, Principles of operation of photodetectors, detector types, characteristics, figure of merits of detectors photodiode materials, photodetector noise, detector response time, temperature effects on gain, comparison of photodetectors. | 08 |
| 5 | **Advance optical fiber system**<br>Point to point link communication system, Link power budget calculation, Semiconductor optical amplifier, EDFA, Raman amplifier, WDM, DWDM, SONT/SDH, Field deployment, Undersea deployment, Typical end to end deployment including last mile, Introduction to SFP, Examples of products. | 09 |
| 6 | **Optical Component and Fiber Optical measurement**<br>Optical couplers, Filters, Add and drop MUX/DEMUX, waveguide grating Circulator, Interferometer, Wavelength convertor, OTDR, Test Equipment Attenuation and dispersion measurement, NA and EYE pattern measurement | 07 |
| 7 | **Optical Access Networks**<br>Network architecture overview, Enhanced HFC, Fiber to the Curb (FTTC), PON evaluation (BPON, GPON, EPON, WPON), RITENET WRPON, LARNET RPON | 06 |
| | **Total Hours** | **56** |

**Suggested Text books / Reference books:**

1. Optical Fiber Communications by Gerd Keiser, 4th Edition (Mc Graw Hill)
2. Optical Fiber Communication by John M. Senior (PHI/Pearson)
3. Fiber optic Communication Systems by G. Agrawal (John Wiley and sons)
4. Optical fiber communications: Principles and Applications by T. L. Singal (Cambridge University Press).
5. Optical Networks by Rajiv Ramaswami (Morgan Kaufmann Press)
6. Fiber-Optic Communication: Systems and Components by Sunita P Ugale Vivekanand Mishra (Wiley)

**Suggested Theory distribution:**

The suggested theory distribution as per Bloom's taxonomy is as per follows. This distribution serves as guidelines for teachers and students to achieve effective teaching- learning process.

| Distribution of Theory for course delivery and evaluation | | | | | |
|---|---|---|---|---|---|
| Remember | Understand | Apply | Analyze | Evaluate | Create |
| 20% | 20% | 30% | 15% | 10% | 5% |

**Suggested List of Experiments:**

1. Setting -up of Analog/ Digital Optical communication Link
2. Measurement of attenuation characteristics of an optical fiber
3. Measurement of NA of a multimode fiber
4. Measurement of Dispersion of optical fiber
5. Performance of TDM on fiber optic link
6. Setting -up of voice link on Optical communication Link.
7. Performing Experiments on the VI characteristics of the optical Sources.
8. Performing Experiments on the characteristics of the optical detectors.
9. Design directional coupler using FEM simulation technique.
10. Design split ring resonator using FEM techniques.
11. Design the 90-degree optical waveguide using photonics crystal.
12. Design the 2-dimensional optical waveguide using FEM technique.
13. To perform micro-bending loss of given single or multimode optical fiber. (Hint: using corrugated structure and weights)
14. To perform macro-bending loss of given multimode optical fiber. (Hint: making the number of loops around the cylindrical mendral.)
15. Find out of Mode Field Diameter (MFD) of given single mode fiber. (Hint: Using a pin hole detector, graph papers and formula, we can calculate MFD.)

**Supplementary Resources:**

1. https://www.nptel.ac.in/courses/117101054/
2. https://nptel.ac.in/courses/117101002/

## Subject Code: 01CT0514

## Subject Name: VLSI Design

## B. Tech. – Year – III (Semester V)

**Objectives:** The objective of this course is to introduce students with various concepts and methods of digital system design techniques. To acquire knowledge of MOS Transistor, understand CMOS Fabrication process and learn the design of CMOS Logic circuits and subsystems. Learning this course would improve the employment potential of students in VLSI and Semiconductor industry.

**Credits Earned:** 05 Credits

**Course Outcomes:** After completion of this course, student will be able to:

1. Acquire basics of VLSI design flow, design methodologies, design quality, design for manufacturability and testability (Apply)
2. Develop fundamentals in fabrication of MOSFETs and MOS transistor (Understand)
3. Analyze MOS inverters with its static and switching characteristics (Analyze)
4. Analyze combinational and sequential MOS logic circuit (Analyze)
5. Acquire basic concepts of low power CMOS logic circuits (Apply)

**Pre-requisite of course:** Elementary knowledge about Electronics including some experience of circuit designing and logic development. Fundamentals of Computer Programming & Utilization. Basic knowledge of digital electronics and real-life digital systems.

**Teaching and Examination Scheme:**

| Teaching Scheme (Hours) | | | Credits | Theory Marks | | | Tutorial / Practical Marks | | Total Marks |
|---|---|---|---|---|---|---|---|---|---|
| | | | | E | I | | V | T | |
| Theory | Tutorial | Practical | | ESE | IA | CSE | Viva | Term Work | |
| 4 | 0 | 2 | 5 | 50 | 30 | 20 | 25 | 25 | 150 |

**Contents:**

| Unit | Topics | Contact Hours |
|---|---|---|
| 1 | **Introduction**<br>Overview of VLSI design methodology, VLSI design flow, Design hierarchy, Concept of regularity, Modularity, and Locality, VLSI design style, Design quality, package technology, introduction to FPGA and CPLD, computer aided design technology. | 6 |

| | | |
|---|---|---|
| 2 | **Fabrication of MOSFET**<br>Introduction, Fabrication Process flow: Basic steps, Wafer formation, Photolithography, Gate oxide, gate and drain formation and Contacts and Metallization. nMOS Fabrication. C-MOS n-Well Process, Layout Design rules, full custom mask layout design. | 6 |
| 3 | **MOS Transistor Theory**<br>Introduction and I-V Characteristics, Non ideal I-V effects: Velocity saturation, mobility degradation and Channel length modulation. Non ideal I-V effects: Body Effect, Sub threshold conduction, Junction leakage, MOSFET scaling and small geometry effects, MOSFET capacitance | 10 |
| 4 | **MOS Inverters**<br>Introduction, Resistive load inverter, Inverters with n-type MOSFET load, CMOS Inverter, Propagation delay, Interconnect delay, switching power dissipation of inverter | 8 |
| 5 | **Combinational and Sequential CMOS Logic Circuits**<br>MOS logic circuit with depletion load, CMOS logic circuits, Complex logic circuit, pass transistor circuits, CMOS with transmission gate, Multiplexer and XOR gate using CMOS transmission gate, SR latch circuit, Clocked latch and flip-flop circuits, CMOS D-latch and edge triggered flip flop, Dynamic logic circuits | 10 |
| 6 | **Chip I/P and O/P Circuits**<br>ESD protection, Input circuits, Output circuits, On chip Clock Generation and Distribution, Latch –Up and its Prevention | 2 |
| 7 | **Low-power CMOS logic circuits**<br>Introduction, Overview of Power Consumption, Low power design, Leakage power dissipation, Reduction in switching activity, Gated clock signals | 6 |
| 8 | **Design for manufacturability**<br>Introduction, Process variations, Basic concepts and definitions | 2 |
| 9 | **Design for Testability**<br>Introduction, Fault types and models, Controllabilityand observability, Ad Hoc Testable design techniques, Scan –based techniques, built-in Self-Test (BIST) techniques, Current monitoring IDDQ test | 4 |
| | **Total Hours** | 54 |

**Suggested Text books / Reference books:**

1. Sung Mo Kang,Yusuf Leblebici, “CMOS Digital Integrated Circuits Analysis and Design”, Tata McGraw Hill, 3rd Edition, 2003.

2. Neil H.E.Weste, David Harris, “CMOS VLSI Design”, Pearson,3rd Edition. 2005, Reprint, 2012.
3. Douglas A. Pucknell, Kamran Eshraghian,“Basic VLSI Design”, Prentice Hall of India, 3rdEdition, Reprint 2009.
4. John P. Uyemura, “Introduction to VLSI circuits and systems”, Wiley, 2rd Edition 2002, Reprint 2014.

**Suggested Theory distribution:**
The suggested theory distribution as per Bloom’s taxonomy is as per follows. This distribution serves as guidelines for teachers and students to achieve effective teaching-learning process.

| Distribution of Theory for course delivery and evaluation | | | | | |
|---|---|---|---|---|---|
| Remember | Understand | Apply | Analyze | Evaluate | Create |
| 15% | 15% | 40% | 10% | 10% | 10% |

**Suggested List of Experiments:**
1. Introduction to SPICE tool.
2. Develop the current-voltage characteristics of NMOS transistor.
3. Develop the current-voltage characteristics of PMOS transistor.
4. Implement NAND gate using CMOS transistors and simulate the design.
5. Implement NOR gate using CMOS transistors and simulate the design.
6. CMOS implementation of XOR and XNOR gate. Simulate the design.
7. Draw CMOS inverter and simulate the design with input and output waveforms.
8. Draw the layout of NAND and NOR gate and simulate the design.
9. Draw the layout of AND and OR gate and simulate the design.
10. Implement the 2x1 MUX using Transmission gate and simulate the design.
11. Develop layout of CMOS inverter and simulate it.
12. Measure propagation delay of CMOS inverter.
13. Develop the D-latch using CMOS transmission gate and simulate it.
14. Develop the edge triggered D flip flop and simulate it.

**Major Equipment/software: SPICE** Circuit simulator

**List of Open-Source Software/learning website:** NPTEL, LTSPICE Spice circuit simulator

**Instructional Method:**
1. Course delivery is combined use of white board/black board and power point presentation using projector as per requirement.

2. Students will be assessed with continuous evaluation approach with assignments and quizzes at regular interval.
3. For effective communication with students, canvas LMS (Learning Management System) is used.

**Supplementary Resources:**

1. NPTEL Videos on CMOS VLSI Design
2. https://nptel.ac.in/courses/108/107/108107129
3. https://nptel.ac.in/courses/117/101/117101058/
4. https://nptel.ac.in/courses/117/101/117101004
5. http://ece-research.unm.edu/jimp/vlsi

# Subject Code: 01CT0611

## Subject Name: Cloud Computing

## B. Tech. Year – III (Semester VI)

**Objective:**
This course is intended to analyse the basics of cloud computing, and make aware students with diversified technologies working for cloud architecture. Course will be focusing on architecture, service models, privacy & security in cloud.

**Credits Earned:** 05 Credits

**Course Outcomes:** After completion of this course, student will be able to:

1. Understand the architecture and infrastructure of cloud computing, including SaaS, PaaS, IaaS, public cloud, private cloud, hybrid cloud, various management and other distinguish services of AWS.
2. Apply the fundamental concepts in datacenters to understand the trade-offs in power, efficiency and cost by the Load balancing approach and instances.
3. Illustrate the fundamental concepts of cloud storage and demonstrate their use in storage systems such as Amazon S3 and Database.
4. Analyze various clouds Service models and apply them to solve problems on the cloud.
5. Deploy applications over commercial cloud computing infrastructures such as AWS

**Pre-requisite of course:**
Operating System and Computer Networks

**Teaching and Examination Scheme:**

| Teaching Scheme (Hours) | | | Credits | Theory Marks | | | Tutorial / Practical Marks | | Total Marks |
|---|---|---|---|---|---|---|---|---|---|
| | | | | E | I | | V | T | |
| Theory | Tutorial | Practical | | ESE | IA | CSE | Viva | Term Work | |
| 04 | 00 | 02 | 05 | 50 | 30 | 20 | 25 | 25 | 150 |

**Contents:**

| Unit | Topics | Hours |
|---|---|---|
| 1 | **Introduction of Cloud & Amazon Web Service**<br>Introduction of cloud computing, how it works Types of cloud, what is Virtualization, Advantages of Cloud, AWS history, Dashboard, AWS Overview, Architecture | 05 |

| | | |
|---|---|---|
| 2 | **Cloud Service Models**<br>Software as a Service (SaaS): Introduction, Challenges in SaaS models: Model, SaaS Integration Services, Advantages and Disadvantages, Infrastructure As a Services (IaaS): Introduction, Virtual Machines, VM Migration Services, Advantages and Disadvantages. Platform As a service (PaaS): Introduction, Integration of Private, and Public Cloud, Advantages and Disadvantages | 08 |
| 3 | **Identity & Access Management**<br>IAM Overview and Policies, IAM Users, Groups, Access Key & Secret Access Key, MFA, Report | 06 |
| 4 | **Elastic Cloud Computing (EC2)**<br>Amazon EC2 Overview, Elastic Block Storage (EBS), Amazon Machine Image (AMI), Instance Purchasing Options, Introduction to EC2 Instance Types Security Group Elastic, Public & private IP Overview, Amazon EBS & Snapshot, AWS CLI, Bootstrap Script, Elastic Load Balancing (ELB), Auto Scaling | 08 |
| 5 | **Virtual Private Cloud (VPC)**<br>Amazon Virtual Private Cloud (VPC), Amazon VPC and Subnets, Route Table, Internet Gateway | 06 |
| 6 | **Amazon Simple Storage Service (S3)**<br>Simple Storage Service (S3), S3 Object Storage and Buckets, Security on bucket, Web Hosting, Logging & event, Glacier, Versioning & Lifecycle Policy, Cross region replication | 08 |
| 7 | **Route 53**<br>DNS Records, Website Hosting, Routing Policy, Health Check | 04 |
| 8 | **Databases**<br>Relation Database System, DB engine & Instance details, Security, Parameter group, Monitoring Resourcing, DynamoDB, Elasticache | 06 |
| 9 | **CloudWatch & Monitoring**<br>Cloud Watch, Matrices, Alarm & notification, Log & billing Monitoring Other AWS monitoring | 05 |
| | **Total Hours** | 56 |

**Suggested Text books / Reference books:**

1. Judith Hurwitz, R Bloor, M.Kanfman, F.Halper “Cloud Computing for Dummies”, Wiley India Edition, First Edition
2. Rajkumar Buyya, James Broberg, Andrzej M. Goscinski, ”Cloud Computing: Principles and Paradigms”, Wiley Publication,2011
3. Tim Mather, SubraKumara swamy, Shahed Latif, “Cloud Security and Privacy: An Enterprise Perspective on Risks and Compliance”, O’ReillyMedia Inc, 2009
4. Mickey Iqbal 2010, “ IT Virtualization Best Practices: A Lean, Green Virtualized Data Center Approach”, MC Press

5. Frank H. P. Fitzek, Marcos D. Katz, “Mobile Clouds: Exploiting Distributed Resources in Wireless, Mobile and Social Networks”, Wiley Publications, ISBN: 978- 0-470-97389-9, Jan 2014.

**Suggested Theory distribution:**

The suggested theory distribution as per Bloom’s taxonomy is as per follows. This distribution serves as guidelines for teachers and students to achieve effective teaching- learning process.

| Distribution of Theory for course delivery and evaluation | | | | | |
|---|---|---|---|---|---|
| Remember | Understand | Apply | Analyze | Evaluate | Create |
| 5% | 15% | 20% | 20% | 20% | 20% |

**Suggested List of Experiments:**

Minimum 12 experiments to be performed during the semester

1. Setup Windows Instance in AWS Cloud using EC2 service and install IIS
2. Setup Linux Instance in AWS Cloud using EC2 service and install Apache(httpd)
3. Add and modify features in Existing Windows Instance
4. Build Your Virtual Private Cloud (VPC) and Launch a Web Server
5. Working with Amazon Elastic Block Store (EBS)
6. Introduction to AWS Identity and Access Management (IAM)
7. Deploy a Web Application on AWS
8. Using Auto Scaling with AWS Lambda and Lifecycle Hooks
9. Implementing a Serverless Architecture with AWS Managed Service
10. Launching EC2 Spot Instances with Auto Scaling and Amazon CloudWatch
11. Create Static Website Using S3
12. Crease S3 Bucket and Upload and Download file
13. Create Lifecycle Policy using S3
14. Setup Versioning & Configure Cross Region Replication in S3
15. Create Load Balancer using EC2 Service
16. RDS : Create Database & Connect
17. Create Autoscaling Group and Configure Multi Factor Authentication

**Supplementary Resources:**

1. https://onlinecourses.nptel.ac.in/noc17_cs23/preview
2. https://www.edx.org/micromasters/cloud-computing
3. https://aws.amazon.com/training/awsacademy/cloud-computing-architecture
4. https://www.coursera.org/specializations/cloud-computing

# Subject Code: 01CT0614

# Subject Name: Optimization Technique

# B.Tech. – Year –III (Semester VI)

**Objective:** The focus of the course is on convex optimization though some techniques will becovered for non-convex function optimization too. After an adequate introduction tolinear algebra and probability theory, students will learn to frame engineering minimamaxima problems in the framework of optimization problems.

**Credits Earned:** 3 Credits

**Course Outcomes:**After completion of this course, student will be able to:

1. Cast engineering minima/maxima problems into optimization framework.
2. Learn efficient computational procedures to solve optimization problems.
3. Apply optimization concepts to deal with real world situations
4. Design the simulation model for the given case study problem

**Pre-requisite of course:** Basic Programming Language, Calculus and Linear Algebra

**Teaching and Examination Scheme**

| Teaching Scheme (Hours) | | | Credits | Theory Marks | | | Tutorial/Practical Marks | | Total Marks |
|---|---|---|---|---|---|---|---|---|---|
| Theory | Tutorial | Practical | | ESE | IA | CSE | Viva | Term Work | |
| 3 | 0 | 0 | 3 | 50 | 30 | 20 | 00 | 00 | 100 |

**Contents:**

| Unit | Topics | Hours |
|---|---|---|
| 1 | **MODULE 1: Introduction to Operations Research**<br>Origin of Operations Research, Nature of Operations Research, Impact of Operations Research, Defining Problem and Generating data, formulating a mathematical model, Deriving solutions from the model, Testing the model | 5 |
| 2 | **MODULE 2: mathematical preliminaries**<br>Linear algebra, matrices, vector space, vector calculus, eigen values, eigen vectors, eigen space analysis, probabilistic theory, elementary multivarient calculus | 3 |

| | | |
|---|---|---|
| 3 | **MODULE 3: linear programming**<br>Introduction to LP problems, formulation of LP problems, steps for solution of LP problems, graphical solution, maximisation and minimization using simplex algorithm, two phase method, duality in LP, integer LP, karmakar method | 6 |
| 4 | **MODULE 4: transportation problems**<br>Introduction to transportation problem, varient of transportation problem, methods to solve transportation problem | 5 |
| 5 | **MODULE 5: assignment problems**<br>Introduction to assignment problems, methods to solve assignment problems | 3 |
| 6 | **MODULE 6: non-linear programming**<br>Graphical illustration of non linear programming, one variable unconstrained optimization, multi variant unconstrained optimization, Quadratic programming, Separable programming, convex programming | 6 |
| 7 | **MODULE 7:network analysis**<br>Network definition, analysis, probability of PERT analysis, project time cost tradeoff, introduction to resource allocation | 5 |
| 8 | **MODULE 8:sequencing**<br>Sequencing needs, processing N jobs in 2 machines, processing N jobs in 3 machines, processing N jobs in m machines | 5 |
| 9 | **MODULE 9: Advance Optimization Algorithms**<br>Genetic Algorithms, Simulated Annealing, Particle Swarm Optimization, Ant Colony Optimization, Optimization of Fuzzy Systems | 5 |
| | **Total Hours** | **43** |

**Suggested Text book/Main Reference:**

1. Introduction to Operations Research, 7th. Ed. Frederick Hillier. McGraw-Hill, 2000.
2. Simulation Model Design and Execution, P. Fishwick. Prentice Hall, 1995. REFERENCE
3. S S Rao, Engineering Optimization, New Age International
4. K Deb, Optimization for Engineering Design: Algorithms and Examples, Prentice-Hall of India
5.Discrete-Event Simulation: Modeling, Programming and Analysis, George S. Fishman. Springer-Verlag, New York, Inc., 2001
6. HTaha, Operation Research –, Pearson Education.
7. A Verma, Operation Research, S.K. Kataria and Sons.
8. V Kapoor, Operation Research, Sultan Chand & Sons

**Suggested Theory distribution:**

The suggested theory distribution as per Bloom's taxonomy is as per follows. This distribution serves as guidelines for teachers and students to achieve effective teaching-learning process

| Distribution of Theory for course delivery and evaluation | | | | | |
|---|---|---|---|---|---|
| Remember | Understand | Apply | Analyse | Evaluate | Create |
| 15% | 15% | 30% | 35% | 5% | -- |

# Subject Code: 01CT0615
# Subject Name: Software Engineering
# B. Tech. Year – III (Semester VI)

**Objective:**
To understand and apply various software project management techniques based on Software Engineering guidelines and Principles.

**Credits Earned:** 03 Credits

**Course Outcomes:** After completion of this course, student will be able to:
1. Understand various software engineering principles and their application
2. Demonstrate use of various Agile methodologies for software development
3. Apply various modelling techniques for designing system requirement
4. Identify different types of risk and evaluate its impact on software system
5. Distinguish different testing strategies and Create test cases
6. Able to understand and apply the basic project management practices in real life projects

**Pre-requisite of course:**
Object Oriented Programming fundamental

**Teaching and Examination Scheme:**

| Teaching Scheme (Hours) | | | Credits | Theory Marks | | | Tutorial / Practical Marks | | Total Marks |
|---|---|---|---|---|---|---|---|---|---|
| | | | | E | I | | V | T | |
| Theory | Tutorial | Practical | | ESE | IA | CSE | Viva | Term Work | |
| 03 | 00 | 00 | 03 | 50 | 30 | 20 | 00 | 00 | 100 |

**Contents:**

| Unit | Topics | Hours |
|---|---|---|
| **1** | **Introduction**<br>Importance of Software Engineering, Discipline of Software Engineering; Eclipse Introduction, Overview, and Demo; Lifecycle models: Requirements Engineering, Design and Implementation, Maintenance, Software Process Model Introduction, Waterfall Process, Spiral Process, Evolutionary Prototyping Process, Agile Process, Choosing a Model, Lifecycle Documents; Version Control System: Introduction to Git, Git Demo: Git + Eclipse, Git . | 06 |

| | | |
|---|---|---|
| **2** | **Requirements Engineering:**<br>General RE Definition, Functional and Non-functional Requirements, User and System Requirements, Modelling Requirements, Analysing Requirements, Requirements Prioritization, Requirements Engineering Process, and steps; Creating SRS and performing requirements inspections. Engineering standards in building, testing, operation and maintenance of the computer and software systems | 06 |
| **3** | **OO Software and UML:** Object Orientation Introduction, UML Structural Diagrams: Class Diagrams, Component Diagram, UML Structural Diagram: Deployment Diagram. UML creation tips.<br>**UML Behavioral Diagram**: Use Case, Use Case Diagram: Creation Tips,<br>**UML behavioral Diagrams:** Sequence,<br>**UML behavioral Diagrams:** State Transition Diagram. UML creation tips;<br>**Software Architecture**: What is Software Architecture? Advantages and use of architectural models. Architectural patterns. Designing architectural patterns. Design Patterns: Patterns Catalogue, Pattern Format, Factory Method Pattern, Strategy Pattern, Choosing a Pattern, Negative Design Patterns. | 12 |
| 4 | **Software Testing:** Black Box Testing Failure, Fault and Error, Verification Approaches, Pros and Cons of Approaches, Testing Introduction, Testing Granularity Levels, Alpha and Beta Testing, Black-Box Testing,<br>**Systematic Functional Testing Approach**; Test Data Selection, Equivalence Partitioning and Boundary Value Analysis, Create and Evaluate Test Case Specifications, Generate Test Cases from Test Case Specifications.<br>**White-Box Testing:** Coverage Criteria Intro, Statement Coverage, Control Flow Graphs, Test Criteria. | 09 |
| **5** | **Agile Development Methods:** Cost of Change, Agile Software Development, Extreme Programming (XP), XP’s Values and Principles, Test First Development, Refactoring, Pair Programming, Continuous Integration, Testing Strategy, High Level Scrum Process.<br>**Unified Software Process:** Use-Case Driven, Inception Phase, Elaboration Phase, Construction Phase, Transition Phase, Phases and Iterations. Software Evolution: Evolution processes, Legacy Systems, Software Maintenance. Situations during software evolution and maintenance. Software Reengineering and Refactoring: Reasons to Reengineer and Refactor, Advantages, Refactoring Demo, Refactoring Risks, Cost of Refactoring, When Not to Refactor | 09 |
| **Total Hours** | | 42 |

**Suggested Hands on activities:**

1 Examine each phase of the Software Development Life Cycle (SDLC) in detail and the numerous activities that are carried out during each one. Determine the goals and summary results for each SDLC phase.

2 As a software architect or project manager, think about each project that will be produced using any technology. Create the project's Software Requirement

Specification (SRS) document.

3 Design all UML diagrams: Activity Diagram, Use-case Diagram, Data Dictionary, e E-R Diagram, Data Flow Diagram of the system.

4 Apply Basic and Intermediate COCOMO to resolve the situation.

5 Examine the case study to find the problem and fix it. In the end, an FP-oriented estimate model must be applied to evaluate the calculation portion of the effort.

6 Draw a control flow diagram and add cyclomatic complexity to the programming code (any java code). Figure out how many of separate paths needed for testing.

7 Assign a group of students a mini project to create software docs for the systems specified below,

- Create a of Software Requirements Specification (SRS)
- Function oriented design using SA/SD
- OO design using UML diagrams
- Develop a test case for given system
- Implementation of any testing method (White box)

8 Address design-based problems (DP) and open-ended issues.

**Suggested Text books / Reference books:**

1. R. Pressman, Software Engineering A Practitioner's Approach (8 ed.), McGraw Hill International, 2019. ISBN 978-1259253157.
2. Sommerville, Software Engineering (10 ed.), Person Publications Publishing Company, 2017. ISBN 978-9332582699.

**Suggested Theory distribution:**

The suggested theory distribution as per Bloom's taxonomy is as per follows. This distribution serves as guidelines for teachers and students to achieve effective teaching-learning process.

| Distribution of Theory for course delivery and evaluation | | | | | |
|---|---|---|---|---|---|
| Remember | Understand | Apply | Analyze | Evaluate | Create |
| 10% | 20% | 10% | 30% | 20% | 10% |

**Supplementary Resources:**

1. http://nptel.ac.in/courses/106101061/
2. https://www.joelonsoftware.com/
3. http://www.codesimplicity.com/
4. http://www.sparxsystems.com/products/ea/index.html
5. http://www.smartdraw.com
6. http://viu.eng.rpi.edu
7. www.en.wikipedia.org/wiki/Software_engineering
8. www.win.tue.nl

9. www.rspa.com/spi
10. www.onesmartclick.com/engsineering/software-engineering.html
11. www.sei.cmu.edus
12. https://www.edx.org/school/uc-berkeleyx

# Subject Code: 01CT0616

## Subject Name: Artificial Intelligence

## B.Tech. Year – III (Semester VI)

**Objective:** Artificial intelligence (AI) is a research field that studies how to realize the intelligent human behaviours on a computer. The ultimate goal of AI is to make a computer that can learn, plan, and solve problems autonomously. The main purpose of this course is to provide the most fundamental knowledge to the students so that they can understand the purpose of AI.

**Credits Earned:** 04 Credits

**Course Outcomes:**

After the course, the students will be able to:

1. Understand the appropriate technique and algorithm for reasoning and developing the solution within an AI problem domain [Understand]
2. Identify the appropriate representation of the AI problem or domain model [Understand]
3. Compare the performance of the AI system or component [Evaluate]
4. Analyse the gaps and improve the research quality for an existing AI problem [Analyse]
5. Develop the solution for an existing AI problem using the concepts of Neural Nets, NLP, Game Theory, Recommendation System and Reinforcement Learnings. [Apply]

**Pre-requisite of course:** Programming using Python, Probability, Linear Algebra, Algorithms

**Teaching and Examination Scheme**

<table>
<tr><th colspan="3">Teaching Scheme (Hours)</th><th rowspan="2">Credits</th><th colspan="3">Theory Marks</th><th colspan="2">Tutorial/ Practical Marks</th><th rowspan="2">Total Marks</th></tr>
<tr><th>Theory</th><th>Tutorial</th><th>Practical</th><th>ESE (E)</th><th>Mid Sem (M)</th><th>Internal (I)</th><th>Viva (V)</th><th>Term work (TW)</th></tr>
<tr><td>3</td><td>0</td><td>2</td><td>4</td><td>50</td><td>30</td><td>20</td><td>25</td><td>25</td><td>150</td></tr>
</table>

**Contents:**

| Unit | Topics | Hours |
|---|---|---|
| 1 | **Introduction to AI:**<br>What is AI, Foundations of AI, History of AI, Risks and Benefits of AI, Intelligent Agents-reactive, deliberative, goal-driven, utility-driven, and learning agents, Good Behaviour: The concept of Rationality, Nature of Environment, Structure of Agents, Criteria For Success | 2 |
| 2 | **Solving Problems by Searching:**<br>Search problems and solution, Search Algorithms- Best-first search, Breadth-first search, Depth First Search, Dijkstra's algorithm, Bidirectional search, Redundant paths, State spaces and search, Heuristic Search Strategies- Hill climbing ,Local Maxima | 3 |
| 3 | **Finding Optimal Path**<br>Brute Force, Branch and Bound, A*, Admissibility of A*, Iterative Deepening A*, Algorithm AO*, Pruning the OPEN and CLOSED List | 3 |
| 4 | **Constraint Satisfaction Problems**<br>Constraint Propagation: Inference in CSPs- Node consistency, Arc consistency, Path consistency, K-consistency ,Global constraints, Sudoku | 3 |
| 5 | **Knowledge representation**<br>The Schema, Frames, Inheritance in taxonomies, Conceptual Graphs,<br>Using Predicate logic- representing facts in logic, functions and predicates, Agents, Facets of knowledge, Resolution in propositional logic and predicate logic, Question Answering | 4 |
| 6 | **Machine Learning**<br>Types of Dataset, Types of Learning, Prediction, Classification, Generation, Regression and Clustering approach, Feature Extraction and Scaling, Loss Function | 5 |
| 7 | **Deep Learning:**<br>Simple Feedforward Network, Computation Graphs for Deep Learning, Activation Functions, Convolutional Network¸ Recurrent Neural Networks, Unsupervised Learning and Transfer Learning, Applications | 7 |
| 8 | **Reinforcement Learning**<br>Learning from Rewards, Active and Passive Reinforcement Learning, Generalization in Reinforcement Learning, Policy Search, Applications of Reinforcement Learning | 6 |
| 9 | **Natural Language Processing**<br>Language Models, Lemmatization, Stemming, Parsing, Word Embeddings, Topic Modeling, Learning texts- Keyword Extraction, Summarizing, Text Ranking | 7 |
| 10 | **Recommender Systems**<br>Recommendation Systems, Factorization Algorithms, SVD, Collaborative Filtering-User based and Item Based, Content-based recommendation- Discovering features of documents | 6 |
| 11 | **Game Theory**<br>What is Game Theory, Applications, Types of Game theory, Nash Equilibrium, Mixed Strategy Nash Equilibrium, Bayesian Games | 3 |
| 11 | **Philosophy, Ethics, and Safety of AI**<br>The Limits of AI, Can Machines Really Think?, The Ethics of AI, The Future of AI | 1 |
| | **Total Hours** | **50** |

**Suggested Textbooks/Reference books:**

1. Deepak Khimani, A first course in Artificial Intelligence, Tata McGraw-Hill
2. Russell, S.J. and Norvig, P., Artificial Intelligence: A Modern Approach, Pearson Education
3. "Artificial Intelligence" -By Elaine Rich And Kevin Knight (2nd Edition) Tata Mcgraw-Hill
4. G.Luger, W.A. Sttubblefield, "Artificial Intelligence", Addison-Wesley Longman
5. N.P. Padhy "Artificial Intelligence and Intelligent Systems", Oxford University Press

**Suggested Theory distribution:**

The suggested theory distribution as per Bloom's taxonomy is as per follows. This distribution serves as guidelines for teachers and students to achieve effective teaching-learning process

| Distribution of Theory for course delivery and evaluation | | | | | |
|---|---|---|---|---|---|
| Remember | Understand | Apply | Analyse | Evaluate | Create |
| 10% | 10% | 40% | 20% | 10% | 10% |

**Suggested List of Experiments:**

1. Implement simple feed-forward network
2. Implement Sequential modelling network
3. Implement the neural network with feed-back system
4. Implement the code for RNN
5. Implement the code for LSTM
6. Implement the code for the image processing
7. Implement the code for CNN
8. Implement the basic code for word embeddings of NLP
9. Implement the code for textrank for keyword extraction
10. Implement the code for textrank for text summarization
11. Implement the code for topic modelling of LDA
12. Implement the recommendation system to recommend movie to users
13. Implement the recommendation system to recommend items to users
14. Implement the content based and collaborative based filtering of recommendation system
15. Implement the snake and ladder game using reinforcement learning
16. Implement the Nash Equilibrium theorem using Game Theory concept
17. Implement the BFS, DFS and Dijkstra's shortest path algorithm
18. Implement the Sudoku game using the concept of CSPs
19. Write a program to implement Tic-Tac-Toe game problem.
20. Write a program to Implement A* Algorithm.

**Instructional Method:**

a. The course delivery method will depend upon the requirement of content and need of students. The teacher in addition to conventional teaching method by black board, may also use any of tools such as demonstration, role play, Quiz, brainstorming, MOOCs etc.

b. The internal evaluation will be done on the basis of continuous evaluation of students in the laboratory and class-room.

c. Students will use supplementary resources such as online videos, NPTEL videos, e-courses, Virtual Laboratory

**Supplementary Resources/Web-Resources:**

1. http://www.journals.elsevier.com/artificial-intelligence/
2. https://www.technologyreview.com/s/534871/our-fear-of-artificial- intelligence/
3. http://www.sanfoundry.com/artificial-intelligence-mcqs-inductive-logic-unification-lifting-1/

## Subject Code: 01CT0617

## Subject Name: Human Centered Design

## B. Tech. Year – III (Semester VI)

**Objective:**

The main objective of this course is to enable students to build solutions for problems in society, understanding needs of the people, finding gaps in needs and existing technological solutions, innovating ideas, developing prototypes and implementing solutions for real world problems.

**Credits Earned:** 01 Credit

**Course Outcomes:** After completion of this course, student will be able to:

1. Demonstrate knowledge of the role of specific techniques in human centered design
2. Conduct user interviews and synthesize learnings to uncover insights and identify opportunities for innovation
3. Bring ideas to life using prototypes to test with real users and identify promising solutions to implement
4. Practice team management, leadership, and project management

**Pre-requisite of course:** NA

**Teaching and Examination Scheme:**

<table>
<tr><th colspan="3" rowspan="2">Teaching Scheme (Hours)</th><th rowspan="3">Credits</th><th colspan="3">Theory Marks</th><th colspan="2">Tutorial / Practical Marks</th><th rowspan="3">Total Marks</th></tr>
<tr><th>E</th><th colspan="2">I</th><th>V</th><th>T</th></tr>
<tr><th>Theory</th><th>Tutorial</th><th>Practical</th><th>ESE</th><th>IA</th><th>CSE</th><th>Viva</th><th>Term Work</th></tr>
<tr><td>00</td><td>00</td><td>02</td><td>01</td><td>00</td><td>00</td><td>00</td><td>50</td><td>50</td><td>100</td></tr>
</table>

**Contents:**

| Unit | Topics | Hours |
|---|---|---|
| 1 | **Introduction**<br>Introduction to Human Centered Design, Human Centered Design Process, Group Discussion, Design Innovations in Practice, Preparing Mindsets: Creative Confidence, Empathy, Learn from Failures, make it approach, Team Formation, Case Study, Activity: Mini Design Challenge | 06 |
| 2 | **Inspiration**<br>Choose Your Design Challenge, Create a Project Plan, Secondary research, Buils Interview Guide, Group and Expert Interviews, Card slot exercise, Immersion, draw solutions, Prepare resource flow | 06 |
| 3 | **Ideation**<br>Share stories and learn from user research, find themes and cluster them, create insight Statements, Create How Might We? Questions, Create Frameworks | 04 |
| 4 | **Prototyping**<br>Brainstorm, Brainstorm Rules, Bundle Ideas, create a concept, Determine what to prototype, Storyboard, Role playing, Rapid Prototyping, Business Model Canvas, Get Feedback, integrate feedback and iterate | 06 |
| 5 | **Implementation**<br>Prepare Roadmap, Resource Assessment, Ways to grow framework, define success, Create Action Plan, create a Pitch, Discussion on ways to go forward | 06 |
| | **Total Hours** | 28 |

**Suggested Text books / Reference books:**

1. "The Field Guide to Human Centered Design", DESIGN KIT
2. J. Liedtka, T. Ogilvie, "Designing for Growth", Columbia University Press
3. M. Cruz-Cunha, I. Miranda, P. Goncalves, "Handbook of Research on ICTs for Human-Centered Healthcare and Social Care Services", SCOPUS
4. Stickdorn, Marc and Jakob Schneider, "This is Service Design Thinking: Basics, Toolsand Cases", Wiley Publishing.
5. H. S. Fogler and S. E. LeBlanc, "Strategies for Creative Problem Solving", 2nd edition, Pearson, Upper Saddle River, NJ, 2008.
6. V. Kumar, "101 Design Methods", Wiley

**Suggested Theory distribution:**

The suggested theory distribution as per Bloom's taxonomy is as per follows. This distribution serves as guidelines for teachers and students to achieve effective teaching-learning process.

| Distribution of Theory for course delivery and evaluation | | | | | |
|---|---|---|---|---|---|
| Remember | Understand | Apply | Analyze | Evaluate | Create |
| 5% | 5% | 15% | 20% | 20% | 40% |

**Supplementary Resources:**

1. https://acumenacademy.org/course/design-kit-human-centered-design
2. https://www.coursera.org/learn/human-computer-interaction
3. https://www.coursera.org/learn/innovation-through-design
4. https://www.designkit.org/human-centered-design
5. https://www.ideo.com/
6. https://dschool.stanford.edu/resources/the-bootcamp-bootleg
7. https://www.coursera.org/learn/uva-darden-design-thinking-innovation
8. https://www.coursera.org/learn/design-thinking-innovation
9. http://www.cs.odu.edu/~cs381/cs381content/problem_solving/problem_solving.html10.https://ryanstutorials.net/problem-solving-skills/

# Subject Code: 01CT0618
# Subject Name: Sensors and IoT
# B. Tech. Year – IV (Semester VII)

**Objective:**
The objective of the course is to introduce to fundamentals of IoT and understand applications of IoT in various domains. Explore hardware, software, communication and data management enablers for IoT and learn to use them along with fulfilling security requirements of IoT.

**Credits Earned:** 05 Credits

**Course Outcomes:** After completion of this course, student will be able to:
1. Understand IoT architecture, hardware and software components, protocols and applications. .
2. Apply proper access technologies and protocols to build IoT Nodes.
3. Implement algorithms related to various layers in protocol stack of IoT framework.
4. Distinguish between various IoT architectural components, hardware modules, communication techniques, security technologies and relate them with IoT applications.
5. Construct an IoT solution for existing application domains.

**Pre-requisite of course:**
Introduction to Single Board Computer Programming, Computer Networks, Internet and Web Technology

**Teaching and Examination Scheme:**

| Teaching Scheme (Hours) | | | Credits | Theory Marks | | | Tutorial / Practical Marks | | Total Marks |
|---|---|---|---|---|---|---|---|---|---|
| | | | | E | I | | V | T | |
| Theory | Tutorial | Practical | | ESE | IA | CSE | Viva | Term Work | |
| 04 | 00 | 02 | 05 | 50 | 30 | 20 | 25 | 25 | 150 |

**Contents:**

| Unit | Topics | Hours |
|---|---|---|
| 1 | **Introduction to Internet of Things**<br>Definitions, Core Concepts, Related Concepts, Challenges, IoT framework, IoT Reference Models, IoT Architecture: IoTWF architecture, architecture for adequate design for required security,<br>architecture of edge computing, OPC unified architecture, oneM2M | 08 |
| 2 | **IoT Devices**<br>Classification of Things in IoT, Sensors and its classification, Actuators and its classification, Working principles of various sensors, MEMS, Smart Objects, Case study – Sensor tag energy harvesting, batteries and super capacitors, interfacing of sensors with microcontroller | 08 |
| 3 | **IoT Protocols**<br>Communication Criteria, Access technologies and communication protocols: Bluetooth, BLE, LoRaWAN, WirelessHART, Zwave, LTE-M, NB-IoT, Sigfox, 6LowPAN, 6TiSCH, LLN, RPL, MQTT, Publish-Subscribe Operation, Packet Structure, Transport Layer (TCP, MPTCP, UDP, DCCP, SCTP)-(TLS, DTLS) – Session Layer- HTTP, XMPP, AMQP, Integrating Internet Services with Interoperable data encoding with XML, JSON and CBOR, Sensor data models and representation, The Sensor Mark-up Language (SENML), lightweight<br>web services for IoT, ContikiOS | 20 |
| 4 | **Security in IoT**<br>protocols and technologies, Lightweight formats for crypto security, CoAP, DTLS, Object security for constrained RESTful environments, OAUTH based authorization, Denial of Service attacks, selective<br>jamming in wireless networks, Intrusion detection systems and firewalls | 10 |
| 5 | **Recent trends in IoT**<br>IoT application domains: Smart Cities, Smart Manufacturing, Smart Grid, Smart Buildings, Intelligent Transportation Systems, Healthcare | 06 |
| | **Total Hours** | 52 |

**Suggested Text books / Reference books:**

1. Q. F. Hassan, "Internet of Things A to Z: Technologies and Applications”, IEEE Press, Wiley
2. D. Hanes, G. Salguerio, P. Grossetete, R. Barton, J. Henry, " IoT Fundamentals: Networking Technologies, Protocols, and Use Cases for the Internet of Things”, CISCO Press
3. J. Holler, V. Tsiatsis, C. Mulligan, S. Karnouskos, S. Avesand, D. Boyle, “From Machine to Machine to Internet of Things”, Academic Press, ELSEVIER
4. P. Raj, A. Raman, “The Internet of Things Enabling Technologies, Platforms, and Use Cases”, CRC Press

5. IEEE Standard for an Architectural Framework for the Internet of Things (IoT)," in IEEE Std 2413-2019, vol., no., pp.1-269, 10 March 2020, doi: 10.1109/IEEESTD.2020.9032420.

**Suggested Theory distribution:**

The suggested theory distribution as per Bloom's taxonomy is as per follows. This distribution serves as guidelines for teachers and students to achieve effective teaching- learning process.

| Distribution of Theory for course delivery and evaluation | | | | | |
|---|---|---|---|---|---|
| Remember | Understand | Apply | Analyze | Evaluate | Create |
| 15% | 30% | 20% | 15% | 10% | 10% |

**Suggested List of Experiments:**

Minimum 12 experiments to be performed during the semester

1. Explain working of Raspberry Pi.
2. Connect Raspberry Pi with your existing system components.
3. To sense temperate and humidity using sensors interfaced with IoT hardware board.
4. To detect presence using proximity sensor interfaced with IoT hardware board.
5. To detect distance of object using ultrasonic sensor interfaced with IoT hardware board.
6. To interface pressure sensor with IoT hardware board and read sensed data.
7. To read RFID tag using RFID reader interfaced with IoT hardware board.
8. To control LED on IoT hardware board using Bluetooth module interfaced with it.
9. To get location data using GPS module interfaced with IoT hardware module on webpage.
10. To understand implementation of MQTT using ContikiOS.
11. To understand implementation of CoAP using ContikiOS.
12. To create IPv6 network and configure network stack using Cooja simulator.
13. Demonstrate a smart object API gateway service reference implementation in IoT toolkit.
14. Sketch the architecture of IoT Toolkit and explain each entity in brief.
15. Write and explain working of an HTTP- to-CoAP semantic mapping proxy in IoT toolkit.
16. Describe gateway-as-a-service deployment in IoT toolkit.
17. Explain application framework and embedded software agents for IoT toolkit.
18. Define and Explain Eclipse IoT Project.
19. List and summarize few Eclipse IoT Projects.
20. Give overview of Zetta.

**Supplementary Resources:**

1. https://www.coursera.org/specializations/iot
2. https://www.coursera.org/specializations/internet-of-things
3. https://nptel.ac.in/courses/106/105/106105166/

# Subject Code: 01CT0619
# Subject Name: Digital Design using Verilog
# B. Tech. – Year – III (Semester VI)

**Objective:**
This course will introduce the students to the Verilog Hardware Description Language (HDL). Students will learn to model the hardware using hardware description language.

**Credits Earned:** 05 Credits

**Course Outcomes:** After completion of this course, student will be able to

1. Understand the Verilog Hardware Description Language
2. Model the combinational and sequential circuits using Verilog
3. Verify the digital design with simulation
4. Analyze the different Verilog modeling style
5. Interpret the data sheets of CPLD and FPGA

**Pre-requisite of course:** Digital Electronics

**Teaching and Examination Scheme**

| Teaching Scheme (Hours) | | | Credits | Theory Marks | | | Tutorial / Practical Marks | | Total Marks |
|---|---|---|---|---|---|---|---|---|---|
| | | | | E | I | | V | T | |
| Theory | Tutorial | Practical | | ESE | IA | CSE | Viva | Term Work | |
| 4 | 0 | 2 | 5 | 50 | 30 | 20 | 25 | 25 | 150 |

**Contents:**

| Unit | Topics | Contact Hours |
|---|---|---|
| 1 | **Digital Circuit Design Flow**<br>Introduction to digital circuit design flow, VLSI design flow, Behavioral design, data path design, logic design, physical design, manufacturing. VLSI design style, FPGA based design, standard cell based design, Full custom design. | 6 |
| 2 | **Introduction to Verilog**<br>Concept of module , Data types in Verilog , Features of Verilog , Verilog operators | 4 |

| | | |
|---|---|---|
| 3 | **Verilog Modeling**<br>Behavioral modeling and structural modeling, Explanation of modeling with different examples, modeling 16x1 multiplexer, modeling 16 bit adder, Switch level modeling | 6 |
| 4 | **Verilog Description Styles**<br>Data flow and behavioral(procedure statements), Example of decoder and D-latch, Various examples using blocking and non blocking assignment, analyzing that how the modeling style influences the simulator and synthesis tool | 8 |
| 5 | **Verilog Test benches**<br>Writing Verilog test benches, write test bench for combinational design, write test bench for sequential design, generating test vectors | 4 |
| 6 | **Modeling Finite State Machine**<br>Moore Machine, Mealy Machine, Examples | 6 |
| 7 | **Data path and Controller design**<br>Data path design includes functional circuits, registers, multiplexers, bus, adders, multipliers, counters etc. Controller design includes Finite State Machine and provide control to the data path, Example to explain above concept | 4 |
| 8 | **Modeling Memory and register banks**<br>Concepts of modeling memory, How to model memory and initialize memory, concepts of modeling register bank | 4 |
| 9 | **Verilog modeling of processor**<br>RISC Processor, Basic pipe line concepts, Understanding pipe line implementation | 6 |
| 10 | **CPLD and FPGA**<br>Evolution, PLA and PAL, Simple PLD and its data sheet, Complex PLD(CPLD) and its data sheet, FPGA, Architecture of FPGA, Configurable logic blocks, I/O blocks, Interconnect logic, Interpretation of datasheets of commercially available FPGA, Realization of digital design using FPGA | 8 |
| | | |
| | **Total Hours** | 56 |

**Suggested Text book/Main Reference:**

1. Verilog HDL A guide to digital design and synthesis by Samir Palnitkar, Pearson Education
2. Fundamentals of Digital Logic with Verilog Design by Stephen Brown and Zvonko Vranesic
3. Verilog HDL Synthesis-A practical primer by J.Bhaskar
4. Verilog Digital System Design by Z.Navabi
5. Digital Design: Principles and practices by Jon F. Wakerly, Prentice Hall
6. Datasheets of CPLD and FPGA

**Suggested Theory distribution:**

The suggested theory distribution as per Bloom's taxonomy is as per follows. This distribution serves as guidelines for teachers and students to achieve effective teaching-learning process:

| Distribution of Theory for course delivery and evaluation | | | | | |
|---|---|---|---|---|---|
| Remember | Understand | Apply | Analyze | Evaluate | Create |
| 5% | 20% | 35% | 30% | 0% | 10% |

**Suggested List of Experiments :( Minimum 12 experiments from given set of experiments and verify with available simulator tool)**

1. Write the Verilog code to implement given logic functions.
2. Write the Verilog code from the given logic circuit.
3. Write the Verilog code for designing 16x1 Multiplexer with 2x1 multiplexer.
4. Write the Verilog code for designing 4x16 decoder with 2x4 decoder.
5. Write the Verilog code for designing 8 to 3 priority encoder.
6. Write the Verilog code for designing half adder and full adder circuit.
7. Write the Verilog code for designing 4 bit ripple carry adder circuit.
8. Write the Verilog code for designing binary to gray code converter circuit.
9. Write the Verilog code for designing BCD to seven segment converter circuit.
10. Write the Verilog code for D latch, SR latch and JK latch.
11. Write the Verilog code for D flip flop, SR flip flop, JK flip flop.
12. Write the Verilog code for designing T-flip flop using D-flip-flop.
13. Design 4-bit register with asynchronous clear and enable using Verilog.
14. Design 4-bit shift register with synchronous reset using Verilog.
15. Design 4 bit up/down counter with parallel load using Verilog.
16. Design Moore machine(FSM) with example using Verilog.
17. Design Mealy machine(FSM) with example using Verilog.

**Open Ended Projects:**

1. Design 4 bit ALU which performs the following tasks.
   a. Add b.Subtract c.Multiplication d. Division e. OR f. AND g. Invert h.XOR
2. Implement bus structure to transfer data among registers using two different approaches.
   a. Using tristate driver b. Using multiplexer
3. Design control circuit for a simple processor to perform basic operations mentioned below.
   a. load data into register b. copy data from register to register c. add d. subtract

**Instructional Method:**

1. Course delivery is combined use of white board/black board and power point presentation using projector as per requirement.
2. Students will be assessed with continuous evaluation approach with assignments and quizzes at regular interval.
3. For effective communication with students, canvas LMS (Learning Management System) is used.
4. Students are given opportunity to interact with mentors from industries through mock interview.

**Supplementary Resources:**

1. Hardware Modeling Using Verilog: Prof.Indranil Sengupta, IIT Kharagpur
   https://nptel.ac.in/courses/106/105/106105165/
2. Digital System Design with PLDs and FPGAs: Prof. Kuruvilla Varghese, IISc Bangalore
   https://nptel.ac.in/courses/117/108/117108040/
   https://www.edaplayground.com/

**Subject Code: 01CT0623**

**Subject Name: Advance Java**

**B. Tech. Year – III (Semester VI)**

**Objective:**
This course develops programming ability of students to create dynamic web applications using server-side technology with Java Database Connectivity. Students can learn networking and remote method invocation using Java API. Different Java frameworks likeSpring, Java Server Faces and Hibernate will increase ability of students in web application development.

**Credits Earned:** 05 Credits

**Course Outcomes:** After completion of this course, student will be able to:
1. Describe the components of J2EE Architecture, MVC Framework and Multi-tier Application and Various Network Protocol.
2. To make use of Servlet and JSP API in the process of enterprise application deployment.
3. Implement components such as Session, Filters, JSTL, Beans.
4. Distinguish Application Server, Web Container, JDBC and ORM tools.
5. Design and Development of web application having collaboration of Servlets,JSPs, JSF, Spring and Hibernate base upon the requirement.

**Pre-requisite of course:**
Object Oriented Programming with JAVA

**Teaching and Examination Scheme:**

| Teaching Scheme (Hours) | | | Credits | Theory Marks | | | Tutorial / Practical Marks | | Total Marks |
|---|---|---|---|---|---|---|---|---|---|
| | | | | E | I | | V | T | |
| Theory | Tutorial | Practical | | ESE | IA | CSE | Viva | Term Work | |
| 04 | 00 | 02 | 05 | 50 | 30 | 20 | 25 | 25 | 150 |

**Contents:**

| Unit | Topics | Hours |
|---|---|---|
| 1 | **JDBC Programming**<br>The JDBC Connectivity Model, Database Programming: Connecting to the Database, Creating a SQL Query, Getting the Results, Updating Database Data, Error Checking and the SQLException Class, The SQLWarning Class, The Statement Interface, PreparedStatement, CallableStatement The ResultSet Interface, Updatable Result Sets, JDBC Types, Executing SQL Queries, ResultSetMetaData, Executing SQL Updates, Transaction Management | 08 |
| 2 | **Servlet API and Overview Servlet Model**<br>Overview of Servlet, Servlet Life Cycle, HTTP Methods Structure and Deployment descriptor ServletContext and ServletConfig interface, Attributes in Servelt, Request Dispacher interface The Filter API: Filter, FilterChain, Filter Config Cookies and Session Management: Understanding state and session, Understanding Session Timeout and Session Tracking, URL Rewriting | 12 |
| 3 | **Java Server Pages JSP Overview**<br>The Problem with Servlets, Life Cycle of JSP Page, JSP Processing, JSP Application Design with MVC, Setting Up the JSP Environment. JSP Directives, JSP Action, JSP Implicit Objects JSP Form Processing, JSP Session and Cookies Handling, JSP Session Tracking JSP Database Access, JSP Standard Tag Libraries, JSP Custom Tag, JSP Expression Language, JSP Exception Handling, JSP XML Processing. | 15 |
| 4 | **Hibernate 4.0**<br>Overview of Hibernate, Hibernate Architecture, Hibernate Mapping Types, Hibernate O/R Mapping, Hibernate Annotation, Hibernate Query Language | 12 |
| 5 | **Spring**<br>Introduction to spring, Dependency Injection, Spring AOP, Spring ORM, Spring MVC. | 09 |
| | **Total Hours** | 56 |

**Suggested Text books / Reference books:**

1. Core and Advanced Java, Black Book, Recommended by CDAC, Revised andUpgraded [eBook] Dreamtech Press.
2. Java The Complete Reference - Eleventh Edition by Herbert Schildt.
3. Advanced Java Programming by Prasanalakshmi B
4. Intermediate & Advanced Java Programming by Stone River
5. Head First Java by Kathy Sierra

**Suggested Theory distribution:**

The suggested theory distribution as per Bloom's taxonomy is as per follows. This distribution serves as guidelines for teachers and students to achieve effective teaching- learning process.

| Distribution of Theory for course delivery and evaluation | | | | | |
|---|---|---|---|---|---|
| Remember | Understand | Apply | Analyze | Evaluate | Create |
| 5% | 25% | 30% | 20% | 10% | 10% |

**Suggested List of Experiments:**

Minimum 12 experiments to be performed during the semester

1. WAP that will retrieve data from Database and display on Console screen. (JDBC)
2. WAP that will take firstName, surName, email from user. Store that data into DB and display data from DB. (JDBC)
3. Search userDOB by passing arguments as date to servlet by submit the search.jsp page at SearchResult.java servlet that returns the rows of result back to clientResult.jsp page. (Servlet).
4. Create one class file named DBTransaction.java file under classes directory. That returns the connection obj. to servlet ConServlet.java file under same classes folder. Use this servlet for controller. Accept the data from CV.jsp page as forms data pass it to servlet that redirect data to the InsertData() method of DBTransaction.java file. Use ServletContext for controller (JDBC-Servlet).
5. Take USerName and Email-id from user in html page. Store email-id in xml file also. Display both values in servlet. (Servlet)
6. A servlet program to do session tracking and session counter using serssionListener.
7. JSP program to demonstrate arithmetic operations.
8. Gets two numbers in html page from the user and submit that numbers in jsp page,print appropriate output using methods. (JSP)
9. Get value from user and create cookie in another jsp page and also view that cookie. (JSP)
10. Get value from user and create session in another jsp page and also view. (JSP)
11. Session Demo program. Create login.jsp and check it from user_master db and set session for next UserAccount.jsp page. (JDBC-JSP)
12. Create employee_master table and check if user is authenticated or not by login module and set appropriate session. Every time whenver user loged in the last Access Time should be shown to user. give logout link and destory the session attributes and redirect the user to again login page. (JDBC-JSP)
13. JSP program to demonstrate jsp: forward action tag.
14. Create one user login registration page in jsp with all required form fields and insert into database. insertion of data done at servlet level where connection method is created in servlet. Accept the client httpServletRequest. (JDBC-Servlet-JSP)

**Supplementary Resources:**

1. www.nptel.com
2. www.javatpoint.com
3. https://www.tutorialspoint.com/java/index.htm
4. https://www.codejava.net/struts-tutorials

## Subject Code: 01CT0624

## Subject Name: Theory of Computation

## B. Tech. Year – III (Semester VI)

**Objective:**

To understand thinking method of computer and how it computes decision are two main motives behind this course. This course also provides finite automata model to design language processing method of computer.

**Credits Earned:** 05 Credits

**Course Outcomes:** After completion of this course, student will be able to:

1. To understand theory behind computer’s thinking capacity
2. To understand design of model of decision-making power of computer.
3. To design automata based on given language.
4. To differentiate the given set of languages.
5. Apply this basic knowledge of Theory of Computation in the computer field to solve computational problems and in the field of compiler also.

**Pre-requisite of course:**

Mathematical terminologies of Computation, Data Structures

**Teaching and Examination Scheme:**

<table>
<tr><th colspan="3" rowspan="2">Teaching Scheme (Hours)</th><th rowspan="3">Credits</th><th colspan="3">Theory Marks</th><th colspan="2">Tutorial / Practical Marks</th><th rowspan="3">Total Marks</th></tr>
<tr><th>E</th><th colspan="2">I</th><th>V</th><th>T</th></tr>
<tr><th>Theory</th><th>Tutorial</th><th>Practical</th><th>ESE</th><th>IA</th><th>CSE</th><th>Viva</th><th>Term Work</th></tr>
<tr><td>04</td><td>00</td><td>02</td><td>05</td><td>50</td><td>30</td><td>20</td><td>25</td><td>25</td><td>150</td></tr>
</table>

**Contents:**

| Unit | Topics | Hours |
|---|---|---|
| 1 | **Mathematical Terminologies for Automata Theory**<br>Mathematical Induction, Set, Functions, Prepositions and Predicates, Proofs, relations, languages, Automata, Computability | 08 |
| 2 | **Automata Theory and Languages**<br>Regular Languages, Finite Automata, Non-Regular Languages, Regular Expressions | 08 |
| 3 | **Grammars**<br>Definition of Grammars, Different types of Grammars, Context-Free Grammars, Derivations using Grammars: Leftmost and Rightmost Derivations, The Languages of a Grammar, Parse Trees, Applications of Context-Free Grammars: Parsers, Ambiguity in Grammars and Languages | 08 |
| 4 | **Context free grammar with Push Down Automata**<br>Definition Formal Definition of Pushdown Automata, A Graphical Notation for PDA's, Instantaneous Descriptions of a PDA, Languages of PDA, Deterministic Pushdown Automata: Definition of a Deterministic PDA, Non determinism, Non- Context free languages | 08 |
| 5 | **Turing Machine**<br>Variants of Turing Machines, Definition and explanation of Church Turing Machine Algorithms | 07 |
| 6 | **Recursive languages and Computability**<br>Decidability, Halting Problem, Undecidable Problems and Mapping Reducibility, Turing Reducibility and Recursion Theorem | 07 |
| 7 | **Complexity theory and Intractability**<br>Time Complexity for NP and P class; Space Complexity: Savitch's Theorem, PSAPCE, L and NL completeness; Intractability theorems and Relativization techniques Advance topics: Probabilistic and Approximation Algorithms, Interactive Proof System, Parallel Computation, Cryptography | 10 |
| | **Total Hours** | 56 |

**Suggested Text books / Reference books:**

1. Introduction to the Theory of Computation By Michael Sipser
2. An introduction to automata theory and formal languages By Adesh K. Pandey, Publisher: S.K. Kataria& Sons

3. Introduction to computer theory By Deniel I. Cohen , Joh Wiley & Sons, Inc
4. Computation: Finite and Infinite By Marvin L. Minsky Prentice-Hall
5. Compiler Design By Alfred V Aho, Addison Weslley
6. Automata Theory, Languages, and Computation By John Hopcroft, Rajeev Motowani, and Jeffrey Ullman

**Suggested Theory distribution:**

The suggested theory distribution as per Bloom's taxonomy is as per follows. This distribution serves as guidelines for teachers and students to achieve effective teaching-learning process.

| Distribution of Theory for course delivery and evaluation | | | | | |
|---|---|---|---|---|---|
| Remember | Understand | Apply | Analyze | Evaluate | Create |
| 15% | 25% | 30% | 20% | 5% | 5% |

**Suggested List of Tutorials:**

Minimum 12 tutorials to be performed during the semester

## **Tutorial** 1

Design Deterministic Finite Automata (DFA) with that accept the following Languages

1. The language over $\Sigma = \{a\}$ of any odd number of a'*s*.
2. The language over $\Sigma = \{a,b\}$ of length exactly three.
3. The language over $\Sigma = \{a,b\}$ of length at least three.
4. The language over $\Sigma = \{a,b\}$ of length at most three.
5. The language over $\Sigma = \{a,b\}$ which starting with *a* and ending with *b*.
6. Let $L = \{w|na(w)mod4 = 3\}$ (where $na(w)$ represents number of $a^0s$ in string $w$) over $\Sigma = \{a,b\}$.
7. The language over $\Sigma = \{a,b\}$ of any even number of *a's* and any odd number of *b's*.
8. The language over $\Sigma = \{a,b\}$, where number of *a's* are even and number of b*'s* are divisible by 3.
9. The language over $\Sigma = \{0,1\}$ whose decimal equivalent is an odd integer.
10. The language over $\Sigma = \{0,1\}$ whose decimal equivalent is divisible by 3.

## **Tutorial** 2

**1.** Design Deterministic Finite Automata (DFA) with that accept the following set of strings over $\Sigma = \{a,b\}$

1. Containing at least one **a** or at least two **b's**.
2. Containing at least one **a** and at most one **b**.
3. Containing even number of **a'sand** no adjacent **a's**.
4. Containing alternating **a'sand** **b's**.
5. Containing even length strings where second symbol is **b**.
6. Containing **aba** as a substring.
7. Set of all strings other than **a** and **bb**.
8. Containing at least two **a's**.
9. Set of all strings such that no two **b's** are adjacent.

**2.** Design a DFA for the language $L = \{a^n b | n \geq 0\}$ over $\Sigma = \{a,b\}$. Hence, design

DFA for language

1. accepting $L^2$.
2. accepting $L^2 - L$.
3. let D = {w — w contains even number of a's and an odd number of b's and does not contain the substring ab}. Give a DFA with five states that recognizes D with $\Sigma = \{a,b\}$.

## Tutorial 3

1. Design DFA for the given NDFA $M1$ =
($\{q0,q1,q2\},\{a,b\},\delta,q0,\{q2\}$) Table 1: NDFA $M1$

| | a | B |
|---|---|---|
| $\rightarrow q0$ | $q0,q1$ | $q2$ |
| $q1$ | $q0$ | $q1$ |
| $q2$ | | $q0,q1$ |

2. Design DFA for the given NDFA $M2$ = ($\{q0,q1,q2,q3\},\{0,1\},\delta,q0,\{q3\}$) Table 2: NDFA $M21$

| | 0 | 1 |
|---|---|---|
| $\rightarrow q0$ | $q0,q1$ | $q0$ |
| $q1$ | $q2$ | $q1$ |
| $q2$ | $q3$ | $q3$ |
| $q3$ | | $q2$ |

3. Construct a Melay machine ($\Sigma = \{0,1\}$) which can output EVEN, ODD according as the total number of 1's encountered is even or odd.
4. Construct DFA accepting each of the following languages:

(a) $\{w \in \{a,b\}* :$ each $^{0}a^{0}$ in $w$ is immediately preceded by a $^{0}b^{0}\}$.

(b) $\{w \in \{a,b\}* : w$ has $abab$as a substring$\}$.

(c) $\{w \in \{a,b\}* : w$ has neither $aa$ nor $bb$ as a substring$\}$.

(d) $\{w \in \{a,b\}* : w$ has both $ab$ and $ba$as substrings$\}$.

5. Minimize the given FA, $M3 = (\{qi|i= 0,1,...,7\},\{a,b\},\delta,q0,\{q3\})$

## Tutorial 4

Write a C program to minimize the given DFA with optimal number of states. Table 3: FA $M3$

| | a | b |
|---|---|---|
| $\rightarrow q0$ | $q1$ | $q0$ |
| $q1$ | $q0$ | $q2$ |
| $q2$ | $q3$ | $q1$ |
| $q3$ | $q3$ | $q0$ |
| $q4$ | $q3$ | $q5$ |
| $q5$ | $q6$ | $q4$ |
| $q6$ | $q5$ | $q6$ |
| $q7$ | $q6$ | $q3$ |

## Tutorial 5

1.Consider the set of strings on {0,1} defined by the requirements below, Design RE for each of the given requirement.

(a)Every 00 is followed immediately by a 1. For example, the strings 101,0010,0010011001 are in the language, but 0001 and 00100 are not.

(b)all strings containing 00 but not 000.

(c) The leftmost symbol differs from the rightmost one.

(d) Every substring of four symbols has at most two 0's. For example, 001110 and 011001 are in language, but 10010 is not since one of its substrings, 0010 contains three zeros.

(e) All strings of length five or more in which the fourth symbol from the right end isdifferent from the leftmost symbol.

(f) All strings in which the leftmost two symbols and the rightmost two symbols areidentical.

2.Design Grammar, FA and Regular Expressions for the following over $\Sigma = \{a,b\}$:
(Those who have done it in Lab 2, can skip in the this)

(a)Set of all words starting and ending with $b$.

(b) Set of all words with no two consecutive $a$'s.

(c) Set of all words exactly two $b$'s.

(d) Set of all words having even number of $a$'s followed by odd number of $b$'s.

(e) Set of all words with at least one $a$ and at least one $b$.

## Tutorial 6

1. Find a Context Free Grammar (CFG) for the set of all regular expression on the alphabet$\{a,b\}$.
2. Find CFG for the following languages (with $n \geq 0, m \geq 0$ and $k \geq 0$)

(a)$L = \{a^n b^m c^k : n = m or m \leq k\}$

(b) $L = \{a^n b^m c^k : k = n + m\}$

(c)$L = \{a^n b^m c^k : k \geq 3\}$ (d) $L = \{a^n b^m c^k : k = |n - m|\}$ 3.Let $L = \{a^n b^n : n \geq 0\}$.

(a) Show that $L^2$ is Context free.

(b) Show that $L^k$is Context free for any given $k \geq 1$.

4.Consider the following grammar $S$
$\rightarrow$

$AB|aaB$ $A$

$\rightarrow a|Aa$

$B \rightarrow b$

Check whether grammar is ambiguous or not. If yes, then construct equivalent unambiguous grammar.

5.Based on your knowledge on C language, write formal definition for the following constructs:
(a) if-else statement
(b) for statement
(c) variable declaration (assume only int, char, float)

## Tutorial 7

1.Find minimum length string generated by the grammar.

$S \to aB\ B$

$\to b\ B$

$\to bS$

$B \to aBB\ S \to bA$
$A \to$

$a\ A \to aS$

$A \to bAA$

2. Design PDA for the following language. $\{a^l b^m c^n | 2l = m + n\}$
3. Design NPDA for accepting the language L = $\{a^n b^n c^m | m,n >= 1\}$
4. Design DPDA $\{a^n b^n : n \geq 1\} U \{a\}$
5. Design DPDA $\{WcW^R : W \in \{a,b\}*\}$
6. Construct a PDA with two states , one initial and one final state.$\{a^m b^n c^{2(m+n)} : m, n \epsilon N\}$
7. Write an algorithm to construct a CFG from a given regular expression. Note that theCFG need not be a Regular Grammar. Prove the correctness of the algorithm.
8. Find CFGs that generate the following languages

(a)$\{a^{n+1} b^2 a b^n : n \in N\}$

(b)$\{$uawb : $u,w \in \{a,b\}*, L(u) = L(w)\}$

(c) $\{a^m b^n : 1 \leq m \leq n\}$

(d) $\{a^m b^n c^k : k = |m - n|; m,n,k \in N\}$

## Tutorial 8

Write a program to accept a Grammar from user, output the Language accepted by that grammar. Here are few assumptions that you can have

1. Upper case characters are Variables of Grammar.
2. Lower case characters are Terminals of Grammar.
3. You can use : as separator instead of in the production rule.
4. Each rule is written on new line. You may also use — as separator between multiple rules ifleft part is same.

### Tutorial 9

Use this Turing machine simulation environment http://morphett.info/turing/turing.html Syntax Info Understand it and you can code also. There are some inbuilt examples to work out.

### Tutorial 10

Study the Grammar of C Language. Design simple grammar for take performing basic arithmetic operations.

### Tutorial 11

Write a C program to find the starting and ending of comments in C file (given by user) for single line and multiline comments.

### Tutorial 12

Write a C program to find the starting and ending of loop statements (nested too) in input C file.

**Supplementary Resources:**

1. https://nptel.ac.in/courses/106104028/

# Subject Code: 01GS0601

# Subject Name: Cognitive Aptitude 2

# B. Tech. Year – III (Semester VI)

**Objective:**
This course shall enrich students' preparedness for the upcoming competitive exams, entrance test, and/or placements. This course will also enhance students' logical and verbal reasoning skills, decision making skill, and comprehension skill.

**Credits Earned:** 00 Credit

**Course Outcomes:** After completion of this course, student will be able to:
1. Inculcate smart approach in logical problem solving
2. Comprehend text of varying difficulty levels and types
3. Analyze logical and verbal problems to arrive at a solution/conclusion.
4. Use logical deductions to make effective decisions
5. Apply the concepts in both competitive exams and placement drives

**Pre-requisite of course:**
Basic Knowledge of English Language

**Teaching and Examination Scheme:**

| Teaching Scheme (Hours) | | | Credits | Theory Marks | | | Tutorial / Practical Marks | | Total Marks |
|---|---|---|---|---|---|---|---|---|---|
| | | | | E | I | | V | T | |
| Theory | Tutorial | Practical | | ESE | IA | CSE | Viva | Term Work | |
| 02 | 00 | 00 | 00 | 00 | 00 | 00 | 00 | 00 | 00 |

**Contents:**

| Unit | Topics (Logical Reasoning) | Hours |
|---|---|---|
| 1 | **Blood Relation**<br>Word-problem simple and complex type, Coded blood relation | 01 |
| 2 | **Direction Sense**<br>Identifying Distance / Direction, Degree related questions, Coded distance/ direction | 01 |

| | | |
|---|---|---|
| 3 | **Coding-Decoding**<br>Word coding, Numeric coding, Symbolic coding, Sentence coding | 01 |
| 4 | Class Test 1 and doubt solving session | 01 |
| 5 | **Analytic Reasoning**<br>Ranking, Seating-Arrangement, Combination | 03 |
| 6 | Class Test 2 and doubt solving session | 01 |
| 7 | **Series**<br>Number Series, Letter series | 02 |
| 8 | **Cubes & Dices** | 01 |
| 9 | **Clock**<br>Calculation of angle between minute hand and hour hand, Calculation of minute between a given time when a particular angle is formed Gaining & Losing examples, Mirror time | 01 |
| 10 | **Calendar**<br>Calculation of day of week on a given date, Calculate day of week based on another date given | 01 |
| 11 | Class Test 3 and doubt solving session | 01 |
| | **Total Hours** | 14 |

**Suggested Text books / Reference books:**

1. Analytic Reasoning – By M K Pandey, BSC Publishing Co. Pvt. Ltd.
2. A Modern Approach to Logical Reasoning – By Agarwala Vikas and R.S. Aggarwal.

| Unit | Topics (Logical Reasoning) | Hours |
|---|---|---|
| 1 | **Statement and its variants**<br>Statement and Conclusion, Statement and Argument, Statement and Assumption, Statement and Course of Action | 03 |
| 2 | **Odd one Out**<br>People, Groups, Object, Phobias, Place, Others | 01 |
| 3 | **Logical Consistency**<br>Logical relationships between items in the data set objects in the data set are maintained | 02 |
| 4 | **Para Jumbles**<br>4/5 sentences are given in a random order and you have to un-jumble all of them, Opening sentence + 4/5 Sentences + Closing Sentence are given | 01 |
| 5 | **Syllogism** | 02 |

| | | |
|---|---|---|
| 6 | **Analogy**<br>Opposites or antonyms, Synonyms or words with identical or similar meetings, near synonyms /antonyms with variations by degree, Part to whole, Uses, Places, Users, Measurement, Product to Producer, Degree of intensity, Symbol/Representation, Object to Function, Professional to Skills. Others | 01 |
| 7 | **Reading Comprehension**<br>Focused reading. Strategies to improve Reading Comprehension, Different question types, Paraphrasing and Summarizing | 03 |
| 8 | **Diagnostic Test** | 01 |
| | **Total Hours** | 14 |

**Suggested Text books / Reference books:**

1. How To Prepare For The Verbal Ability & Reading Comprehension For The CAT by Arun Sharma and Meenakshi Upadhyay
2. A Modern Approach to Verbal & Non-Verbal Reasoning - R.S. Aggarwal
3. www.wordpandit.com – A Comprehensive Website for Campus and Competitive exams
4. http://iim-cat-questions-answers.2iim.com/- 2IIM's Guide to Preparing for the CAT | Free CAT Level Questions
5. Analytic Reasoning – By M K Pandey, BSC Publishing Co. Pvt. Ltd.
6. A Modern Approach to Logical Reasoning – By Agarwala Vikas and R.S. Aggarwal.

**Suggested Theory distribution:**

The suggested theory distribution as per Bloom's taxonomy is as per follows. This distribution serves as guidelines for teachers and students to achieve effective teaching- learning process.

| Distribution of Theory for course delivery and evaluation | | | | | |
|---|---|---|---|---|---|
| Remember | Understand | Apply | Analyze | Evaluate | Create |
| 25% | 25% | 25% | 25% | 0% | 0% |

**Supplementary Resources:**

1. www.englishteststore.net
2. https://online.2iim.com/cat-exam/blogs/bharaths-curated-reading-list-for-cat-exam/
3. https://www.vocabulary.com/
4. www.indiabix.com
5. www.careerbless.com
6. www.sawaal.com
7. www.allindiaexams.com
8. www.freshersworld.com

## Subject Code: 01CT0626

## Subject Name: Game Programming and Virtual Reality

## B. Tech. Year – III (Semester VI)

**Objectives:** The main objectives of the course are to Introduce 3D Immersive Environments and content creation specifically for 3D Game development and the game creation pipeline, from design, implementation and testing. The course focuses on Virtual Reality, hardware and software. It aims to gain an understanding of how game players move in virtual environments and how to create a narrative immersive experience in VR. The course enables students to create their own immersive games using various head mounted displays.

**Credits Earned:** 05 Credits

**Course Outcomes:** After completion of this course, student will be able to:

1. Have an appreciation for 3D digital games in both desktop and immersive context.
2. Understand the basic principles and requirements of virtual reality.
3. Be able to create 3D Game content including character generation and control.
4. Write software for using game controllers and tracking for motion control.
5. Describe historical developments of VR games and understand their social impact and their benefits in a variety of situations, such as education and serious games.
6. Create narrative experiences and application specifically for VR.

**Teaching and Examination Scheme:**

| Teaching Scheme (Hours) | | | Credits | Theory Marks | | | Tutorial / Practical Marks | | Total Marks |
|---|---|---|---|---|---|---|---|---|---|
| | | | | E | I | | V | T | |
| Theory | Tutorial | Practical | | ESE | IA | CSE | Viva | Term Work | |
| 4 | 0 | 2 | 05 | 50 | 30 | 20 | 25 | 25 | 150 |

**Contents:**

| Unit | Topics | Contact Hours |
|---|---|---|
| 1 | **Introduction to visual scripting using unity**<br>Unity Hub, Unity Editor Basic Windows, Unity Editor Windows, Editor Layout-Render Pipelines- Package Manager- 2D and 3D, Visual Scripting, Post Processing, Ambient Occlusion URP, Text, Text MeshPro -Prefabs, Unity Package- Grids, Render Texture, Introduction to Visual Scripting windows, Arrange Panels of Script Graph windows, Pan Zoom and return to the script graph windows. Preparing the Script Scene, Creating Script Machine, Creating Graphs, Setting up Script Graph Window- Program a Visual Script, Start and Update, Display Fuzzy Finder- | 08 |

| | | |
|---|---|---|
| | Examining Unit, using Graph Inspector, Configuring a Unit - Changing Inline Values in a graph | |
| 2 | **Programming using visual scripting in unity**<br>Configuring Variables, Creating variables in black board, Object Types- Graph variables, Object Variables- One Graph and two variable objects. Programming Fundamentals in visual scripting, Add a New Graph, Get the rotation rate- Adding Time Unit- Adding Multiply Unit, Applying calculated value, Branch the flow- Change position with vector3- Switch | 08 |
| 3 | **Basic unity programming in gaming perspective**<br>Physics behind gaming, Player Movement -Player Speed, player jumping -is groundedsuper units- visual scripting groups, animations, Cinemachine- platform visuals- Spikes, Visual scripting events, UI, Player falls to death, Coins, Level win, multiple level, post processing, Shared graph | 09 |
| 4 | **Introduction to VR systems**<br>Augmented-Virtual and Mixed Reality, Taxonomy, technology and features of augmented reality, difference between AR ,VR and MR, Challenges with AR, AR systems and functionality, Augmented reality methods, visualization techniques for augmented reality, VR as a discipline, Basic features of VR systems, Architecture of VR systems, VR hardware : VR input hardware: tracking systems, motion capture systems, data gloves, VR output hardware: visual displays. | 06 |
| 5 | **Stereoscopic Vision & Haptic rendering**<br>Fundamentals of the human visual system, Depth cues, Stereopsis, Retinal disparity, Haptic sense, Haptic devices, Algorithms for haptic rendering and parallax, Synthesis of stereo pairs, Pipeline for stereo images | 08 |
| 6 | **VR software development**<br>Challenges in VR software development, Master/slave and Client/server architectures, Cluster rendering, Game Engines and available sdk to develop VR applications for different hardware (HTC VIVE, Oculus, Google VR) | 07 |
| 7 | **Application of VR in Digital Entertainment**<br>VR Technology in Film & TV Production. VR Technology in Physical Exercises and Games. Demonstration of Digital Entertainment by VR | 06 |
| | **Total Hours** | 52 |

**Suggested List of Experiments:**

1. Installation of Unity and Visual Studio,
2. Installation of VR development environment
3. Demonstration of the working of HTC Vive, Google Cardboard, Google Daydream and Samsung gear VR.
4. Develop a scene in Unity that includes objects like a cube, plane and sphere, apply transformations on the 3 game objects.
5. Add video and audio source to a designed scene

6. Change the colour, material and texture of each Game object separately in the scene.
7. Write a C# program in visual studio to change the colour and material/texture of the game objects dynamically on button click.
8. Develop a scene in Unity that includes a sphere and plane . Apply Rigid body component, material and Box collider to the game Objects.
9. Write a C# program to grab and throw the sphere using vr controller.
10. Develop a simple UI(User interface ) menu with images, canvas, sprites and button.
11. Write a C# program to interact with UI menu through VR trigger button such that on each successful trigger interaction display a score on scene
12. Create an immersive environment (living room/ battlefield/ tennis court) with only static game objects. 3D game objects can be created using Blender or use available 3D models.
13. Include animation and interaction in the immersive environment

**Suggested Text books / Reference books:**

1. George Mather, Foundations of Sensation and Perception:Psychology Press; 2 edition, 2009.
2. The VR Book: Human-Centered Design for Virtual Reality, by Jason Jerald
3. Learning Virtual Reality  by Tony Parisi, O' Reilly
4. Burdea, G. C. and P. Coffet. Virtual Reality Technology, Second Edition.Wiley-IEEE Press, 2003/2006.
5. Alan B. Craig, Understanding Augmented Reality, Concepts and Applications, Morgan Kaufmann, 2013.

**Suggested Theory distribution:**

The suggested theory distribution as per Bloom's taxonomy is as per follows. This distribution serves as guidelines for teachers and students to achieve effective teaching-learning process.

| Distribution of Theory for course delivery and evaluation | | | | | |
|---|---|---|---|---|---|
| Remember | Understand | Apply | Analyze | Evaluate | Create |
| 15% | 20% | 30% | 20% | 10% | 5% |

**Instructional Method:**

1. The course delivery method will depend upon the requirement of content and need of students. The teacher in addition to conventional teaching method by black board, may also use any of tools such as demonstration, role play, Quiz, brainstorming, MOOCs etc.
2. The internal evaluation will be done on the basis of continuous evaluation of students in the laboratory and class-room.
3. Practical examination will be conducted at the end of semester for evaluation of performance of students in laboratory.
4. Students will use supplementary resources such as online videos, NPTEL videos, e-courses, Virtual Laboratory.

**List of simulation software / IDEs:**

1. Unity
2. PyCharm
3. Google Colab
4. Jupyter Notebook

# Subject Code: 01CTXXXX

# Subject Name: Advanced Web Technology

## B. Tech. Year – III (Semester VI)

**Objective:**
The objective of the course is to understand modern web technologies based on JavaScript.

**Credits Earned:** 05 Credits

**Course Outcomes:** On the completion of the course, students will be able to:

1. Implement NoSQL Database CRUD operations
2. Acquire knowledge about Server-side JS framework to make Database Connectivity
3. Acquire knowledge about functionalities of Client-side and Server-side JS frameworks
4. Explore ReactJS features and create component-based web pages
5. Develop Front-end web pages and connect to the Back-end Databases

**Pre-requisite of course:**

- Student should have a basic understanding of fundamental languages used by the browser and the server.
- Student should be confident in designing and styling web pages using HTML & CSS.
- Fundamental concepts of JavaScript should be clear and should also be familiar with DOM(Document Object Model) in browser.
- Basic understanding of Node/express will speed up the learning process but is not recommended.

**Teaching and Examination Scheme:**

| Teaching Scheme (Hours) | | | Credits | Theory Marks | | | Tutorial / Practical Marks | | Total Marks |
|---|---|---|---|---|---|---|---|---|---|
| | | | | E | I | | V | T | |
| Theory | Tutorial | Practical | | ESE | IA | CSE | Viva | Term Work | |
| 04 | 00 | 02 | 05 | 50 | 30 | 20 | 25 | 25 | 150 |

**Contents:**

| Unit | Topics | Hours |
|---|---|---|
| 1 | **Client-side JS Framework – ReactJS**<br>Introduction to ReactJS, Introducing JSX, Rendering Elements, Component and Props, State and Life Cycle, Handling Events, Conditional Rendering, List and Keys, Forms, Lifting State Up, Composition vs Inheritance, Thinking in React, Manual and Unit Testing. | 14 |
| 2 | **Server-side JS Framework – Node JS**<br>Get started with Node.js, Node Package Manager, Modules Asynchronous Program, Callbacks, Events and Event Loop, Streams and Buffers, Connect Node.js to Database, Web Sockets, API using NodeJS | 7 |
| 3 | **Express JS**<br>MVC Pattern, Introduction to Express, Routing, HTTP Interaction, Handle Form Data, Handle Query Parameters, Cookies and Sessions, User Authentication, Error Handle, Create and Consume RESTful Services, Use Templates, Functional and Unit Testing | 14 |
| 4 | **MongoDB**<br>Introduction to MongoDB, CRUD Operations in Mongodb, Introduction to Mongoose, Core concepts of Mongoose, Extending Models - Working with hooks, Validation of model data, Creating custom static methods, Creating custom instance methods, CRUD operations with Mongoose | 7 |
| 5 | **Cloud & Deployment**<br>Basics of Devops and Cloud Infrastructure, In-depth of DNS and network terminologies, Introduction to AWS, AWS-ECS, EC2, Docker, Kubernetes, Git Basics, Git with CI/CD, Hosting website on various platforms like Heroku, etc. | 10 |
| | **Total Hours** | **52** |

**Suggested Text books / Reference books:**

1. Krasimir Tsonev, "Node.js by Example"
2. Title: MongoDB Cookbook Author(s): Amol Nayak
3. Title: Fullstack React: The Complete Guide to ReactJS and Friends Author(s): Anthony Accomazzo
4. https://reactjs.org/docs/getting-started.html
5. https://nodejs.dev/en/learn/

**Suggested Theory distribution:**

The suggested theory distribution as per Bloom's taxonomy is as per follows. This distribution serves as guidelines for teachers and students to achieve effective teaching- learning process.

| Distribution of Theory for course delivery and evaluation | | | | | |
|---|---|---|---|---|---|
| Remember | Understand | Apply | Analyze | Evaluate | Create |
| 15% | 30% | 20% | 15% | 10% | 10% |

**Suggested List of Experiments:**

1. Create an application for student result management using React JS.
2. Develop a web application which involves database operations using NodeJS
3. Improve any React (+NodeJS) application by adding Error Handling.
4. Develop a web application which involves database operations using Express
5. Create modern, scalable and high-speed Web Applications with React and Node.js +Express
6. Create a RESTful service with Node, Express and MongoDB
7. Frontend: Using ReactJS, make Image Carousel, FAQ/Accordion and Shopping item list with filters.
8. Frontend: Using ReactJS, integrate video player like a youtube clone.
9. Frontend: Using ReactJS, make a e-commerce website (flipkart or amazon) clone
10. Backend: Using NodeJS, build a real time chat application or email sender.
11. Backend: Using NodeJS, build a job search platform or e-commerce platform api to search and filter.
12. Database: Using MongoDB, build the CRUD operations with NodeJS
13. Database: using MongoDB, NodeJS and ReactJS, build a project to fetch and post data from frontend to database.
14. Deployment: Using AWS, deploy the project in EC2 instances or use Lambda functionalities to build APIs.

**Additional Frameworks:**

1. Frontend: **Next JS** (ReactJS based framework), **Angular 12/13** (requires Typescript knowledge)
2. Backend: **Nest JS**
3. Database: **MySQL, PostgreSQL**
4. Cloud: **Google Cloud Services**

# Subject Code: 01CT0622

## Subject Name: Big Data Analytics

## B. Tech. Year – III (Semester VI)

**Objective:**
Big data is an extremely useful area in the era of computing techniques as it aids in finding useful pattern from large datasets. Large datasets are so huge that they cannot be processed with traditional technologies. We require special computing system which can handle large data and tandem it with other important aspects like parallel processing, data failure and data pre-processing.

**Credits Earned:** 04 Credits

**Course Outcomes:** After completion of this course, student will be able to:
1. Gain Understanding about Big Data Technology and its Tools.
2. Understand and apply extracting useful pattern from large datasets.
3. Implementation of Big data mining techniques using different software.
4. Understand how data analytics and data science maps to current industry.
5. Understanding and implementing Algorithms in an optimized way using various Big Data Tools.

**Pre-requisite of course:**
Basic Programming Knowledge, Data Mining

**Teaching and Examination Scheme:**

| Teaching Scheme (Hours) | | | Credits | Theory Marks | | | Tutorial / Practical Marks | | Total Marks |
|---|---|---|---|---|---|---|---|---|---|
| | | | | E | I | | V | T | |
| Theory | Tutorial | Practical | | ESE | IA | CSE | Viva | Term Work | |
| 04 | 00 | 02 | 05 | 50 | 30 | 20 | 25 | 25 | 150 |

**Contents:**

| Unit | Topics | Hours |
|---|---|---|
| 1 | **Introduction to Big Data**<br>Introduction-Distributed file System, What is Big Data? Difference between traditional Distributed file system and Big Data Software, Big Data Analytics, Big data Applications | 05 |
| 2 | **Introduction to Hadoop**<br>How Hadoop works? Hadoop Architecture, Explanation of Hadoop EcoSystem, Hadoop Basic commands. | 06 |
| 3 | **Hadoop Input and Output**<br>Data Integrity in Hadoop, Data Compression and Data Serialization in Hadoop, Avro, How Avro works? | 06 |
| 4 | **Hadoop MapReduce**<br>Mapper, Reducer, MapReduce YARN, Sorting and<br>Shuffling in MapReduce, MapReduce Input Formats, MapReduce Output Formats, How to code in MapReduce program , analyze data using MapReduce | 09 |
| 5 | **Hadoop Ecosystem/Environment: Pig, Hive, Hbase, ZooKeeper**<br>Pig Latin Structures, Statements, Functions, User-Defined Function in Pig, Loading, Storing and Sorting Data in Pig, HiveQL, Tables in Hive, Querying Data, User-Defined Function in Hive, Introduction to HBase, HBASE vs RDBMS, What is ZooKeeper, Zoopkeeper Services, Build Application with ZooKeeper | 10 |
| 6 | **Apache Spark**<br>Introduction to Apache Spark, pySpark, Working with Key-value pair, Loading and saving data in spark, Learning about Machine Learning Library in Spark. | 08 |
| 7 | **NoSql**<br>Introduction to NoSql, NoSql vs SQL, Introduction to MongoDB, MongoDB Create-Drop Databases, Create-Drop Collection, CRUD operation in documents, MongoDB indexing, Aggregation, replication, Connect Java Application with MongoDB. | 07 |
| | **Total Hours** | 51 |

**Suggested Text books / Reference books:**

1. Tom White, “HADOOP: The definitive Guide”, O Reilly 2012.
2. BIG Data and Analytics , Sima Acharya, Subhashini Chhellappan, Willey
3. MongoDB in Action, Kyle Banker,Piter Bakkum , Shaun Verch, Dream tech Press
4. Learning Spark: Lightning-Fast Big Data Analysis Paperback by Holden Karau

**Suggested Theory distribution:**

The suggested theory distribution as per Bloom's taxonomy is as per follows. This distribution serves as guidelines for teachers and students to achieve effective teaching-learning process.

| Distribution of Theory for course delivery and evaluation | | | | | |
|---|---|---|---|---|---|
| Remember | Understand | Apply | Analyze | Evaluate | Create |
| 10% | 20% | 25% | 25% | 10% | 10% |

**Suggested List of Experiments:**

1. Installation and use of Hadoop in ubuntu.
2. Run HDFS commands in hadoop environment.
3. Implementation of a MapReduce Algorithm.
4. Hive Installation.
5. Run Hive related commands on given data.
6. UDF creation in Hive to truncate blank space.
7. Install HBASE and Apply various table queries.
8. Install MongoDB and execute basic commands in MongoDB Shell.
9. Connect MongoDB with java.
10. Install Scala and program in interactive mode and script mode.
11. Run a job on Apache spark.
12. Create and run SQL and NOSQL queries

**Supplementary Resources:**

1. http://in.reuters.com/tools/rss
2. http://www.altova.com/xmlspy.html
3. https://www.w3.org/RDF/

## Subject Code: 01CT0621

## Subject Name: Computer Vision

## B. Tech. Year – III (Semester VI)

**Objective:**
Computer vision focuses on the development of algorithms and techniques to analyze and interpret the visible world around us. This requires an understanding of the fundamental concepts related to multi-dimensional signal processing, feature extraction, stochastic optimization, etc. Knowledge of these concepts is necessary for research and further developments in the field of computer vision. Applications range from Biometrics, Medical diagnosis, document processing, mining of visual content, surveillance, advanced rendering, etc.

**Credits Earned:** 05 Credits

**Course Outcomes:** After completion of this course, student will be able to:

1. Understand the foundations of image formation and the working of vision algorithms.
2. Implement low, mid, and high-level vision algorithms.
3. Apply computer vision techniques on images and videos to get the desired output.
4. Analyze the strengths and weaknesses of different vision methods and techniques for vision problems.
5. Develop an application using computer vision concepts.

**Pre-requisite of course:**
Linear Algebra, Vector Calculus, Data Structure, and Programming

**Teaching and Examination Scheme:**

| Teaching Scheme (Hours) | | | Credits | Theory Marks | | | Tutorial / Practical Marks | | Total Marks |
|---|---|---|---|---|---|---|---|---|---|
| | | | | E | I | | V | T | |
| Theory | Tutorial | Practical | | ESE | IA | CSE | Viva | Term Work | |
| 04 | 00 | 02 | 05 | 50 | 30 | 20 | 25 | 25 | 150 |

**Contents:**

| Unit | Topics | Hours |
|---|---|---|
| 1 | **Image Formation**<br>Orthographic and Perspective Projection, Camera model, Camera calibration, Intrinsic and Extrinsic Parameters, Perspective, Binocular Stereopsis: Camera and Epipolar Geometry; Homography, Rectification, DLT, RANSAC, Stereo Vision | 08 |
| 2 | **Basic Image Processing**<br>Image Enhancement, Image Filtering, Convolution, Histogram Processing, Fourier Transform, Image Morphology | 08 |
| 3 | **Shape from X**<br>Light at Surfaces, Phong Model, Reflectance, Properties of shape, Shape from Shading, Texture, color, motion and edges | 07 |
| 4 | **Feature detection and matching**<br>Edge detection, Line detection, interest points, and corners detection, shape analysis, SIFT, SURF, HOG | 05 |
| 5 | **Segmentation**<br>Active contours, Region growing, K-means and mixtures of Gaussians, Mean shift, Graph cuts, Fourier and wavelet descriptors, Important applications: Background subtraction, Forming Image regions | 08 |
| 6 | **Optimization techniques**<br>Optimization-based algorithms for solving vision problems, Markov random field and its applications to depth estimation/ image restoration/ image deconvolution, Compressed sensing for vision applications | 09 |
| 7 | **Applications of Computer Vision**<br>Object detection, Object recognition, Biometrics, In Vehicle Vision Systems | 07 |
| | **Total Hours** | 52 |

**Suggested Text books / Reference books:**

1. Szeliski Richard, "Computer Vision: Algorithms and Applications", 1st edition, Springer-Verlag London Limited, 2011
2. D. Forsyth and J. Ponce, "Computer Vision- A model approach", 2nd edition, Pearson Prentice Hall, 2012
3. Rafael C. Gonzalez and Richard E. Woods, "Digital Image Processing", 3rd edition, Prentice-Hall, 2008
4. E. R. Davies, " Computer and Machine Vision: Theory, Algorithms, Practicalities", 4th edition, Elsevier Inc. 2012
5. Learning OpenCV: Computer Vision with the OpenCV Library, Gary Bradski, O`Reilly Media, 2008.

**Suggested Theory distribution:**

The suggested theory distribution as per Bloom's taxonomy is as per follows. This distribution serves as guidelines for teachers and students to achieve effective teaching-learning process.

| Distribution of Theory for course delivery and evaluation | | | | | |
|---|---|---|---|---|---|
| Remember | Understand | Apply | Analyze | Evaluate | Create |
| 5% | 25% | 30% | 20% | 10% | 10% |

**Suggested List of Experiments:**

Minimum 12 experiments to be performed during the semester

1. Understanding camera calibration and parameters
2. Implement Image Pre-processing
3. Implement image filtering using linear filters
4. Perform shape from shading
5. Implement depth estimation from SFS
6. Generate disparity map
7. Implement edge detection using a canny edge detector
8. Implement corner detection using Harris-corner detector
9. Find lines from images using Hough transform
10. To detect local features using SIFT and SURF
11. To segment image using region growing
12. Implement Object recognition
13. Perform Image morphing
14. Perform Background subtraction
15. Implement target tracking
16. To perform face recognition
17. To construct a 3D model from a single image

**Supplementary Resources:**

1. https://nptel.ac.in/courses/106105216/
2. https://ocw.mit.edu/courses/electrical-engineering-and-computer-science/6-801-machine-vision-fall-2004/index.htm
3. https://www.udacity.com/course/introduction-to-computer-vision--ud810
4. https://www.coursera.org/learn/computer-vision-basics

# Subject Code: 01CT0627

# Subject Name: Cyber Security

# B. Tech. Year – III (Semester VI)

**Objective:**

This course develops the understanding of cyber security tools, crime, and security measures. Students can learn the foundations of Cyber security and threat landscape and develop skills to that will help them to plan, implement and monitor cyber mechanism to ensure the protection of information technology assets. Students are also able to understand the governance, regulatory, legal, economic, environmental, social, and ethical contexts of cyber security.

**Credits Earned:** 05 Credits

**Course Outcomes:** After completion of this course, student will be able to:

1. Understand the concept of Cyber security and issues and challenges associated with it.
2. Understand the cybercrimes, their nature, legal remedies and as to how report the crimes through available platforms and procedures.
3. Understand various privacy and security concerns on online social media and understand the reporting procedure of inappropriate content, underlying legal aspects and best practices for the use of social media platforms.
4. Apply the basic concepts related to E-Commerce and digital payments to create a secure environment for various digital payment modes and related cyber security aspects.
5. Will be able to implement basic tools and technologies to protect their devices.

**Pre-requisite of course:** None

**Teaching and Examination Scheme:**

| Teaching Scheme (Hours) | | | Credits | Theory Marks | | | Tutorial / Practical Marks | | Total Marks |
|---|---|---|---|---|---|---|---|---|---|
| | | | | E | I | | V | T | |
| Theory | Tutorial | Practical | | ESE | IA | CSE | Viva | Term Work | |
| 04 | 00 | 02 | 05 | 50 | 30 | 20 | 25 | 25 | 150 |

**Contents:**

| Unit | Topic | Hours |
|---|---|---|
| 1 | **Introduction to Cyber security**<br>Defining Cyberspace and Overview of Computer and Web technology, Architecture of cyberspace, Communication and web technology, Internet, World wide web, Advent of internet, Internet infrastructure for data transfer and governance, Internet society, Regulation of cyberspace, Concept of cyber security, Issues, and challenges of cyber security. | 07 |
| 2 | **Cyber-crime and Cyber law**<br>Classification of cyber-crimes, Common cyber-crimes- cyber-crime targeting computers and mobiles, cyber-crime against women and children, financial frauds, social engineering attacks, malware and ransomware attacks, zero day and zero click attacks, Cybercriminals modus-operandi , Reporting of cyber-crimes, Remedial and mitigation measures, Legal perspective of cyber-crime, IT Act 2000 and its amendments, Cyber-crime and offences, Organizations dealing with Cyber-crime and Cyber security in India, Case studies | 08 |
| 3 | **Social Media Overview and Security**<br>Introduction to Social networks. Types of social media, Social media platforms, Social media monitoring, Hashtag, Viral content, Social media marketing, Social media privacy, Challenges, opportunities and pitfalls in online social network, Security issues related to social media, Flagging and reporting of inappropriate content, Laws regarding posting of inappropriate content, Best practices for the use of Social media, Case studies. | 10 |
| 4 | **E - Commerce and Digital Payments**<br>Definition of E- Commerce, Main components of E-Commerce, Elements of E-Commerce security, E-Commerce threats, E-Commerce security best practices, Introduction to digital payments, Components of digital payment and stake holders, Modes of digital payments- Banking Cards, Unified Payment Interface (UPI), e-Wallets, Unstructured Supplementary Service Data (USSD), Aadhar enabled payments, Digital payments related common frauds and preventive measures. RBI guidelines on digital payments and customer protection in unauthorized banking transactions. Relevant provisions of Payment Settlement Act,2007. | 10 |
| 5 | **Digital Devices Security, Tools and Technologies for Cyber Security**<br>End Point device and Mobile phone security, Password policy, Security patch management, Data backup, Downloading and management of third-party software, Device security policy, Cyber Security best practices, Significance of host firewall and Ant-virus, Management of host firewall and Anti-virus, Wi-Fi security, Configuration of basic security policy and permissions. | 10 |

| | | |
|---|---|---|
| 6 | **Impact of Security and Security standards**<br>BSI Security standards like BS ISO/IEC 27002, BS ISO/IEC 27033-1, BS ISO/IEC 27033-2, BS ISO/IEC 27033-3, BS ISO/IEC 27033-4, BS ISO/IEC 27033-5, NIST SP 800-114, Hyperconverged Infrastructure and its impact on network security | 07 |
| | **Total Hours** | **52** |

**Suggested Text books / Reference books:**

1. Cyber Crime Impact in the New Millennium, by R. C Mishra , Auther Press. Edition 2010.
2. Cyber Security Understanding Cyber Crimes, Computer Forensics and Legal Perspectives by Sumit Belapure and Nina Godbole, Wiley India Pvt. Ltd. (First Edition, 2011)
3. Security in the Digital Age: Social Media Security Threats and Vulnerabilities by Henry A. Oliver, Create Space Independent Publishing Platform. (Pearson , 13th November, 2001)
4. Electronic Commerce by Elias M. Awad, Prentice Hall of India Pvt Ltd.
5. Cyber Laws: Intellectual Property & E-Commerce Security by Kumar K, Dominant Publishers.
6. Network Security Bible, Eric Cole, Ronald Krutz, James W. Conley, 2nd Edition, Wiley India Pvt. Ltd.
7. Fundamentals of Network Security by E. Maiwald, McGraw Hill

**Suggested Theory distribution:**

The suggested theory distribution as per Bloom's taxonomy is as per follows. This distribution serves as guidelines for teachers and students to achieve effective teaching- learning process.

| Distribution of Theory for course delivery and evaluation | | | | | |
|---|---|---|---|---|---|
| Remember | Understand | Apply | Analyze | Evaluate | Create |
| 10% | 30% | 20% | 20% | 10% | 10% |

**Suggested List of Experiments:**

Minimum 12 experiments to be performed during the semester

1. Checklist for reporting cyber crime at Cyber crime Police Station.
2. Checklist for reporting cyber crime online.
3. Reporting phishing emails.
4. Demonstration of email phishing attack and preventive measures.
5. Basic checklist, privacy and security settings for popular Social media platforms.
6. Reporting and redressal mechanism for violations and misuse of Social media platforms.
7. Configuring security settings in Mobile Wallets and UPIs.
8. Checklist for secure net banking.

9. Setting, configuring and managing three password policy in the computer (BIOS, Administrator and Standard User).
10. Setting and configuring two factor authentication in the Mobile phone.
11. Security patch management and updates in Computer and Mobiles.
12. Managing Application permissions in Mobile phone.
13. Installation and configuration of computer Anti-virus
14. Installation and configuration of Computer Host Firewall.
15. Wi-Fi security management in computer and mobile.

**Supplementary Resources:**

1. www.nptel.com
2. https://onlinecourses.swayam2.ac.in/nou19_cs08/preview
3. https://www.coursera.org/

# Subject Code: 01CT0605

## Subject Name: RF and Microwave Communication

## B. Tech. Year – III (Semester VI)

**Objective:**

This course is designed to understand and analyses various components used in RF and Microwave communications like transmission lines, waveguides, microwave components etc. It also focuses on various methods and tools used to analyses various circuit designs. Subject is extended to the design of strip lines and micro strip lines, MIC, MMIC

**Credits Earned:** 05 Credits

**Course Outcomes:** After completion of this course, student will be able to:

1. Understand applications, concepts and design aspects of transmission lines and waveguides
2. Apply scattering and other parameters in microwave circuit analysis and design
3. Measure various parameters using smith chart
4. Understand design and analyse various microwave components, tubes and circuits
5. Design of microwave strip and integrated Circuits

**Pre-requisite of course:**

Basic understanding of electrodynamics

**Teaching and Examination Scheme:**

| Teaching Scheme (Hours) | | | Credits | Theory Marks | | | Tutorial / Practical Marks | | Total Marks |
|---|---|---|---|---|---|---|---|---|---|
| | | | | E | I | | V | T | |
| Theory | Tutorial | Practical | | ESE | IA | CSE | Viva | Term Work | |
| 04 | 00 | 02 | 05 | 50 | 30 | 20 | 25 | 25 | 150 |

**Contents:**

| Unit | Topics | Hours |
|---|---|---|

| | | |
|---|---|---|
| 1 | **Introduction**<br>Spectrum of RF and microwave frequencies, Frequency bands and regions of spectrum allocations, Decibel for power ratios, representation of Power-Voltages dBm, dBW, dBµV/m, Modeling lumped and distributed components at radio frequencies, Propagation of EM waves, Application of RF and microwaves | 08 |
| 2 | **Transmission lines and distributed systems**<br>Introduction to transmission lines and familiar examples, Lumped and distributed systems, Telegraph equations and the waves solution, Wave equation, Characteristic impedance and propagation velocity, Load effect on the reflected wave, Types of transmission lines (coaxial, conductor-pair, printed – microstrip, stripline), Standing-wave in a transmission-line, Reflection coefficient and voltage-standing-wave-ratio (VSWR), Efficiency of power-transfer, Short, open, and matched loads' impedance as viewed at the end of a variable-length transmission line, Reflection parameters, Transmission parameters, Wave representation of two-port and the s-parameters, Phase velocity and group velocity, Dispersion | 16 |
| 3 | **The Smith Chart and Impedance Matching**<br>Smith chart – impedance on the reflection plane, Review of transmission lines and normalized impedances, Display of smith chart – constant resistance and reactance circles, Presenting admittance in the smith chart, Technique for impudence matching, Fixed SWR circles, Finding the impedance seen into a loaded reactive circuit, Impedance matching – L, π, T, sections, transmission lines and stubs, Bandwidth of matching networks, Quarter wavelength transformer | 12 |
| 4 | **Microwave Components**<br>Wave-guide tees, Magic tee, Directional couples, Circulars and isolators, Corners, Bends, Twists, Flanges, Matched termination, Coupling probes, Loops | 08 |
| 5 | **Microwave Tubes and Circuits**<br>Limitations of conventional tubes at UHF & Microwave, Klystrons, Velocity modulation, Multi cavity klystron, Reflex klystron, Traveling wave tube, Magnetron. | 07 |
| 6 | **Micro Strip & Integrated Circuits**<br>Strip lines and micro strip lines, MIC, MMIC | 05 |
| | **Total Hours** | 56 |

**Suggested Text books / Reference books:**

1. Samuel Liao, Microwave Devices and Circuits, PHI
2. David Pozar, Microwave Engineering, Wiley
3. Dennis Roddy, Microwave Technology, PHI
4. Annapurna Das, Sisir K.Das, Microwave Engineering, TMG

5. Microstrip Circuit Analysis - David H. Schrader, Prentice Hall PTR, New Jersey
6. Devendra K. Misra, Radio-Frequency and Microwave Communication Circuits, John Wiley & Sons
7. Kai Chang, Inder Bahl, Vijay Nair, RF and Microwave Circuit and Component Design for Wireless Systems

**Suggested Theory distribution:**

The suggested theory distribution as per Bloom's taxonomy is as per follows. This distribution serves as guidelines for teachers and students to achieve effective teaching-learning process.

| Distribution of Theory for course delivery and evaluation | | | | | |
|---|---|---|---|---|---|
| Remember | Understand | Apply | Analyze | Evaluate | Create |
| 20% | 20% | 30% | 15% | 10% | 5% |

**Suggested List of Experiments:**

1. Introduction to HFSS Software.
2. To Understand 3D Modeling, Properties, Commands & Attributes for Antenna Design.
3. To Apply Wave Port Excitation, Radiation Setup & Analysis to antenna using HFSS.
4. To create, simulate, and analyze a UHF probe using the Ansoft HFSS Design Environment.
5. To create, simulate, and analyze a Monopole and Dipole Antenna using the Ansoft HFSS Design Environment.
6. To create, simulate, and analyze a waveguide horn Antennas using the Ansoft HFSS Design Environment.
7. To create, simulate, and analyze Horn Antenna using the Ansoft HFSS Design Environment.
8. To create, simulate, and analyze Helix Antenna using the Ansoft HFSS Design Environment.
9. To create, simulate, and analyze Array Antenna using the Ansoft HFSS Design Environment.
10. To create, simulate, and analyze Probe Feed Patch Antenna using the Ansoft HFSS Design Environment.
11. To create, simulate, and analyze Slot Coupled Patch Antenna using the Ansoft HFSS Design Environment.

12. To create, simulate, and analyze Corner Reflector using the Ansoft HFSS Design Environment.

**Supplementary Resources:**

1. http://www.ni.com/product-documentation/3992/en
2. https://www.keysight.com/main/editorial.jspx?cc=IN&lc=eng&ckey=2129625&id=2129625&cmpid=zzfindrfresource
3. https://www.udemy.com/rf-microwave-radio-transmission-theory-online-course-rahsoft-rahch200
4. https://rfandwireless.com/tutorials
5. https://www.qsl.net/va3iul/Files/RF_courses_lectures.htm
6. https://nptel.ac.in/courses/108101112

# Subject Code: 01CT0610

## Subject Name: Satellite Communication

## B. Tech. Year – III (Semester VI)

**Objective:**

The goal of the course is to introduce students to the fundamentals of satellite Communication. The course enables analysis and design of satellite links for various types of services and familiarity with terms and techniques related to performance evaluation and the availability of such links. It also uses to enable the students to become familiar with satellites and satellite services.

**Credits Earned:** 05 Credits

**Course Outcomes:** After completion of this course, student will be able to:

1. Understand principle, working and operation of various sub systems of satellite as well as the earth station.
2. Apply various communication techniques for satellite communication. 3. Analyze and design satellite communication link
4. Analyze the various methods of satellite access.
5. Interpret role of satellite in various applications.

**Pre-requisite of course:**

Electronics Communication, Digital Communication

**Teaching and Examination Scheme:**

| Teaching Scheme (Hours) | | | Credits | Theory Marks | | | Tutorial / Practical Marks | | Total Marks |
|---|---|---|---|---|---|---|---|---|---|
| | | | | E | I | | V | T | |
| Theory | Tutorial | Practical | | ESE | IA | CSE | Viva | Term Work | |
| 04 | 00 | 02 | 05 | 50 | 30 | 20 | 25 | 25 | 150 |

**Contents:**

| Unit | Topics | Hours |
|---|---|---|
| 1 | **Introduction to Satellite Communication**<br>Historical background, Basic concepts of Satellite Communications, Communication Networks and Services, Growth of Satellite communications. Satellite in Networks. | 05 |

| | | |
|---|---|---|
| 2 | **Satellite Orbits**<br>Kepler's Laws, Newton's law, orbital parameters, orbital perturbations, station keeping, geo stationary and non Geo-stationary orbits – Look Angle Determination- Limits of visibility –eclipse-Sub satellite point –Sun transit outage-Launching Procedures – launch vehicles and propulsion. | 10 |
| 3 | **Space Segment**<br>Introduction, The Power Supply, Attitude Control, Spinning satellite stabilization, Momentum wheel stabilization, Station Keeping, Thermal Control, TT&C Subsystem, Transponders: The wideband receiver, The input demultiplexer, The power amplifier, The Antenna Subsystem. | 06 |
| 4 | **Earth Segment**<br>Introduction – Receive – Only home TV systems – Outdoor unit – Indoor unit for analog (FM) TV – Master antenna TV system – Community antenna TV system – Transmit – Receive earth stations. | 06 |
| 5 | **The Space Link**<br>Introduction, Equivalent Isotropic Radiated Power, Transmission Losses: Free-space transmission, Feeder losses, Antenna misalignment losses, Fixed atmospheric and ionospheric losses, The Link-Power Budget Equation, System Noise, Carrier-to-Noise Ratio, The Uplink: Saturation flux density, Input backoff, Downlink, Output back-off, Satellite TWTA output, Combined Uplink and Downlink C/N Ratio. Inter-satellite Link. | 06 |
| 6 | **Satellite Access**<br>Introduction, Single Access, Preassigned FDMA, Demand-Assigned FDMA, Spade System, TDMA, Preassigned TDMA, Demand-assigned TDMA, Satellite-Switched TDMA, Code-Division Multiple Access. | 06 |
| 7 | **Satellite Applications**<br>INTELSAT Series, INSAT, VSAT, Mobile satellite services: GSM, GPS, INMARSAT, LEO, MEO, Satellite Navigational System. Direct Broadcast satellites (DBS)- Direct to home Broadcast (DTH), Digital audio broadcast (DAB)- World space services, Business TV(BTV), GRAMSAT, Specialized services – E –mail, Video conferencing. | 09 |
| 8 | **Advances in Satellite Communication**<br>Satellite based societal application for national development, Disaster management, Microwave remote sensors, Digital signal processing for microwave sensors, Optical and infrared remote sensing. | 08 |
| | **Total Hours** | 56 |

**Suggested Text books / Reference books:**

1. Satellite Communications, by Dennis Roddy(Fourth edition),McGraw Hill.
2. Satellite Communication, by Timothy Pratt, Charles Bostian, Jeremy Allnutt(Second Edition),
3. John Wiley & Sons

4. B. Elbert, Introduction to Satellite Communications, 2nd ed., Artech House, 1999.
5. Bruce R. Elbert,"The Satellite Communication Applications: Hand Book", Artech House Bostan, London.
6. Myron Kyton, Walfred Fried, Avionics Navigation systems, 2nd edition, John Willy & Sons, 1997.

**Suggested Theory distribution:**

The suggested theory distribution as per Bloom's taxonomy is as per follows. This distribution serves as guidelines for teachers and students to achieve effective teaching- learning process.

| Distribution of Theory for course delivery and evaluation | | | | | |
|---|---|---|---|---|---|
| Remember | Understand | Apply | Analyze | Evaluate | Create |
| 10% | 20% | 30% | 25% | 10% | 5% |

**Suggested List of Experiments:**

1. Understanding the basic concepts of satellite communication
2. To setup a communication link between uplink transmitter and downlink receiver using Satellite.
3. To setup an Active satellite communication link and demonstrate link fail operation
4. To communicate voice & Video signal through satellite link
5. Observe the effect of Different combinations of uplink and downlink frequencies on satellite link.
6. To transmit and receive three separate signals (Audio, Video ,Tone) simultaneously through satellite link
7. To study radiation pattern and beam width of patch antenna.
8. To transmit and receive function generator signals through satellite link.
9. To measure the signal parameters in an analog FM/FDM TV satellite link.
10. To transmit digital waveforms through a satellite communication link.
11. To Calculate Bit Error Rate in a satellite communication link.
12. To write a program to observe the variations in the antenna look angles for the earth station antennas.

**Supplementary Resources:**

1. https://nptel.ac.in/courses/117105131/
2. https://ocw.mit.edu/search/ocwsearch.htm?q=satellite%20communication 3. www.radio-electronics.com

**Marwadi University**
**Faculty of Technology**
**Department of Information and Communication Technology**

## Subject Code: 01CT1702

## Subject Name: Information Theory and Coding

## B. Tech. Year – IV (Semester VII)

**Objective:** The objective of the course is to define and apply basic concepts of information theory, learn principles and applications of information theory in communication systems, how information is measured in terms of probability and entropy, information coding techniques including error-correcting codes and various data compression methods.

**Credits Earned:** 05 Credits

**Course Outcomes:** After completion of this course, student will be able to:

1. Understand information channels and explain the working of various source and channel coding algorithms.
2. Calculate information measures for various discrete channels and coding schemes.
3. Design code words for given probability distributions using various source and channel coding algorithms.
4. Distinguish the relationship between information parameters and analyze statistics for various coding algorithms.
5. Implement coding algorithms, related matrices, polynomials, encoding, and decoding diagrams.

**Pre-requisite of course:** Linear Algebra, Probability Theory

**Examination Scheme:**

| TeachingScheme(Hours) | | | Credits | TheoryMarks | | | Tutorial/ PracticalMarks | | TotalMarks |
|---|---|---|---|---|---|---|---|---|---|
| | | | | E | I | | V | T | |
| Theory | Tutorial | Practical | | ESE | IA | CSE | Viva | TermWork | |
| 3 | 2 | 0 | 5 | 50 | 30 | 20 | 25 | 25 | 150 |

**Contents:**

| Unit | Topics | Content Hours |
|---|---|---|
| 1 | **Introduction to Information Theory:** Concept of the amount of information, Entropy, Mutual Information, Conditional, and Joint Entropy, Measures for Continuous Random Variable, Relative Entropy, Information Rate, Channel Capacity, Redundancy and Efficiency of channels, Discrete Channels: Binary Symmetric Channel, Binary Erasure Channel, Noiseless and Deterministic Channels, Cascaded Channels, Binary Asymmetric Channel, Shannon Theorem | 08 |
| 2 | **Source Coding:** Encoding techniques, Purpose of encoding, Instantaneous Codes, Kraft Inequality, Coding efficiency and Redundancy, Lossless compression algorithms: Shannon-Fano Elias coding, Huffman Coding, Run Length Coding, Arithmetic Coding, LZW Coding | 08 |
| 3 | **Chanel Coding-I:** Parity check coding, Linear block codes, Error detecting and correcting capabilities, Generator and Parity check matrices, Standard array and Syndrome decoding, Hamming codes Cyclic codes – Generator polynomial, Generator and Parity check matrices, Encoding of cyclic codes, Syndrome computation, and error detection, Decoding of cyclic codes, BCH codes, RS codes, Burst error correction | 09 |
| 4 | **Chanel Coding-II:** Convolutional codes – Encoding and State, Tree and Trellis diagrams, Maximum likelihood decoding of convolutional codes -Viterbi algorithm, Sequential decoding - Stack algorithm. Interleaving techniques – Block and convolutional interleaving, Coding, and interleaving applied to CD digital audio system - CIRC encoding and decoding, interpolation, and muting. ARQ – Types of ARQ, Performance of ARQ, Probability of error and throughput | 10 |
| 5 | **Rate-Distortion Theory:** Rate distortion function, random source codes; joint source-channel coding and the separation theorem, Lossy compression techniques: JPEG for images, MPEG for video, LPC for speech | 07 |
| | **Total Hours** | **42** |

**Suggested Text books / Reference books:**

1. T. M. Cover, J. A. Thomas, "Elements of Information Theory", Second Edition, Wiley
2. R. Togneri, C. J. S. DeSilva, "Fundamentals of Information Theory and Coding Design", Taylor and Francis
3. R. Bose, "Information Theory Coding and Cryptography", Tata McGraw Hill
4. M. Borda, "Fundamentals of Information Theory and Coding", Springer
5. R. J. McEliece, "The Theory of Information and Coding", Cambridge University Press

**Suggested Theory distribution:**

The suggested theory distribution as per Bloom's taxonomy is as per follows. This distribution serves as guidelines for teachers and students to achieve effective teaching-learning process.

| Distribution of Theory for course delivery and evaluation | | | | | |
|---|---|---|---|---|---|
| Remember | Understand | Apply | Analyze | Evaluate | Create |
| 10% | 20% | 30% | 20% | 15% | 5% |

**Suggested List of Tutorials:**

**Minimum 19 tutorials to be performed during the semester**

**Tutorial 1:** To verify the entropy asymptomatic properties and solve the problem of entropy.
**Tutorial 2:** To checking the chain rules for joint entropy and conditional entropy
**Tutorial 3:** To construct of the model of the information channel and the determination of its channel capacity.
**Tutorial 4:** To design and verify instantaneous codes
**Tutorial 5:** To verify Kraft McMillan's equality with compact codes
**Tutorial 6:** To design the Huffman encoding system for digital communication systems
**Tutorial 7:** To design of arithmetic encoding as a data compression method
**Tutorial 8:** To design LZW encoding algorithm for data compression
**Tutorial 9:** To design linear block code and verifying its properties for digital communication system
**Tutorial 10:** To construct systematic a single-error correcting (n,k) linear block code and the corresponding decoding table
**Tutorial 11:** To design error correcting polynomial codes
**Tutorial 12:** To design Convolutional encoder (2,1,1) for digital communication system
**Tutorial 13:** To implement a convolution decoder using Viterbi algorithms and trellis diagrams.

**Tutorial 14:** Write a program to implement Arithmetic codes
**Tutorial 15:** Write a program to implement Run-length coding
**Tutorial 16:** Write a program for coding and decoding for Linear Block Codes.
**Tutorial 17:** Write a program for coding and decoding for Convolution codes.
**Tutorial 18:** Write a program for coding and decoding for the BCH code.
**Tutorial 19:** Write a program for coding and decoding for the RS code.

**Instructional Method:**

1. The course delivery method will depend upon the requirement of content and need of students. The teacher in addition to conventional teaching method by black board, may also use any of tools such as demonstration, role play, Quiz, brainstorming, MOOCs etc.
2. The internal evaluation will be done on the basis of continuous evaluation of students in the laboratory and class-room.
3. Practical examination will be conducted at the end of semester for evaluation of performance of students in laboratory.
4. Students will use supplementary resources such as online videos, NPTEL videos, e-courses, Virtual Laboratory

**Supplementary Resources:**

1. https://nptel.ac.in/courses/117/101/117101053/
2. https://www.coursera.org/learn/information-theory
3. https://ocw.mit.edu/courses/electrical-engineering-and-computer-science/6-441-information-theoryspring-2016/syllabus

# Subject Code: 01CT0704

# Subject Name: Management Information System

# B. Tech. Year – IV (Semester VII)

**Objective:**
The main goals of an MIS are to help executives of an organization make decisions that advance the organization's strategy and to implement the organizational structure and dynamics of the enterprise for the purpose of managing the organization in a better way for a competitive advantage.

**Credits Earned:** 03 Credits

**Course Outcomes:** After completion of this course, student will be able to:
1. Understand the role of management information systems in achieving competitive business advantage through informed decision making.
2. Analyze how information technology affects a firm in terms of value creation and brings strategic benefits to a firm.
3. Interpret how to use information technology to solve business problems.
4. Develop meaningful decision-making capacity for the purpose of acquisition, development, deployment and management of information systems.

**Pre-requisite of course:** NA

**Teaching and Examination Scheme:**

| Teaching Scheme (Hours) | | | Credits | Theory Marks | | | Tutorial / Practical Marks | | Total Marks |
|---|---|---|---|---|---|---|---|---|---|
| | | | | E | I | | V | T | |
| Theory | Tutorial | Practical | | ESE | IA | CSE | Viva | Term Work | |
| 03 | 00 | 00 | 03 | 50 | 30 | 20 | 00 | 00 | 100 |

**Contents:**

| Unit | Topics | Hours |
|---|---|---|
| 1 | **Organisations and Computing**<br>Introduction, Modern Organization-IT enabled- Networked-Dispersed-Knowledge Organization, Information Systems in Organisations- what are information systems?, Brief history of computing- ENIAC: Way to commercial computers- Advent of artificial intelligence- advent of personal computing-Free Software Movement- Advent of Internet, The | 06 |

| | | |
|---|---|---|
| | role of internet- Internet and Web: they are different-the internet changes everything. Strategic business use of IS: Interdependence between organization and IS, IS strategies for competitive advantage using Porter's Five Forces Model and Value Chain Model. | |
| 2 | **Managing Information Systems in Organisations**<br>Introduction, Managing in the Internet Age, Managing Information Systems in Organizations — IT Interaction Model, Challenges for Managers — Information to Build Information? -To spend them on information systems? -What capabilities should be built with information systems? -How should services be centralized? -What level of safety is required? What is the technology road map for the organization? | 05 |
| 3 | **Competing with IT**<br>Introduction, competitive environment of business - Partnership for mutual benefit -Bargaining power of suppliers - Bargaining power of buyers and options - Barriers to entry-risk of industry regulations, IT, using competition to compete at low cost. | 05 |
| 4 | **Decision Support Systems**<br>Introduction, Understanding DSS- MIS and DSS-Decision making-types of decisions, Analytics and Business Intelligence- BI techniques | 04 |
| 5 | **Managing Data Resources**<br>Introduction, The Need for Data Management- History of data use, Challenges of Data Management- data independence- reduced data redundancy- data consistency- data access- data administration- managing concurrency-managing security- recovery from crashes-application development, Database Concepts- fields, records and files- basic architecture, Data Warehouses- data mining uses | 06 |
| 6 | **Managing IT Function**<br>Introduction, challenges of managing IT function - modern IT environment - centralization vs. decentralization - IT security - technology selection, vendor management - vendor selection - vendor contracts and service levels – relationship management - vendor retention or termination | 04 |
| 7 | **Ethical issues**<br>Introduction, key issues - privacy - workplace monitoring - power over users, information security: First Line of defence - People / Staff, Second Line of defence - Technology, Prevention, Detection and Response to Authority Contemporary / emerging technologies: Cloud and Mobile Computing, E-commerce, m-commerce, Internet of things | 08 |
| 8 | **Practical**<br>Students should emulate an organization and its processes and develop a hypothetical information system. Students should study information systems adapted by various business institutions. | 04 |
| | **Total Hours** | 42 |

**Suggested Text books / Reference books:**

1. Essentials of Management Information Systems by Kenneth Laudon, Jane Laudon PHI
2. Management Information systems by W.S. Jawadekar TMH
3. Information Technology for Management: Transforming Organizations in Digital Economy by EfraimTurban, Dorothy Leidner, Ephraim McLean and James Wetherby, Wiley
4. Information Systems: Managing the Digital Firm Management by Kenneth Laudon, Jane Laudon, Pearson

**Suggested Theory distribution:**

The suggested theory distribution as per Bloom's taxonomy is as per follows. This distribution serves as guidelines for teachers and students to achieve effective teaching-learning process.

| Distribution of Theory for course delivery and evaluation | | | | | |
|---|---|---|---|---|---|
| Remember | Understand | Apply | Analyze | Evaluate | Create |
| 10% | 25% | 25% | 25% | 10% | 5% |

**Supplementary Resources:**

1. https://www.inc.com/encyclopedia/management-information-systems-mis.html
2. https://www.smartsheet.com/management-information-systems

# Subject Code: 01CT0715

## Subject Name: Capstone project

## B. Tech. Year – IV (Semester VII)

**Objective:**

The subject provides hands-on learning experience to the students with the opportunity to explore a problem or issue of personal or professional interest and to address that problem or issue through focused study and applied research under the direction of a faculty member or industrial guide. This course also provides a platform to implement learnt concepts in various subjects in case of project design and to provide in-depth exposure in the field of software, data analytics, embedded, VLSI, networking, and security in case of industrial training. It is also useful to enhance students' ability to think critically and creatively, to solve practical problems, to make reasoned and ethical decisions, and to communicate effectively.

**Credits Earned:** 03 Credits

**Course Outcomes:** After completion of this course, student will be able to:

1. Identify the existing problems
2. Apply the concepts and theories learnt in various courses
3. Apply the various methodologies to design project for specific application
4. Explore the new ideas and the possible areas to work ahead
5. Sharpen the skills by analyzing and evaluating the obtained outcomes

**Pre-requisite of course:**

Basic knowledge of all academic subjects and readiness to explore new things

**Teaching and Examination Scheme:**

<table>
<tr><th colspan="3" rowspan="2">Teaching Scheme (Hours)</th><th rowspan="3">Credits</th><th colspan="3">Theory Marks</th><th colspan="2">Tutorial / Practical Marks</th><th rowspan="3">Total Marks</th></tr>
<tr><th>E</th><th colspan="2">I</th><th>V</th><th>T</th></tr>
<tr><th>Theory</th><th>Tutorial</th><th>Practical</th><th>ESE</th><th>IA</th><th>CSE</th><th>Viva</th><th>Term Work</th></tr>
<tr><td>0</td><td>0</td><td>6</td><td>3</td><td>00</td><td>00</td><td>00</td><td>50</td><td>50</td><td>100</td></tr>
</table>

**Contents:**

| Unit | Topics |
|---|---|
| 1 | The Project work should include appropriate elements of engineering standards, design, analysis, modeling, simulation, experimentation, prototyping, software development, research etc. as per the requirement of the project definition |
| 2 | Exploration of various domains of the discipline and finalization of domain for project or Industrial Training |
| 3 | Identification of proposed project definition by student or students' group in coordination with faculty guide or industrial mentor to address issue related to economic, environmental, social, political, ethical, health & safety, manufacturability, sustainability, management, science etc. |
| 4 | Student's presentation on selected topic with outcomes of the project/Industrial Training and approval by project approval panel |
| 5 | Intermediate semester presentations include block diagram, flow chart, micro level block diagram, schematic, required hardware or software, features and application of project at regular interval |
| **Total Hours: 6 / week** | |

**Assessment of project work:**

| | | | |
|---|---|---|---|
| **In semester evaluation**<br>Evaluation by project evaluation committee from institute (50% marks) and project guide (50% marks) | **Assessment tool** | **Review – I 1st month of semester** | **Review – II Mid of semester** |
| | TW Marks Distribution | 25 Marks | 25 Marks |
| **End semester evaluation**<br>Evaluation by project evaluation committee from institute (50% marks) and project guide (50% marks) | **Assessment tool** | **Viva Exam** | |
| | Viva Marks Distribution | 50 Marks | |

**Suggested Theory distribution:**

The suggested distribution as per Bloom's taxonomy is as per follows. This distribution serves as guidelines for teachers and students to achieve theory effective teaching-learning processes.

| Distribution of Theory for course delivery and evaluation | | | | | |
|---|---|---|---|---|---|
| Remember | Understand | Apply | Analyze | Evaluate | Create |
| 5% | 5% | 15% | 15% | 20% | 40% |

## Subject Code: 01CT0716

## Subject Name: Mobile and Pervasive Computing

## B. Tech. Year – IV (Semester VII)

**Objective:**
The objectives of this course are

- To understand the pervasive computing and its applications
- To introduce the concepts of mobile communication systems and pervasive computing.
- To understand the concepts of emerging wireless technologies.
- To be aware of pervasive computing practices.

**Credits Earned:** 05 Credits

**Course Outcomes:** After completion of this course, student will be able to:

1. Understand the fundamental concepts of pervasive computing.
2. Analyze the cellular network architecture and protocols.
3. Analyze various wireless network systems.
4. Design and implement pervasive application systems.

**Pre-requisite of course:**
Analog and digital communication, signals & systems, probability and statistics, Algorithm and data structures, and Object oriented programming

**Teaching and Examination Scheme:**

| Teaching Scheme (Hours) | | | Credits | Theory Marks | | | Tutorial / Practical Marks | | Total Marks |
|---|---|---|---|---|---|---|---|---|---|
| | | | | E | I | | V | T | |
| Theory | Tutorial | Practical | | ESE | IA | CSE | Viva | Term Work | |
| 04 | 00 | 02 | 05 | 50 | 30 | 20 | 25 | 25 | 150 |

**Contents:**

| Unit | Topics | Hours |
|---|---|---|
| 1 | **Overview of Wireless Systems:** Infrastructure-based vs Ad-hoc, Wireless LANs, Cellular systems, Sensor networks, Bluetooth, WiFi, WiMAX, Zigbee, RFID | 10 |
| 2 | **Medium Access:** Link Adaptation, Routing Protocols | 5 |
| 3 | **Mobility and Handoff Management:** Link layer mobility mechanisms (location management protocols), Network layer mobility mechanisms (Macro and Micro mobility protocols), Handoff management protocols. | 6 |
| 4 | **Cellular Networks:** LTE and 5G overview, GSM network architecture, protocols, frequency allocation, Mobility management | 10 |
| 5 | **Pervasive Computing:** Principles, Characteristics, Pervasive devices, Smart sensors and actuators, Human-machine Interfaces, Biometrics | 8 |
| 6 | **Context Aware Sensor Networks:** Open protocols (SDP, Jini, SLP, UPnP), SyncML framework, Context aware mobile services, Context aware security. | 4 |
| 7 | Energy Efficiency, Energy harvesting, Localization (GPS/WiFi/GSM), Security | 4 |
| 8 | **Recent Advances in Wearable devices** | 5 |
| 9 | **Body Area Networks (BAN)** | 4 |
| | **Total Hours** | 56 |

**Suggested Text books / Reference books:**

1. I. STOJMENOVIC (2002), Handbook of Wireless Networks and Mobile and Pervasive Computing, Wiley.
2. S. LOKE (2006), Context-aware Pervasive Systems: Architectures for a New Breed of Applications, CRC Press.
3. A. OSSEIRAN, J.F. MONSERRAT, P. MARSCH, (Eds.), 5G Mobile and Wireless Communications Technology, Cambridge University Press, 2016
4. R. KAMAL (2008), Mobile and Pervasive Computing, Oxford University Press, 3rd Edition
5. L. MERK, M. NICLOUS (2006), Principles of Mobile and Pervasive Computing, Dreamtech Press, 2nd Edition.
6. G. AGGELOU (2004), Mobile Ad hoc Networks: From Wireless LANs to 4G Networks, McGraw-Hill Professional
7. J.J. DRAKE, Z. LANIER, C. MULLINER, P.O. FORA, S.A. RIDLEY, G. WICHERSKI (2014), Android Hacker's Handbook, John Wiley, 1st Edition
8. Ashok K.Talukder and Roopa R.Yuvagal, “Mobile Computing”, 2nd Edition, Tata McGraw Hill, 2010.
9. JochenBurkhardt, Horst Henn, Stefan Heper, Klaus Rindtorff and Thomas Schack,“Pervasive Computing Technology and Architecture of Mobile Internet Applications”Addison Wesley, 2002.

10. UweHansmann, L. Merk, M. Nicllous, T. Stober and U.Hansmann, “Pervasive Computing”, Springer Verlag, 2003.Johcehn H.Schiller, “Mobile Communications”, Addison-Wesley, 2003.

**Suggested Theory distribution:**

The suggested theory distribution as per Bloom’s taxonomy is as follows. This distribution serves as guidelines for teachers and students to achieve an effective teaching- learning process.

| Distribution of Theory for course delivery and evaluation | | | | | |
|---|---|---|---|---|---|
| Remember | Understand | Apply | Analyze | Evaluate | Create |
| 10% | 20% | 25% | 20% | 10% | 15% |

**Suggested List of Experiments:**

1. Introduction to Android Integrated Development Environment. Develop an application that displays “Hello World !!!” message.
2. Create a login Activity. It asks for “username” and “password” from the user. If the username and password are valid, it displays a Welcome message using new activity.
3. Develop a calculator android application.
4. Develop an application for multimedia processing.
5. Developing an application for data persistence.
6. Develop an application to establish http connection and toast notification.
7. Develop an application that auto sends received SMS.
8. Develop an application that identifies the Bluetooth devices in the wireless range.
9. Develop an application for text communication using Bluetooth.
10. Develop an application that prints the signal strength of Wi-Fi connection
11. Develop an application that marks the present location of the device on google map.
12. Develop an application that demonstrates use of any built-in sensor.

**Supplementary Resources:**

1. https://nptel.ac.in/courses/106106147/
2. https://www.coursera.org/videos/5g-training-qualcomm/hJkVd?query=mobile+computing&source=search&utm_campaign=programId%3ANNqDyxeeEeyRdxIhkRqYvw%3Bday%3A1632207600000%3Binvitation&utm_medium=email&utm_source=other
3. 3. https://www.coursera.org/learn/wireless-communications

## Subject Code: 01CT0717

## Subject Name: VLSI Physical Design

## B.Tech. Year – IV (SEM VII)

**Type of course: Elective**

**Course objective:**
The course will introduce the participants about basic design flow in VLSI physical design. This course will help students to understand the back-end design concepts.

**Course outcome:** After completion of this course, student will be able to

1. Know the basic design flow in VLSI physical design domain
2. Understand the static timing analysis
3. Understand floor planning and partitioning
4. Analyze the clock routing
5. Know concepts of DFT and BIST
6. Analyze low power design techniques

**Prerequisite:** Basic concepts in digital circuit design

**Teaching and Examination Scheme**

| Teaching Scheme (Hours) | | | Credits | Theory Marks | | | Tutorial / Practical Marks | | Total Marks |
|---|---|---|---|---|---|---|---|---|---|
| | | | | E | I | | V | T | |
| Theory | Tutorial | Practical | | ESE | IA | CSE | Viva | Term Work | |
| 3 | 0 | 2 | 4 | 50 | 30 | 20 | 25 | 25 | 150 |

**Content:**

| Unit | Topics | Contact Hours |
|---|---|---|
| 1 | **Introduction**<br>VLSI design styles, VLSI Physical Design flow | 2 |
| 2 | **Floor Planning and placement**<br>Partitioning, floor planning and its algorithms, pin assignments, placement, classification of placement algorithms | 4 |

| | | |
|---|---|---|
| 3 | **Routing**<br>Grid routing, global routing, detail routing | 4 |
| 4 | **Clock design**<br>Clock design issues, Clock distribution, clock skew and jitter, Clock network synthesis, set-up time and hold time, strategies to reduce clock skew, power and ground routing | 8 |
| 5 | **Timing analysis**<br>Time closure, timing driven placement, Timing driven routing, static timing analysis, slack calculation, timing analysis problems | 6 |
| 6 | **Physical Synthesis and interconnect**<br>Physical synthesis, gate sizing, buffering, netlist restructuring, performance driven design flow. Timing optimization, interconnect modeling, wire geometry, layer stack, wire resistance, choice of metal, cross talk, Design rule check, Layout | 6 |
| 7 | **Design for Testability**<br>Various sources of faults and types of faults, fault modeling, Design for testability, DFT techniques, scan path design, scan flip flop, boundary scan, built in self-test | 6 |
| 8 | **Low power design techniques**<br>Types of power dissipation, Techniques to reduce power, gate level design for low power | 6 |
| | **Total Hours** | 42 |

**Suggested Reference:**

1. VLSI Physical Design Automation: Theory And Practice by Sait Sadiq M. Et.Al, Cambridge India

2. VLSI Physical Design From Graph Partitioning to Timing Closure by Andrew B. Kahng, Jens Lienig, Igor L. Markov, Jin Hu , Springer

3. Lecture notes on VLSI Physical Design by Prof.Indraneel Sengupta,IIT Kharagpur

**Supplementary Resources:**

1. https://nptel.ac.in/courses/106105161

**Marwadi University**
**Faculty of Technology**
**Department of Information and Communication Technology**

## Subject Code: 01CT0718

## Subject Name: FPGA Based System Design

## B.Tech.–Year–IV (Semester VII)

**Objectives:** The main objective of this course is to provide the basics about internal architecture of FPGA and working of FPGA

**Credits Earned:** 04 Credits

**Course Outcomes:** After completion of this course, student will be able to:

1. Know the concepts of digital design
2. Understand evolution of programmable logic device
3. Learn FPGA architecture
4. Program the FPGA device
5. Develop FPGA based system

**Pre-requisite of course:** Basic Concept in digital circuit design

**Teaching and Examination Scheme:**

| Teaching Scheme (Hours) | | | Credits | Theory Marks | | | Tutorial/ Practical Marks | | Total Marks |
|---|---|---|---|---|---|---|---|---|---|
| | | | | E | I | | V | T | |
| Theory | Tutorial | Practical | | ESE | IA | CSE | | TermWork | |
| 3 | 0 | 2 | 4 | 50 | 30 | | Viva | 25 | 150 |

**Contents:**

| **Unit** | **Topics** | **Contact Hours** |
|---|---|---|
| 1 | **Revision of basic Digital systems**. Combinational Circuits, Sequential Circuits, Timing, Electrical Characteristics, Power Dissipation. | 4 |

| | | |
|---|---|---|
| 2 | **Current state of the field**<br>SoC, IP Design, SoPC, Design methodology, System Modeling, Hardware-Software Co-design, Device Technology, Application Domains. | 6 |
| 3 | **Digital system Design**.<br>Top down Approach to Design, Case study, Data Path, Control Path, Controller behavior and Design, Case study Mealy & Moore Machines.Timing of sequential circuits, Pipelining, Resource sharing. | 6 |
| 4 | **Programmable Logic Devices**.<br>Introduction, Evolution: PROM, PLA, PAL, Architecture of PAL's, Applications, Programming PLD's, Design Flow, Programmable Interconnections, Complex PLD's (MAX - 7000, APEX).Architecture, Resources, Applications, Tools | 8 |
| 5 | **FPGA Architecture**<br>Introduction, Logic Block Architecture, Routing Architecture, Programmable Interconnections, Design Flow,Xilinx Virtex-II Architecture, Altera Stratix Architecture | 6 |
| 6 | **Programming the FPGA**<br>Boundary Scan, Programming of the FPGA, Constraint Editor, Static Timing Analysis, One hot encoding, Applications, Tools, Case Study,Xilinx Virtex II Pro, Embedded System on Programmable Chip.Hardware-software co-simulation, Debugging FPGA Design | 6 |
| 7 | **HDL for Synthesis**<br>Introduction, Behavioral, Data flow, Structural Models,Simulation Cycles, Process, Concurrent Statements, Sequential Statements,Loops, Delay Models, Sequential Circuits, FSM Coding | 6 |
| | **TotalHours** | 42 |

**Suggested Text books/Reference books:**

1. Jon F Wakerly, Digital Design: Principles and Practices, Prentice Hall.
2. Kevin Skahil, VHDL for programmable logic, Addison Wesley.
3. Zainalabedin Navabi, VHDL, analysis and modeling of digital systems, McGraw-Hill.
4. Stephen Brown and Zvonko Vranesic, Fundamentals of Digital Logic with Verilog Design, McGrowHill Third Edition
5. Seetharaman Ramachandran, “Digital VLSI Systems Design: A Design Manual for Implementation of Projects on FPGAs and ASICs Using Verilog”, Springer Science & Business Media, 14-Jun-2007
6. PLD, FPGA data sheets

**Suggested Theory distribution:**

The suggested theory distribution as per Bloom’s taxonomy is as per follows. This distribution serves as guidelines for teachers and students to achieve effective teaching-learning process.

| Distribution of Theory for course delivery and evaluation | | | | | |
|---|---|---|---|---|---|
| Remember | Understand | Apply | Analyze | Evaluate | Create |
| 15% | 15% | 40% | 10% | 10% | 10% |

**Suggested List of Experiments:**

1. Introduction to the FPGA development board.
2. Interfacing input/output devices on the FPGA development board.
3. Implementing adder circuits such as half/full and ripple carry adder on the FPGA development board.
4. Implement multiplexers and demultiplexers on the FPGA development board
5. Implement encoders and decoders on the FPGA development board.
6. Implement code converters on the FPGA development board
7. Implement flip-flops and registers on the FPGA development board.
8. Implement a counter with a frequency divider on the FPGA development board.
9. Implement Mealy and Moore machine examples on the FPGA development board.
10. Implement a Traffic Light Controller on the FPGA development board.
11. Implement Digital Alarm Clock on the FPGA development board.
12. Implement 8-bit RISC processor on the FPGA development board.
13. Implement FIR/IIR filter on the FPGA development board.
14. Implement sensor-based systems on the FPGA development board.
15. Implement vending machine on the FPGA development board.

**Major Equipment/software**: FPGA board's IDE

**List of Open-Source Software/learning website:**

NPTEL, Beginners Guide to get started with Xilinx FPGA Programming, FPGA4FUN.COM

**Instructional Method:**

1. Course delivery is the combined use of whiteboard/blackboard and PowerPoint presentation using a projector as per requirement.
2. Students will be assessed with a continuous evaluation approach with assignments and quizzes at regular intervals.
3. For effective communication with students, Canvas LMS (Learning Management System) is used.

**Supplementary Resources:**

1.https://nptel.ac.in/courses/117108040

## Subject Code: 01CT0719

## Subject Name: AdHoc Wireless Networks

## B. Tech. Year – IV (Semester VII)

**Objective:**
The main objectives of this course are to understand the concepts of Ad Hoc wireless networks and its architecture, understand the designing issues and challenges of various layer protocols, and analyze Ad Hoc wireless networks and its applications.

**Credits Earned:** 04 Credits

**Course Outcomes:** After completion of this course, student will be able to:
1. Identify different issues in Ad Hoc wireless networks
2. Evaluate the existing network and improve its quality of service
3. Analyze various layer protocols for different applications
4. Apply the concepts of Ad Hoc Networks in WSN and VANETs.

**Pre-requisite of course:** Computer Networks

**Teaching and Examination Scheme:**

| Teaching Scheme (Hours) | | | Credits | Theory Marks | | | Tutorial / Practical Marks | | Total Marks |
|---|---|---|---|---|---|---|---|---|---|
| | | | | E | I | | V | T | |
| Theory | Tutorial | Practical | | ESE | IA | CSE | Viva | Term Work | |
| 3 | 0 | 2 | 4 | 50 | 30 | 20 | 25 | 25 | 150 |

**Contents:**

| Unit | Topics | Hours |
|---|---|---|
| 1 | **Overview of Ad Hoc wireless networks**<br>Elements of Ad hoc Wireless Networks, Issues in Ad Hoc wireless networks, Examples and applications of Ad Hoc networking | 2 |
| 2 | **MAC protocols**<br>MAC Protocols for Ad-hoc Wireless Networks: Introduction, Issues in Designing a MAC Protocol, Design Goals of MAC Protocols, Classification of MAC protocols, Contention-Based Protocols, Contention-Based Protocols with Reservation Mechanisms, Contention-Based Protocols with Scheduling Mechanisms, MAC Protocols that Use Directional Antennas | 8 |

| | | |
|---|---|---|
| 3 | **Routing protocols**<br>Routing Protocols for Ad-hoc Wireless Networks Introduction, Issues in Designing a Routing Protocol for Ad-hoc Wireless Networks; Classification of Routing Protocols | 8 |
| 4 | **Transport protocols**<br>Introduction, Issues in designing a Transport Layer Protocol, design goals of a Transport Layer Protocol, Classification of Transport Layer protocols, Security in Ad-hoc Wireless Networks, Issues and Challenges in Security Provisioning, Network Security Attacks and solutions | 4 |
| 5 | **Quality of Service**<br>Quality of Service and Energy Management in Ad-hoc Wireless Networks: Issues and Challenges in Providing QoS in Ad-hoc Wireless Networks, Classification of QoS Solutions, MAC Layer Solutions, Network Layer Solutions | 2 |
| 6 | **Sensor Networks**<br>*Introduction and Architecture:*<br>Challenges for Wireless Sensor Networks, Enabling Technologies for Wireless Sensor Networks, WSN applications and examples, Single-Node Architecture - Hardware Components, Energy consumption of Sensor Nodes, Network architecture - Sensor Network scenarios<br><br>***WSN Networks and protocols****:*<br>MAC Protocols for Wireless Sensor Networks, Low Duty Cycle Protocols and Wakeup Concepts - S-MAC, Contention based protocols, Schedule based protocols – LEACH, IEEE 802.15.4 MAC protocol, Routing Protocols- Energy Efficient Routing, Challenges and Issues in Transport layer protocol.<br><br>***WSN security****:*<br>Network Security Requirements, Issues and Challenges in Security Provisioning, Network Security Attacks, Layer wise attacks in wireless sensor networks, possible solutions | 10 |
| 7 | **Vehicular Ad-Hoc Network**<br>Introduction: Challenges and Requirements, Layered architecture for VANETs, DSRC /WAVE standard (IEEE 802.11p), IEEE 802.11p protocol Stack (PHY & MAC), survey on Proposed MAC approaches for VANETs like TDMA, SDMA and CDMA based approaches, DSRC MAC & LLC, Georouting: CBF, Flooding with broadcast suppression | 8 |
| | **Total Hours** | 42 |

**Suggested Text books / Reference books:**

1. Siva Ram Murthy and B.S. Manoj, Ad hoc Wireless Networks Architectures and protocols, 2nd edition, Pearson Education, 2007
2. C. K. Toh, Adhoc Mobile Wireless Networks, Pearson Education, 2002
3. Charles E. Perkins, Adhoc Networking, Addison – Wesley, 2000
4. Dipankar Raychaudhuri, Mario Gerla, Emerging Wireless Technologies and the Future Mobile Internet, D, Cambridge.

5. Holger Karl, Andreas Willing, ―Protocols and Architectures for Wireless Sensor Networks‖, John Wiley & Sons, Inc., 2005.
6. Ozan K. Tonguz and Gianguigi Ferrari: Ad-hoc Wireless Networks, John Wiley, 2007.
7. Xiuzhen Cheng, Xiao Hung, Ding-Zhu Du: Ad-hoc Wireless Networking, Kluwer Academic Publishers, 2004.

**Suggested Theory distribution:**

The suggested distribution as per Bloom's taxonomy is as per follows. This distribution serves as guidelines for teachers and students to achieve theory effective teaching-learning process.

| Distribution of Theory for course delivery and evaluation | | | | | |
|---|---|---|---|---|---|
| Remember | Understand | Apply | Analyze | Evaluate | Create |
| 10% | 15% | 20% | 30% | 15% | 10% |

**Suggested List of Experiments:**

| Sr No | Suggested Content |
|---|---|
| 1 | Introduction and installation of NS-2. |
| 2 | Introduction to TCL script.<br>Introduction to TCL Syntax, looping, conditional check, functions, execution of Mathematical Operations and Execution of commands. |
| 3 | Simulation of Wireless topology of two Nodes. |
| 4 | Simulate the mobile node for Ad Hoc wireless network. |
| 5 | Simulate the Ad Hoc wireless network and analyze data rate for various situations. |
| 6 | Simulate the Ad Hoc wireless network and analyze delay for various situations. |
| 7 | Implement a Power Efficient and Delay Aware MAC protocol using Simulation Tool |
| 8 | Implement an Ad-hoc On-demand Distance Vector protocol using a Simulation tool. |
| 9 | Compare Ad Hoc wireless routing protocols. |
| 10 | Implement a Transmission Control Protocol using Simulation tool. |
| 11 | Implement User Datagram Protocol using Simulation Tool. |
| 12 | Create a mobile Ad-hoc network using a Simulation Tool and analyze the results for speed vs data rate. |
| 13 | Simulate WSN and analyze the QoS parameters. |
| 14 | Mini project. |

**Supplementary Resources:**

1. https://study-ccna.com/eigrp-overview/

2. https://www.netacad.com/
3. https://www.computernetworkingnotes.com/
4. https://www.isi.edu/nsnam/ns/

## SubjectCode:01CT0720

## SubjectName:Cloud developing

## B.Tech.Year –IV (SemesterVII)

**Objective:**

The objective of this course is to gain technical expertise in development with cloud technologies. Students would explore a scenario that provides opportunities to build a variety of infrastructures through a guided, and hands-on approach.

**CreditsEarned:**04Credits

**CourseOutcomes:**Aftercompletionofthiscourse, studentwill beable to:

1. Write code that interacts with Amazon DynamoDB by using the AWS SDKs
2. Configure containers
3. Develop solutions with Amazon Simple Queue Service (Amazon SQS) and Amazon Simple Notification Service (Amazon SNS)
4. create a REST API using Amazon API Gateway
5. Identify the best practices to deploy secure applications

**Pre-requisiteofcourse:**
Cloud computing

**TeachingandExaminationScheme:**

<table>
<tr><th colspan="3" rowspan="2">TeachingScheme(Hours)</th><th rowspan="3">Credits</th><th colspan="3">TheoryMarks</th><th colspan="2">Tutorial/ PracticalMarks</th><th rowspan="3">TotalMarks</th></tr>
<tr><th>E</th><th colspan="2">I</th><th>V</th><th>T</th></tr>
<tr><th>Theory</th><th>Tutorial</th><th>Practical</th><th>ESE</th><th>IA</th><th>CSE</th><th>Viva</th><th>TermWork</th></tr>
<tr><td>3</td><td>0</td><td>2</td><td>4</td><td>50</td><td>30</td><td>20</td><td>25</td><td>25</td><td>150</td></tr>
</table>

**Contents**:

| Unit | Topics | Hours |
|---|---|---|
| 1 | **Introduction to Developing on AWS**<br>Introduction, Systems development lifecycle, Steps to get started developing on AWS, Demonstration: AWS CLI installation, Fundamentals of working with the AWS SDKs | 2 |
| 2 | **Developing Flexible NoSQL Solutions**<br>Introduction, Introducing AWS database options, Key concepts for DynamoDB, Partitions and data distribution, Secondary indexes, Read/write throughput, Calculating Read Capacity Units (RCUs) and Write Capacity Units (WCUs), Streams and global tables, Backup and restore, Basic operations for DynamoDB tables | 5 |
| 3 | **Developing REST APIs**<br>Introducing APIs, Introducing API Gateway, creating a REST API, Integrating with API Gateway, Deploying an API, controlling access to a REST API, monitoring a REST API, Optimizing API Gateway | 6 |
| 4 | **Developing Event-Driven Serverless Solutions**<br>Introducing serverless computing, Introducing Lambda, Invoking Lambda functions, setting permissions for Lambda, Authoring and configuring Lambda functions, Deploying Lambda functions, Monitoring and debugging tools for application developers, Demonstration: Using X-Ray with Lambda | 6 |
| 5 | **Introducing Containers and Container Services**<br>Introducing containers, Introducing Docker containers, migrating a Web Application to Docker Containers, containers for microservices, Introducing AWS container services, Deploying applications with AWS Elastic Beanstalk | 6 |
| 6 | **Caching Information for Scalability**<br>Introduction, Caching overview, Caching with ElastiCache, Caching Application Data with ElastiCache, Caching with CloudFront, Caching strategies | 5 |
| 7 | **Developing with Messaging Services**<br>Processing requests asynchronously, Introducing Amazon SQS, Working with Amazon SQS messages, Configuring Amazon SQS queues, Introducing Amazon SNS, Developing with Amazon SNS, Demonstration: Working with Amazon Messaging Services, introducing Amazon Kinesis Data Streams | 2 |
| 8 | **Developing Secure Applications on AWS**<br>Securing network connections, authenticating with AWS Security Token Service (AWS STS), Authenticating with Amazon Cognito, Implementing Application Authentication using Amazon Cognito | 4 |
| 9 | **Automating Deployment Using CI/CD Pipelines**<br>Introducing DevOps, AWS code services for continuous integration and continuous delivery (CI/CD), Deploying applications with AWS CloudFormation, deploying applications with the AWS Serverless Application Model (AWS SAM), Automating Application Deployment Using a CI/CD Pipeline | 6 |
| | **TotalHours** | 42 |

**SuggestedTextbooks/Referencebooks:**

1. John Culkin, Mike Zazon, AWS Cookbook, 1st edition, O'Reilly Media, 2021
2. Gaurav Raje, Security and Microservice Architecture on AWS, 1st edition, O'Reilly Media, 2023
3. Ralph Kihpehers, AWS: Amazon Web Services for Beginners, 1st edition, 2013
4. Mark Wilkins, Learning Amazon Web Services, Addison-Wessley Professional, 1st edition, 2019

**SuggestedTheorydistribution:**

ThesuggesteddistributionasperBloom'staxonomyisasperfollows.Thisdistributionservesasguidelinesfor teachersand students toachievetheoryeffectiveteaching-learning process.

| DistributionofTheoryfor coursedeliveryandevaluation | | | | | |
|---|---|---|---|---|---|
| Remember | Understand | Apply | Analyze | Evaluate | Create |
| 10% | 15% | 30% | 20% | 15% | 10% |

**SuggestedListofExperiments:**

| SrNo | SuggestedContent |
|---|---|
| 1 | Setup Cloudshell and cloud9 environment. |
| 2 | Create an IAM role and instance role which can have S3 full access permission. |
| 3 | Create a Dynamo DB database that can have an automatic backup at 12:00 AM. |
| 4 | Create an API using API gateway in AWS which can trigger lambda function on invoke. |
| 5 | Create any 5 APIs using API gateway. |
| 6 | Implementing a Serverless Architecture with AWS Managed Service. |
| 7 | Create a lambda function using SDK. |
| 8 | Implement microservices architecture using containers. |
| 9 | Create any 2-container image and push it to ECR. |
| 10 | Migrating a Web Application to Docker Containers. |
| 11 | On lambda invoke trigger SNS notification to your respective mail. |
| 12 | Implementing a Messaging System Using Amazon SNS and Amazon SQS. |
| 13 | Implementing Application Authentication Using Amazon Cognito. |
| 14 | Create 2 simple websites and push their code to code commit. |
| 15 | Automating Application Deployment Using a CI/CD Pipeline. |
| Advance experiments | |

| | |
|---|---|
| 16 | To send a message to SQS from the API. |
| 17 | Convert any monolithic architecture to micro-service. |
| 18 | Create CI/CD pipeline for deploying any project. |

**SupplementaryResources:**

1. https://awsacademy.instructure.com/courses/21018
2. https://aws.amazon.com/kubernetes/
3. https://aws.amazon.com/marketplace/pp/prodview-isd7rfyswfr4s?ref=portal_asin_url
4. https://aws.amazon.com/marketplace/pp/prodview-mm6u6prvppowc?sr=0-2&ref_=beagle&applicationId=AWSMPContessa

**Marwadi University**
**Faculty of Technology**
**Department of Information and Communication Technology**

# Subject Code: 01CT0721

# Subject Name: Blockchain

# B. Tech. Year – IV (Semester VII)

**Objective:**
The goal of this course is to learn the fundamentals of blockchain technology. Learners will explore numerous facets of blockchain technology during this course, such as its applications in various fields. Learners will gain knowledge of smart contracts, private and public blockchains, and other topics by implementing.

**Credits Earned:** 04 Credits

**Course Outcomes:** After completion of this course, student will be able to:
1. Understand the basic concepts and technology used for blockchain.
2. Understand the primitives of the distributed computing and cryptography related to blockchain.
3. Apply the concepts of Bitcoin and their usage.
4. Apply security features in blockchain technologies.
5. Solve block chain-based problems and write smart contract using Ethereum Framework.

**Pre-requisite of course:**
Cryptography, Networking and OOP.

**Teaching and Examination Scheme:**

| Teaching Scheme (Hours) | | | Credits | Theory Marks | | | Tutorial / Practical Marks | | Total Marks |
|---|---|---|---|---|---|---|---|---|---|
| | | | | E | I | | V | T | |
| Theory | Tutorial | Practical | | ESE | IA | CSE | Viva | Term Work | |
| 03 | 00 | 02 | 04 | 50 | 30 | 20 | 25 | 25 | 150 |

**Contents:**

| Unit | Topics | Hours |
|---|---|---|
| 1 | **Introduction to Cryptography**<br>What is Cryptography, Symmetric Ciphers, Asymmetric Ciphers, Data Encryption, Standard - Advanced Encryption Standard - Multiple Encryption and Triple DES, MD5 message digest algorithm - Secure hash algorithm (SHA) Digital Signatures: Digital Signatures - authentication protocols - digital signature standards (DSS) - proof of digital signature algorithm. | 06 |
| 2 | **Introduction to Blockchain**<br>What is Blockchain, Blockchain Technology Mechanisms & Networks, Blockchain Origins, Objective of Blockchain, Blockchain Challenges, Transactions and Blocks, P2P Systems, Keys As Identity, private vs. public Blockchain, Key Problem Challenges and Solutions. | 06 |
| 3 | **BitCoin and Cryptocurrency**<br>What is Bitcoin, The Bitcoin Network, The Bitcoin Mining Process, Mining Developments, Bitcoin Wallets, Decentralization and Hard Forks, Ethereum Virtual Machine (EVM), Merkle Tree, Double-Spend Problem, Blockchain and Digital Currency, Transactional Blocks, Impact Of Blockchain Technology On Cryptocurrency. | 06 |
| 4 | **Introduction to Ethereum**<br>What is Ethereum, Introduction to Ethereum, Consensus Mechanisms, How Smart Contracts Work, Metamask Setup, Ethereum Accounts, Receiving Ether’s Transaction, Smart Contracts. | 06 |
| 5 | **Introduction to Hyperledger**<br>What is Hyperledger? Distributed Ledger Technology & its Challenges, Hyperledger & Distributed Ledger Technology, Hyperledger Fabric, Hyperledger Composer | 06 |
| 6 | **Solidity Programming**<br>Solidity - Language of Smart Contracts, Installing Solidity & Ethereum Wallet, Basics of Solidity, Layout of a Solidity Source File & Structure of Smart Contracts, General Value Types (Int, Real, String, Bytes, Arrays, Mapping, Enum, address) | 08 |
| 7 | **Blockchain Applications**<br>Internet of Things, Medical Record Management System, Domain Name Service and Future of Blockchain, Alt Coins. | 04 |
| | **Total Hours** | 42 |

**Suggested Text books / Reference books:**

1. Antonopoulos, Mastering Bitcoin: Unlocking Digital Cryptocurrencies
2. Satoshi Nakamoto, Bitcoin: A Peer-to-Peer Electronic Cash System
3. DR. Gavin Wood, "ETHEREUM: A Secure Decentralized Transaction Ledger," Yellow paper.2014.
4. Nicola Atzei, Massimo Bartoletti, and TizianaCimoli, A survey of attacks on Ethereum smart contracts
5. D. Drescher, Blockchain Basics. Apress, 2017.

**Suggested Theory distribution:**

The suggested theory distribution as per Bloom's taxonomy is as per follows. This distribution serves as guidelines for teachers and students to achieve effective teaching learning process.

| Distribution of Theory for course delivery and evaluation | | | | | |
|---|---|---|---|---|---|
| Remember | Understand | Apply | Analyze | Evaluate | Create |
| 10% | 20% | 30% | 15% | 15% | 10% |

**Suggested List of Experiments:**

1. Create a Simple Blockchain in any suitable programming language.
2. Use Geth to Implement Private Ethereum Block Chain.
3. Build Hyperledger Fabric Client Application.
4. Build Hyperledger Fabric with Smart Contract.
5. Create Case study of Block Chain being used in illegal activities in real world.
6. Using Python Libraries to develop Block Chain Application.
7. Develop a program to implement cryptographic Hash Function.
8. Develop a program to implement Public Key Infrastructure.
9. Develop a program to implement Key Exchange technique.
10. Write a program to implement SHA.
11. Build and deploy block chain application for on premise and cloud-based architecture.
12. Integrate ideas from various domains and implement them using block chain technology in different perspectives.
13. Develop a Block chain application for creation of an account.
14. Develop a Blockchain application regarding transaction.
15. Develop a Block chain application for any Supply Chain Management.

**Supplementary Resources:**

1. https://onlinecourses.nptel.ac.in/noc22_cs44/preview
2. https://www.coursera.org/specializations/blockchain
3. https://www.udemy.com/course/build-your-blockchain-az/
4. https://eduxlabs.com/courses/blockchain-technologytraining/?tab=tab-curriculum

## Subject Code: 01CT0722

## Subject Name: Deep Learning

## B. Tech. Year – IV (Semester VII)

**Objectives:** This course aims at teaching supervised, unsupervised and reinforcement deep learning methods which helps to develop state-of-the-art artificial intelligence applications. The course will provide an overview of the challenges of vision, the commonly used techniques and the current approaches. This course investigates different transformation operation, depth estimation, feature extraction and shading. This course also includes Generative learnings and topics in Natural Language Processing leading to the seq2seq models leading to the solution of the real-world problems.

**Credits Earned:** 04 Credits

**Course Outcomes:** After completion of this course, student will be able to:

**Teaching and Examination Scheme:**

<table>
<tr><th colspan="3" rowspan="2">Teaching Scheme (Hours)</th><th rowspan="3">Credits</th><th colspan="3">Theory Marks</th><th colspan="2">Tutorial / Practical Marks</th><th rowspan="3">Total Marks</th></tr>
<tr><th>E</th><th colspan="2">I</th><th>V</th><th>T</th></tr>
<tr><th>Theory</th><th>Tutorial</th><th>Practical</th><th>ESE</th><th>IA</th><th>CSE</th><th>Viva</th><th>Term Work</th></tr>
<tr><td>3</td><td>0</td><td>2</td><td>04</td><td>50</td><td>30</td><td>20</td><td>25</td><td>25</td><td>150</td></tr>
</table>

**Contents:**

| Unit | Topics | Contact Hours |
|---|---|---|
| 1 | **Introduction of Deep Learning**<br>History, AI vs ML vs DL, Deep Learning and its Applications, loss function, cost function, Multilayer perceptron, forward propagation; Model Training: Backpropagation, Stochastic Gradient Descent and Optimizers: Momentum, RMSProp, Adam; Deep Learning Experiments: Datasets, training-validation, testing set, evaluation measures: accuracy, precision, recall, f-measure. | 03 |
| 2 | **Model Improvement and Regularization:**<br>Overfitting vs underfitting, Bias vs Variance, hyper parameter tuning: random, coarse to fine; Regularization: L1, L2 regularization, Dropout, Early stopping, Data normalization, Augmentation | 03 |
| 3 | **Convolutional Neural Network**<br>Convolutional Neural Networks, NNs for Recognition and Verification (Siamese Networks, Triplet Loss, Contrastive Loss, Ranking Loss); CNNs for Detection: | 09 |

| | | |
|---|---|---|
| | Background of Object Detection, R-CNN, YOLO, CNNs for Segmentation: FCN, U-Net, Mask-RCNN | |
| 4 | **Recurrent Neural Networks** Time-series data analysis, forward propagation, Backpropagation Through Time (BPTT), word embedding, Vanishing-exploding gradients, LSTM, GRU; RNN Se2Seq model, Encoder-Decoder, Attention Mechanism, Self-Attention Transformer, BERT, Application: Sentiment analysis, text generation, image captioning, machine translation | 10 |
| 5 | **Generative Learning** Variational Auto-encoders, Generative Adversarial Neural Networks; GL Applications: Image generation, font generation, anime face/celebrity face generation | 09 |
| 6 | **Variants and Applications of Generative Models in Vision** Image Editing, Super resolution, 3D Object Generation, Cycle GANs, Progressive GANs | 08 |
| | **Total Hours** | 42 |

**Suggested List of Experiments:**

1. Implement Multi Layer Feed Forward Neural Network
2. Implement CNN
3. Implement R-CNN and Masked R-CNN
4. Implement YOLO
5. Implement U-Net
6. Implement RNN and LSTM
7. Implement Encoder-Decoder Architecture
8. Implement Transformer and Self-Attention Mechanism
9. Implement Image Recognition Algorithm
10. Implement Image Generation system
11. Implement 3D Object Generation
12. Implement Text Generation Approach
13. Implement Image Labelling/Image Captioning System
14. Implement Machine Translation

**Suggested Text books / Reference books:**

1. Ian Goodfellow, Yoshua Bengio, Aaron Courville, Deep Learning, 2016
2. Michael Nielsen, Neural Networks and Deep Learning, 2016
3. Yoshua Bengio, Learning Deep Architectures for AI, 2009
4. Richard Szeliski, Computer Vision: Algorithms and Applications, 2010.
5. Simon Prince, Computer Vision: Models, Learning, and Inference, 2012.
6. David Forsyth, Jean Ponce, Computer Vision: A Modern Approach, 2002.

**Suggested Theory distribution:**

The suggested theory distribution as per Bloom's taxonomy is as per follows. This distribution serves as guidelines for teachers and students to achieve effective teaching-learning process.

| Distribution of Theory for course delivery and evaluation | | | | | |
|---|---|---|---|---|---|
| Remember | Understand | Apply | Analyze | Evaluate | Create |
| 15% | 20% | 30% | 20% | 10% | 5% |

**Instructional Method:**

1. The course delivery method will depend upon the requirement of content and need of students. The teacher in addition to conventional teaching method by black board, may also use any of tools such as demonstration, role play, Quiz, brainstorming, MOOCs etc.
2. The internal evaluation will be done on the basis of continuous evaluation of students in the laboratory and class-room.
3. Practical examination will be conducted at the end of semester for evaluation of performance of students in laboratory.
4. Students will use supplementary resources such as online videos, NPTEL videos, e-courses, Virtual Laboratory.

**List of simulation software / IDEs:**

1. PyCharm
2. Google Colab
3. Jupyter Notebook

## Subject Code: 01CT0723

## Subject Name: Information Retrieval and Natural Language Processing

## B. Tech. Year – IV (Semester VII)

**Objectives:** This course provides an understanding of common and emerging methods of organizing, summarizing, and analyzing large collections of unstructured and lightly structured text. Students will gain an in-depth knowledge of the commonly used algorithms for processing the natural languages. The course examines NLP models and algorithms using both traditional symbolic recent statistical approaches.

**Credits Earned:** 04 Credits

**Course Outcomes:** After completion of this course, student will be able to:

1. Comprehend types of text analysis, Information retrieval, IR system architecture, query processing models and probabilistic models.
2. Understand natural language processing and the importance of word representation.
3. Manage information retrieval systems by performing network management, search engine optimization, records compliance and risk management.
4. Perform indexing, compression, information categorization and sentiment analysis
5. Apply deep learning to solve natural language problems such as language modeling, machine translation, POS tagging, Seq2Seq generation.
6. Solve NLP problem of real time scenario

**Teaching and Examination Scheme:**

| Teaching Scheme (Hours) | | | Credits | Theory Marks | | | Tutorial / Practical Marks | | Total Marks |
|---|---|---|---|---|---|---|---|---|---|
| | | | | E | I | | V | T | |
| Theory | Tutorial | Practical | | ESE | IA | CSE | Viva | Term Work | |
| 3 | 0 | 2 | 04 | 50 | 30 | 20 | 25 | 25 | 150 |

**Contents:**

| Unit | Topics | Contact Hours |
|---|---|---|
| 1 | **Introduction to Information Retrieval**<br>Boolean retrieval, Vector Space Model, Feature Vectors, Document/Passage Retrieval, Search Engines, Relevance Feedback & Query Expansion, Document Filtering and Categorization, flat and hierarchical clustering, Latent Semantic Analysis, Web Crawling and the Google algorithm. | 04 |

| | | |
|---|---|---|
| 2 | **Language models and IR systems**<br>Unigram, Bigram language models, generating queries from documents, Language models and smoothing, ranking with language models, Kullback Leibler divergence, Divergence from randomness, Passage retrieval and ranking.<br>Management of Information Retrieval Systems: Knowledge management, Information management, Digital asset management, Network management, Search engine optimization, Records compliance and risk management, Version control, Data and data quality, Information system failure.<br>Types of information retrieval systems: Web retrieval and mining, Semantic web, XML information retrieval, Recommender systems and expert locators, Knowledge management systems, Decision support systems, Geographic information system (GIS). Indexing: Inverted indices, Index components and Index life cycle, Interleaving Dictionary and Postings lists, Index construction | 12 |
| 3 | **Statistical Natural Language Processing**<br>Sequence Labeling: POS-tagging, Named Entity Recognition and Normalization.<br>Syntactic Parsing: Dependency Syntactic Parsing, Ambiguity in language<br>Shallow Semantic Parsing: Predicate Argument Structures, Relation Extraction (supervised and semi-supervised).<br>Discourse Parsing: Coreference Resolution and discourse connective classification | 08 |
| 4 | **Neural NLP Models**<br>Word Window Classification, Neural Networks for text, N-gram Language Models, Perplexity, Hidden Markov Models, Recurrent Neural network, Vanishing Gradients and exploding gradient, 1D-CNN for NLP, Contextual Representations, Encoder-Decoder, Transformers | 09 |
| 5 | **Joint NLP and IR applications**<br>Deep Linguistic Analysis for Question Answering: QA tasks (open, restricted, factoid, non-factoid), NLP Representation, Question Answering Workflow, QA Pipeline, Question Classification.<br>Fine-Grained Opinion Mining: automatic review classification, automatic product extraction and review | 09 |
| | **Total Hours** | 42 |

**Suggested Text books / Reference books:**

1. Daniel Jurafsky and James H. Martin, Speech and Language processing an introduction to Natural Language Processing, Computational Linguis (2 ed.), Prentice Hall, 2008. ISBN 978-0131873216.
2. Steven Bird, Ewan Klein and Edward Lopper, Natural Language Processing with Python (2 ed.), O′Reilly, 2009. ISBN 978-0596516499.
3. Siddiqui and Tiwari, Natural Language Processing and Information Retrieval (1 ed.), Oxford University Press, 2008. ISBN 978-0195692327
4. Butcher S., Clarke C.L.A. and Cormack G., Information Retrieval (1 ed.), The MIT Press, 2010. ISBN 978-0262026512.
5. Bates M.J., Understanding Information Retrieval Systems (1 ed.), CRC press, 2011. ISBN 978-1439891964.

**Suggested Theory distribution:**

The suggested theory distribution as per Bloom's taxonomy is as per follows. This distribution serves as guidelines for teachers and students to achieve effective teaching-learning process.

| Distribution of Theory for course delivery and evaluation | | | | | |
|---|---|---|---|---|---|
| Remember | Understand | Apply | Analyze | Evaluate | Create |
| 15% | 20% | 30% | 20% | 10% | 5% |

**List of Experiments**

1. Study of Boolean model and/or its implementation
2. Study of Vector Space model and/or its implementation
3. Study of Stemming Algorithms and/or its implementation
4. Index creation for IR system: Inverted Files
5. Index creation for IR system: Signature Files
6. Thesaurus Construction
7. Text document pre-processing and Classification
8. Ontology building
9. Text processing practice: sentence segmentation, word tokenization, stemming and lemmatization, preparation of dictionary, etc.
10. Implement a n-gram model
11. Programming exercises on employing HMM for PoS tagging
12. Programming exercises to implement log-linear model for PoS tagging problem
13. Programming exercises for employing CRF on NER tasks
14. Programming exercises for using existing NLP tools (CoreNLP/NLTK) and obtaining the syntactic parsing of the text.

15. Programming exercises for employing a multi-layer feedforward network on PoS tagging and NER tasks
16. Programming exercises for using LSTM in text classification task
17. Programming exercises for employing CNN on the text classification task
18. Programming exercises for using a sequence to sequence model on machine translation tasks

**Instructional Method:**

1. The course delivery method will depend upon the requirement of content and need of students. The teacher in addition to conventional teaching method by black board, may also use any of tools such as demonstration, role play, Quiz, brainstorming, MOOCs etc.
2. The internal evaluation will be done on the basis of continuous evaluation of students in the laboratory and class-room.
3. Practical examination will be conducted at the end of semester for evaluation of performance of students in laboratory.
4. Students will use supplementary resources such as online videos, NPTEL videos, e-courses, Virtual Laboratory.

**List of simulation software / IDEs:**

1. PyCharm
2. Google Colab
3. Jupyter Notebook

# Subject Code: 01CT0724

# Subject Name: Compiler Design

# B. Tech. Year – IV (Semester VII)

**Objective:**

The purpose of this course is to teach the students about the basic techniques, theory and tools underlie the practice and act of Compiler Construction. This Course introduces the major concept areas of language translation and compiler design.

**Credits Earned:** 04 Credits

**Course Outcomes:** After completion of this course, student will be able to:

1. Understand compiler and different phases. Using this translate program from source code to executable code and files.
2. Explain lexical analysis phase and their connection to language definition through regular expressions and grammars.
3. Explain the syntax analysis phase and differentiate among various parsing techniques and grammar transformation techniques.
4. Use formal attributed grammars for specifying the syntax and semantics of programming languages.
5. Identify the effectiveness of optimization and differences between machine dependent and independent translation.
6. Use the powerful compiler generation tools such as Lex and YACC.

**Pre-requisite of course:**

Basic syntax and semantics of programming languages like object-oriented programming, Data Structure and Theory of Computation

**Teaching and Examination Scheme:**

| Teaching Scheme (Hours) | | | Credits | Theory Marks | | | Tutorial / Practical Marks | | Total Marks |
|---|---|---|---|---|---|---|---|---|---|
| | | | | E | I | | V | T | |
| Theory | Tutorial | Practical | | ESE | IA | CSE | Viva | Term Work | |
| 03 | 00 | 02 | 04 | 50 | 30 | 20 | 25 | 25 | 150 |

**Contents:**

| Unit | Topics | Hours |
|---|---|---|
| 1 | **Introduction to Compiler**<br>Review of Languages & Grammar, Translators-Compilation and Compiler, Interpreter and Assembler, overview of linker and loader - Language processors -The Phases of Compiler-Errors Encountered in Different Phases-The Grouping of Phases-Compiler Construction Tools - Programming Language basics, pass structure. | 8 |
| 2 | **Scanner**<br>Need and Role of Lexical Analyzer-Lexical Errors-Expressing Tokens by Regular Expressions-Recognition of Tokens, A Language for Specifying Lexical Analyzer, Finite Automata from Regular Expression, Converting Regular Expression to DFA- Minimization of DFA-Language for Specifying Lexical Analyzers-LEX- Design of Lexical Analyzer for a sample Language. | 8 |
| 3 | **Parsing**<br>Top-down Parsing, Predictive parsing, non-recursive predictive parsing, First and Follow set, LL (1) grammar, error handling for LL (1), Bottomup parsing, handle pruning, shift reduce parsing, operator precedence parser, LR (0) parser, SLR (1) Parser, Canonical LR (1) Parser, LALR (1) Parser, error detection and recovery in LR Parser, Parser generators (Yacc & Lex) | 8 |
| 4 | **Intermediate Code Generation**<br>Introduction, Intermediate Languages, Types of intermediate forms, Three address Codes: Quadruple & Triples, Translation of Assignment Statements, Boolean expressions, Control Statements, Postfix Translation, Syntax Directed Translation Attributes and Mechanism, Directed Acyclic Graph, Static Single Assignment | 6 |
| 5 | **Memory Management**<br>Introduction, Importance of Memory Management, organization for storage purpose, static allocation, stack allocation, dynamic allocation, different methods of parameter passing, activation record, symbol table | 6 |
| 6 | **Code Optimization**<br>Introduction of Code Optimization, Advantage of code optimization, Types of Code Optimization, Block and Loop Optimization, Global Data Flow Analysis | 6 |
| | **Total Hours** | 42 |

**Suggested Text books / Reference books:**

1. Aho, Lam, Sethi, and Ullman, Compilers: Principles, Techniques and Tools, Second Edition, Pearson, 2014
2. D. M. Dhamdhere: System Programming, Mc Graw Hill Publication
3. Dick Grune, Henri E. Bal, Jacob, Langendoen: Modern Compiler Design, Wiley India Publication

**Suggested Theory distribution:**

The suggested theory distribution as per Bloom's taxonomy is as per follows. This distribution serves as guidelines for teachers and students to achieve effective teachinglearning process.

| Distribution of Theory for course delivery and evaluation | | | | | |
|---|---|---|---|---|---|
| Remember | Understand | Apply | Analyze | Evaluate | Create |
| 10% | 20% | 30% | 15% | 15% | 10% |

**Suggested List of Experiments:**

Minimum 12 experiments to be performed during the semester.

1. WAP to remove Left Recursion from the grammar.
2. WAP to remove Left Factoring from the grammar.
3. WAP to verify that the given input is valid identifier or keyword.
4. WAP to compute FIRST and FOLLOW Set of the given grammar.
5. WAP to implement Operator precedence parser.
6. Prepare report for Lex, Flex and Yet Another Compiler Compiler Tool.
7. WAP with the help of Lex and Yacc file to implement Calculator which performs basic operations like addition, subtraction, multiplication and division.
8. WAP Lex Program to count words, characters, lines, Vowels and consonants from given input.
9. WAP Lex Program to generate string which is ending with zeros.
10. WAP Lex Program to check given string is simple or compound string.
11. WAP Lex Program to count the total number of printf and scanf statement in given C file. Also convert it into readf and write out respectively to another file.
12. WAP to check given number is positive negative or zero.
13. WA Lex Program to print HTML tags of given file.
14. WA YACC Program to generate Calculator.

**Supplementary Resources:**

1. https://nptel.ac.in/courses/106/104/106104123/
2. https://nptel.ac.in/courses/106/108/106108113/
3. https://onlinecourses.nptel.ac.in/noc21_cs07/preview

**Marwadi University**
**Faculty of Technology**
**Department of Information and Communication Technology**

# Subject Code: 01CT0725

# Subject Name: Advanced Database

# B. Tech. Year – IV (Semester VII)

**Objective:**
The objective of this course is giving the understanding the advanced concepts of database management system and its applications, data modelling, database design, and query languages and query optimizations.

**Credits Earned:** 04 Credits

**Course Outcomes:** After completion of this course, student will be able to:
1. Understand the application of different data modelling methods in requirement analysis, design, and implementation of database system.
2. Explain the working and application of PL/SQL, Trigger and Procedures.
3. Apply the normal forms for efficient designing of relational database.
4. Use appropriate storage and access structures.
5. Use techniques for transaction management, concurrency control, and recovery.

**Pre-requisite of course:**
Basic knowledge of database management, SQL, Normalization and Concurrency Control.

**Teaching and Examination Scheme:**

| Teaching Scheme (Hours) | | | Credits | Theory Marks | | | Tutorial / Practical Marks | | Total Marks |
|---|---|---|---|---|---|---|---|---|---|
| | | | | E | I | | V | T | |
| Theory | Tutorial | Practical | | ESE | IA | CSE | Viva | Term Work | |
| 03 | 00 | 02 | 04 | 50 | 30 | 20 | 25 | 25 | 150 |

**Contents:**

| Unit | Topics | Hours |
|---|---|---|
| 1 | **RDBMS**<br>Entity –Relationship model – Relational Model – Relational constraints-Relational algebra, Tuples and Domain Relational calculus, Database Administrator, Introduction to SQL, Data Definition Language, Data Manipulation Language, Data Control Language, Queries, Join, Functions, Operators, Invoking SQL *Plus, Commit, Rollback, Normal forms, ER Diagram, mapping. | 8 |
| 2 | **PL/SQL**<br>Introduction to Pl/SQL, Control Statements, View, Indexes, Sequences, PL/SQL Cursor, Database Trigger, Function, Procedure, | 6 |
| 3 | **Query Optimization**<br>Query processing and optimization-Transactions-Properties of Transactions-Concurrency Control, Recovery, Security and Authorization, Storage-Indexing and Hashing, B+ Trees, Trees-X Trees, Dynamic Hashing. Distributed Databases-Principles –Design-Queries Translation of queries optimization Access Strategies, Management of Distributed Transactions actions-concurrency Control-Reliability. . | 8 |
| 4 | **Database System Architecture**<br>Centralized and Client-Server Systems, Parallel Databases, Distributed Databases, Heterogeneous and Homogeneous Databases, Concurrency Control in Distributed Databases, Distributed Query Processing. | 06 |
| 5 | **Object Oriented Concepts**<br>Data Object Models-Object Based Databases –Object Oriented Databases-Object Oriented Databases Relational Databases-Object Definition Languages-Object Query Languages-SQL3-Concurrency in OODBs-Storage and Access Data Access. | 08 |
| 6 | **Databases Tools**<br>MongoDB, Improvado, Microsoft SQL Server, Postgre SQL, Oracle RDBMS, IBM DB2. | 06 |
| | **Total Hours** | 42 |

**Suggested Text books / Reference books:**

**Text Book:**

1. Fred R. McFadden, Jeffery A. Hoffer, Mary B., Modern Database Management, Prescott, Fifth Edition, Edition Wesley, 2000.
2. Elmasri, Navathe, Fundamentals Of Database Systems, Third Edition, Addison Wesley, 2000.

3. Abraham Silberchartz, Henry F. Korth, S. Sudarshan, Database System Concepts, Third Edition, McGraw-Hill, 1996.

**Reference Book:**

1. Jefry D. Ullman, Jenifer Widom, A First Course in Database Systems, Pearson Education Asia, 2001.
2. Stefano Ceri, Giuseppe Pelagatti, Distributed Databases Principles & Systems, McGraw-Hill International Editions, 1985
3. Rajesh Narang, Object Oriented Interfaces & Databases, Prentice Hall Of India, 2002.

**Suggested Theory distribution:**

The suggested theory distribution as per Bloom's taxonomy is as per follows. This distribution serves as guidelines for teachers and students to achieve effective teaching learning process.

| Distribution of Theory for course delivery and evaluation | | | | | |
|---|---|---|---|---|---|
| Remember | Understand | Apply | Analyze | Evaluate | Create |
| 10% | 20% | 30% | 15% | 15% | 10% |

**Suggested List of Experiments:**

Minimum 12 experiments to be performed during the semester.

1. WAP to implement all DDL queries.
2. WAP to implement all DML queries.
3. WAP to implement all DCL queries.
4. WAP to implement all constraints.
5. WAP to implement all aggregate functions.
6. WAP to implement all inbuilt functions of SQL.
7. WAP to implement Triggers in SQL.
8. WAP to implement Procedures in SQL.
9. WAP to implement View in SQL.
10. WAP to implement database connectivity in various database softwares.
11. WAP to create database in various database softwares like MongoDB, PostgreSQL etc.
12. WAP to implement Nested Queries.
13. WAP to implement PL/SQL Block structure.
14. Create Extended Entity Relationship diagram.
15. WAP to implement Cursors.

**Supplementary Resources:**

1. https://www.coursera.org/specializations/oracle-sql-databases
2. https://nptel.ac.in/courses/106105175
3. https://www.udemy.com/course/mysql-bootcamp/

## Subject Code : 01CT0726

## Subject Name: Software Defined Networks

## B.Tech.Year –IV(SemesterVII)

**Objective:**
This course introduces software defined networking, an emerging paradigm in the field of networking which allows a logically centralized software program to control the behavior of an entire network.

**Credits Earned:** 04Credits

**CourseOutcomes:**Aftercompletionofthiscourse, studentwill beable to:

1. Understand the concepts of Software Defined Networks
2. Apply various SDN Principles with different Architectures
3. Apply concepts of Virtualization, Framework solutions on Data Centers
4. Analyze a given scenario and implement Social Defined Networks

**Pre-requisiteofcourse:**
Cloud computing

**TeachingandExaminationScheme:**

| TeachingScheme(Hours) | | | Credits | TheoryMarks | | | Tutorial/ PracticalMarks | | TotalMarks |
|---|---|---|---|---|---|---|---|---|---|
| | | | | E | I | | V | T | |
| Theory | Tutorial | Practical | | ESE | IA | CSE | Viva | TermWork | |
| 3 | 0 | 2 | 4 | 50 | 30 | 20 | 25 | 25 | 150 |

**Contents:**

| Unit | Topics | Hours |
|---|---|---|
| 1 | **Introduction to SDN**<br>History of Software Defined Networking (SDN), Modern Data Center, Traditional Switch Architecture, need of SDN, Evolution of SDN, working principle of SDN, Centralized and Distributed Control, and Date Planes | 8 |
| 2 | **Open flow and SDN controllers**<br>Open Flow Specification, Drawbacks of Open SDN, SDN via APIs, SDN via Hypervisor- Based Overlays, SDN via Opening up the Device, SDN Controllers | 8 |
| 3 | **Data centers**<br>Multitenant and Virtualized Multitenant Data Center, SDN Solutions for the Data Center Network – VLANs, EVPN, VxLAN, NVGRE | 8 |
| 4 | **SDN Programming**<br>Programming SDNs: Northbound Application Programming Interface, Current Languages and Tools, Composition of SDNs, Network Functions Virtualization (NFV) and Software Defined Networks: Concepts, Implementation and Applications | 9 |
| 5 | **SDN**<br>Juniper SDN Framework, IETF SDN Framework, Open Daylight Controller, Floodlight Controller, Bandwidth Calendaring, Data Center Orchestration | 9 |
| | **TotalHours** | 42 |

**SuggestedTextbooks/Referencebooks:**

1. Paul Goransson and Chuck Black, Software Defined Networks: A Comprehensive Approach, Morgan Kaufmann Publications, 2014
2. Thomas D. Nadeau,SDN: Software Defined Networks, An Authoritative Review of Network Programmability Technologies, Ken Gray Publisher: O’Reilly Media, August 2013
3. Vivek Tiwari, SDN and OpenFlow for Beginners, Amazon Digital Services, 2013
4. Fei Hu,Network Innovation through OpenFlow and SDN: Principles and Design, CRC Press, 2014
5. Siamak Azodolmolky,Software Defined Networking with OpenFlow, Packt Publishing, 2013

**SuggestedTheorydistribution:**

ThesuggesteddistributionasperBloom’staxonomyisasperfollows.Thisdistributionservesasguidelinesfor teachersand students toachievetheoryeffectiveteaching-learning process.

| DistributionofTheoryfor coursedeliveryandevaluation | | | | | |
|---|---|---|---|---|---|
| Remember | Understand | Apply | Analyze | Evaluate | Create |
| 10% | 20% | 30% | 20% | 15% | 5% |

**SuggestedListofExperiments:**

| SrNo | SuggestedContent |
|---|---|
| 1 | Introduction to Mininet. |
| 2 | To perform distributed system and autonomous decisions using BGP for legacy networks. |
| 3 | To establish the semi static forwarding paths. |
| 4 | Introduction to SDN. |
| 5 | To configure SDN network. |
| 6 | To configure VXLAN to provide network traffic isolation. |
| 7 | Introduction to OpenFlow protocol management. |
| 8 | To preform routing within SDN network. |
| 9 | To establish the interconnections between legacy networks and SDN networks. |
| 10 | To configure virtual private LAN service. |
| 11 | To apply equal cost multi path protocol within SDN networks. |
| 12 | To apply the algorithm for a self-stabilizing control plane. |

**SupplementaryResources:**

1. https://www.coursera.org/learn/sdn
2. https://www.udemy.com/course/sdn-openflow-nfv-introduction/
3. https://www.coursera.org/learn/network-virtual

# Subject Code: 01CT1801

# Subject Name: Project

## B. Tech. Year – IV (Semester VIII)

**Objective:**
The subject provides hands-on learning experience to the students with the opportunity to explore a problem or issue of personal or professional interest and to address that problem or issue through focused study and applied research under the direction of a faculty member or industrial guide. This course also provides platform to implement learnt concepts in various subjects in case of project design and to provide in-depth exposure in the field of software, data analytics, embedded, VLSI, networking, and security in case of industrial training. It is also useful to enhance students' ability to think critically and creatively, to solve practical problems, to make reasoned and ethical decisions, and to communicate effectively.

**Credits Earned:** 13 Credits

**Course Outcomes:** After completion of this course, student will be able to:
1. Investigate the chosen topic in depth
2. Apply the concepts and theories learnt in previous subjects
3. Apply the various methodologies to design project for specific application
4. Explore the new ideas & the possible areas to work ahead
5. Sharpen the skills in specific direction

**Pre-requisite of course:**
Basic knowledge of all academic subjects and readiness to explore new things

**Teaching and Examination Scheme:**

| Teaching Scheme (Hours) | | | Credits | Theory Marks | | | Tutorial / Practical Marks | | Total Marks |
|---|---|---|---|---|---|---|---|---|---|
| | | | | E | I | | V | T | |
| Theory | Tutorial | Practical | | ESE | IA | CSE | Viva | Term Work | |
| 00 | 00 | 26 | 13 | 00 | 00 | 00 | 100 | 100 | 200 |

**Contents:**

| Unit | Topics |
|---|---|
| 1 | The Project work should include appropriate elements of engineering standards, design, analysis, modeling, simulation, experimentation, prototyping, software development, research etc. as per the requirement of the project definition |
| 2 | Exploration of various domains of the discipline and finalization of domain for project or Industrial Training |

| | |
|---|---|
| 3 | Identification of proposed project definition by student or students' group in coordination with faculty guide or industrial mentor to address issue related to economic, environmental, social, political, ethical, health & safety, manufacturability, sustainability, management, science etc. |
| 4 | Student's presentation on selected topic with outcomes of the project/Industrial Training and approval by project approval panel |
| 5 | Intermediate semester presentations include block diagram, flow chart, micro level block diagram, schematic, required hardware or software, features and application of project at regular interval |
| **Total Hours: 26 / week** | |

**Assessment of project work:**

| In semester evaluation | | | |
|---|---|---|---|
| **In semester evaluation**<br>Evaluation by project evaluation committee from institute (50% marks) and project guide (50% marks) | **Assessment tool** | **Review – I 1st month of semester** | **Review – II Mid of semester** |
| | TW Marks Distribution | 50 Marks | 50 Marks |
| **End semester evaluation**<br>Evaluation by project evaluation committee from institute (50% marks) and project guide (50% marks) | **Assessment tool** | **Viva Exam** | |
| | Viva Marks Distribution | 100 Marks | |

**Suggested Theory distribution:**
The suggested theory distribution as per Bloom's taxonomy is as per follows. This distribution serves as guidelines for teachers and students to achieve effective teaching-learning process.

| Distribution of Theory for course delivery and evaluation | | | | | |
|---|---|---|---|---|---|
| Remember | Understand | Apply | Analyze | Evaluate | Create |
| 5% | 5% | 15% | 15% | 20% | 40% |

**Marwadi University**
**Faculty of Technology**
**Department of Information and Communication Technology**

## Subject Code: 01CT0811
## Subject Name: Introduction to DevOps Tools
## (MOOC Credit)
## B. Tech. Year – IV (Semester VIII)

**Objective:**
The Objective of this course is to give students an understanding of devOps technology. Students will be able to understand the working of devOps tool and its working with other operations of organization.

**Credits Earned:** 03 Credits

**Course Outcomes:** After completion of this course, student will be able to:
1. Diagnose a team's delivery pipeline and bring forward prioritized recommendations to improve it
2. Explain the skill sets and roles involved in DevOps and how they contribute toward a continuous delivery capability
3. Review and deliver automation tests across the development stack
4. Explain the key jobs of system operations and how today's leading techniques and tools apply to them
5. Explain how high-functioning teams use DevOps and related methods to reach a continuous delivery capability
6. Facilitate prioritized, iterative team progress on improving a delivery pipeline

**Pre-requisite of course:**
NA

**Teaching and Examination Scheme:**

| Teaching Scheme (Hours) | | | Credits | Theory Marks | | | Tutorial / Practical Marks | | Total Marks |
|---|---|---|---|---|---|---|---|---|---|
| | | | | E | I | | V | T | |
| Theory | Tutorial | Practical | | ESE | IA | CSE | Viva | Term Work | |
| 03 | 00 | 00 | 03 | 50 | 30 | 20 | 25 | 25 | 150 |

The course is offered with the objective of credit transfer by learning through MOOC course. The selection of the online course should reflect the syllabus content, mentioned below. The MOOC course must be of minimum 36 hours with appropriate assessment scheme.

**Content Overview:**

Understating of DevOps & DevOps Process, Git introduction and installation, Configure User Information in GIT, GIT Text Editor, Compare Stage Area with Local Repository in GIT, Architectural Overview of Jenkins, Code Pipeline, Configure Jenkins with GIT & Maven, Remote Build Trigger in Jenkins, Jenkins Job DSL with Maven Project, Jenkins as a code pipeline, Docker File Instructions & Construction Commands, Stop-Remove the Containers, Docker CLI Monitoring, Docker Swarm, Kubernetes, Kubernetes Node, Workflow, HELM on Kubernetes, AWS VPC, EC2 Instance Auto scaling, EKS Cluster Using AWS.

**Suggested Theory distribution:**

The suggested theory distribution as per Bloom's taxonomy is as per follows. This distribution serves asguidelines for teachers and students to achieve effective teaching-learning process.

| Distribution of Theory for course delivery and evaluation | | | | | |
|---|---|---|---|---|---|
| Remember | Understand | Apply | Analyze | Evaluate | Create |
| 10% | 20% | 40% | 30% | - | - |

## Subject Code: 01CT0816

## Subject Name: Advance Machine Learning

## (MOOC Credit)

## B. Tech. Year – IV (Semester VIII)

**Objectives:** The course has been kept flexible so that Instructor can choose special topics which have evolved or added in this area. It has been specially designed in this way, to cover up all the latest tools, research and industry relevant content and the gaps due to the fast changes happening in the technology.

**Credits Earned:** 03 Credits

**Course Outcomes:** After completion of this course, student will be able to:

1. To familiarize and learn about the latest trends and research in the field.
2. To equip themselves with the conceptual and practical experience of few latest methods, tools, technologies or algorithms in Machine Learning.
3. Understand the mathematics necessary for constructing novel machine learning solutions.
4. Be able to design and implement various machine learning algorithms in a range of real-world applications

**Pre-requisite of course:** Programming, Algorithms, Data Structures, Machine Learning, Artificial Intelligence

**Teaching and Examination Scheme:**

| Teaching Scheme (Hours) | | | Credits | Theory Marks | | | Tutorial / Practical Marks | | Total Marks |
|---|---|---|---|---|---|---|---|---|---|
| | | | | E | I | | V | T | |
| Theory | Tutorial | Practical | | ESE | IA | CSE | Viva | Term Work | |
| 3 | 0 | 0 | 03 | 50 | 30 | 20 | 00 | 00 | 100 |

The course is offered with the objective of credit transfer by learning through MOOC course. The selection of the online course should reflect the syllabus content, mentioned below. The MOOC course must be of minimum 36 hours with appropriate assessment scheme.

**Content Overview:**

Major focus of the course will be on Relational Machine Learning, Bayesian Machine Learning, Graph learning, Reinforcement learning, Causal inference, handling bias and variance in the dataset, variational methods, etc. The course includes understanding the implementation of Machine Learning concepts to predict, classify, cluster or generate from the real time data dealing with different fields like Bioinformatics, Transportation, Logistics, Security, Education, Healthcare, Environment, Military, etc.

**Suggested Theory distribution:**

The suggested theory distribution as per Bloom's taxonomy is as per follows. This distribution serves as guidelines for teachers and students to achieve effective teaching-learning process.

| Distribution of Theory for course delivery and evaluation | | | | | |
|---|---|---|---|---|---|
| Remember | Understand | Apply | Analyze | Evaluate | Create |
| 10% | 20% | 40% | 30% | - | - |

## Subject Code: 01CT0817

## Subject Name: Advance Data Analytics

## (MOOC Credit)

## B. Tech. Year – IV (Semester VIII)

**Objectives:** This course has been kept flexible so that Instructor can choose special topics which have evolved or added in this area. It has been specially designed in this way, to cover up all the latest tools, research and industry relevant content and the gaps due to the fast changes happening in the technology.

**Credits Earned:** 03 Credits

**Course Outcomes:** After completion of this course, student will be able to:
1. To familiarize and learn about the latest trends and research in the field.
2. To equip themselves with the conceptual and practical experience of few latest methods, tools, technologies or algorithms in Data Analytics.
3. Access databases as a data scientist using Jupyter notebooks with SQL and Python
4. Work with advanced concepts like Stored Procedures, Views, ACID Transactions, Inner & Outer JOINs

**Pre-requisite of course:** Programming, Algorithms, Data Structures, Data Analytics Tools

**Teaching and Examination Scheme:**

| Teaching Scheme (Hours) | | | Credits | Theory Marks | | | Tutorial / Practical Marks | | Total Marks |
|---|---|---|---|---|---|---|---|---|---|
| | | | | E | I | | V | T | |
| Theory | Tutorial | Practical | | ESE | IA | CSE | Viva | Term Work | |
| 3 | 0 | 0 | 03 | 50 | 30 | 20 | 00 | 00 | 100 |

The course is offered with the objective of credit transfer by learning through MOOC course. The selection of the online course should reflect the syllabus content, mentioned below. The MOOC course must be of minimum 36 hours with appropriate assessment scheme.

**Content Overview:**

Major focus of the course will be on Capturing, managing and using data for decision making., Using tools for mining different types of data such as structured data, text data, and web data, Building the technology stack for Data Analytics in terms of 4 V's of big data, i.e. Volume, Velocity, Variety, and Veracity, Research Data Analytics in different industries, Data security issues, Ethics and privacy issues. The course also focuses on the intermediate SQL, Relational Database and integrating SQL with Python. Implement the concepts of Data Analytics to infer from the real time data dealing with different fields like Bioinformatics, Transportation, Logistics, Security, Education, Healthcare, Environment, Military, etc.

**Suggested Theory distribution:**

The suggested theory distribution as per Bloom's taxonomy is as per follows. This distribution serves as guidelines for teachers and students to achieve effective teaching-learning process.

| Distribution of Theory for course delivery and evaluation | | | | | |
|---|---|---|---|---|---|
| Remember | Understand | Apply | Analyze | Evaluate | Create |
| 10% | 20% | 40% | 30% | - | - |

# Subject Code: 01CT0818
# Subject Name: Analog Circuit Design
# (MOOC Credit)
# B. Tech. Year – IV (Semester VIII)

**Objective:**
The Objective of this course is to give students an understanding of Analog Circuit Design.

**Credits Earned:** 03 Credits

**Course Outcomes:** After completion of this course, student will be able to:
1. Design analog circuits with industry standard specifications
2. Analyze error budgeting of various analog circuits
3. Design current source for various applications
4. Understand detail working of different types of ADC
5. Do transformer design and heat sink design

**Pre-requisite of course:**
Basics of Electronics Engineering

**Teaching and Examination Scheme:**

| Teaching Scheme (Hours) | | | Credits | Theory Marks | | | Tutorial / Practical Marks | | Total Marks |
|---|---|---|---|---|---|---|---|---|---|
| | | | | E | I | | V | T | |
| Theory | Tutorial | Practical | | ESE | IA | CSE | Viva | Term Work | |
| 03 | 00 | 00 | 03 | 50 | 30 | 20 | 25 | 25 | 150 |

The course is offered with the objective of credit transfer by learning through MOOC course. The selection of the online course should reflect the syllabus content, mentioned below. The MOOC course must be of minimum 36 hours with appropriate assessment scheme.

**Content Overview:**
This course includes the analog circuit design concepts in detail. It covers basic design using transistors and opamp. It covers opamp based voltage regulator as a primary design and covers more opamp based designs which are applications in industry. The course also includes the calculations of probable errors in design with necessary error budgeting concepts which helps in critical design requirements. The course also includes design of current source and 4 to 20ma current transmitter to make students aware with industrial

need of such designs. Various types of Analog to Digital converters are also discussed in detail.

**Suggested Theory distribution:**

The suggested theory distribution as per Bloom's taxonomy is as per follows. This distribution serves asguidelines for teachers and students to achieve effective teaching-learning process.

| Distribution of Theory for course delivery and evaluation | | | | | |
|---|---|---|---|---|---|
| Remember | Understand | Apply | Analyze | Evaluate | Create |
| 10% | 20% | 40% | 30% | - | - |

# Subject Code: 01CT0819
# Subject Name: Real Time Operating System
# (MOOC Credit)
# B. Tech. Year – IV (Semester VIII)

**Objective:**

To acquire knowledge and skills about concepts related to real time OS such as scheduling techniques, threads, inter-thread communications, memory management, different types of scheduling, Common standards and commercial real time operating systems, multiprocessor and distributed system management.

**Credits Earned:** 03 Credits

**Course Outcomes:** After completion of this course, student will be able to:

1. Describe the fundamental concepts of RTOS.
2. Understand the resource sharing among real time tasks and protocols.
3. Develop programs for real time operating systems using Free RTOS.
4. Understand multiprocessor and distributed systems management.
5. Analyze various trace tools for real time operating systems.
6. Design Real World embedded system application with RTOS.

**Pre-requisite of course:**

Basic of Microcontroller programming, Embedded Concepts

**Teaching and Examination Scheme:**

| Teaching Scheme (Hours) | | | Credits | Theory Marks | | | Tutorial / Practical Marks | | Total Marks |
|---|---|---|---|---|---|---|---|---|---|
| | | | | E | I | | V | T | |
| Theory | Tutorial | Practical | | ESE | IA | CSE | Viva | Term Work | |
| 03 | 00 | 00 | 03 | 50 | 30 | 20 | 25 | 25 | 150 |

The course is offered with the objective of credit transfer by learning through MOOC course. The selection of the online course should reflect the syllabus content, mentioned below. The MOOC course must be of minimum 36 hours with appropriate assessment scheme.

**Content Overview:**

Introduction, Characteristics of Real –time system Embedded Systems, Types of real time tasks, Basics of Real Time- Task Scheduling, Cyclic executives, Cyclic Scheduler, Frame Size Constraints, Event Driven Scheduling, Rate Monotonic Scheduler, Challenges associated with RMA scheduling, Deadline monotonic scheduling, Resource sharing among real time tasks, Highest locker, Priority Inheritance and Priority Ceiling Protocols, Analysis of Priority Ceiling protocol, Handling Task dependencies, Embedded Firmware Design Approaches, Super-loop-based approach, Embedded Operating System based approach, Programming in EmbeddedC, Integrated development environment (IDE), Overview of IDEs for Embedded System Development, Introduction to multiprocessor and distributed systems, Static allocation of tasks, Dynamic allocation of tasks, Centralized clock synchronization in distributed RT systems, Distributed clock synchronization in RT systems, Unix based real time operating systems, Windows as RTOS, Basics of real time communication, Real-Time communication in LAN, Free RTOS trace analyzer setup, Analysis of valuable dynamic behavior information , troubleshoot, optimize Free RTOS firmware. Visualizing the real-time execution of tasks and ISRs, including Free RTOS calls and UserEvents.

**Supplementary Resources:**

1. https://www.st.com/en/embedded-software/freertos-kernel.html
2. https://www.freertos.org/portstm32iar.html
3. https://nptel.ac.in/courses/106105229

**Suggested Theory distribution:**

The suggested theory distribution as per Bloom's taxonomy is as per follows. This distribution serves asguidelines for teachers and students to achieve effective teaching-learning process.

| Distribution of Theory for course delivery and evaluation | | | | | |
|---|---|---|---|---|---|
| Remember | Understand | Apply | Analyze | Evaluate | Create |
| 10% | 20% | 40% | 30% | - | - |

# SubjectCode:01CT0820
# Subject Name: Introduction to 5G
# (MOOC Credit)
# B. Tech. Year – IV (Semester VIII)

**Objective:**

The Objective of this course is to provide the fundamental knowledge of the 5G network, its architecture, standards, data flow, mobility management and security aspects. In addition, the course focuses on interface configurations.

.

**Credits Earned:** 03 Credits

**Course Outcomes:** After completion of this course, student will be able to:

1. Understand the 5G network architecture and its components.
2. Analyse radio interface, data rate and latency of 5G networks.
3. Configure 5G network interfaces.
4. Analyse network protocol stack and its services.
5. Provide the security to 5G networks.

**Pre-requisite of course:**

Basic Knowledge of mobile communication, and computer networks

**Teaching and Examination Scheme:**

| Teaching Scheme (Hours) | | | Credits | Theory Marks | | | Tutorial / Practical Marks | | Total Marks |
|---|---|---|---|---|---|---|---|---|---|
| | | | | E | I | | V | T | |
| Theory | Tutorial | Practical | | ESE | IA | CSE | Viva | Term Work | |
| 03 | 00 | 00 | 03 | 50 | 30 | 20 | 25 | 25 | 150 |

The course is offered with the objective of credit transfer by learning through MOOC course.

**Content Overview:**

5G services and architecture, The New Radio interface: Introduction to the numerologies, frequency ranges, modulations, latency, power, capacity of the mobile network, difference between NR radio interface and LTE. Data Flow and Mobility Management, Security, Service-Based Interfaces and Virtualization, Security and Interconnection

**Suggested Theory distribution:**

The suggested distribution as per Bloom's taxonomy is as per follows. This distribution serves as guidelines for teachers and students to achieve theory effective teaching-learning process.

| Distribution of Theory for course delivery and evaluation | | | | | |
|---|---|---|---|---|---|
| Remember | Understand | Apply | Analyze | Evaluate | Create |
| 10% | 20% | 40% | 30% | - | - |

# Subject Code: 01CT0821
# Subject Name: OOAD
# (MOOC Credit)
# B. Tech. Year – IV (Semester VIII)

**Objective:**
The objective of the course is to make proficient students in software modelling & design using object-oriented concepts.

**Credits Earned:** 03 Credits

**Course Outcomes:** After completion of this course, student will be able to:
1. Understand the importance and basic concepts and of object oriented modelling.
2. Specify, analyze and design the use case driven requirements for a particular system
3. Model the event driven state of object and transform them into implementation specific layouts.
4. Identify, Analyze the subsystems, various components and collaborate them interchangeably.

**Pre-requisite of course:**
Students should have detailed Knowledge of Object Oriented Programming & Data Structure

**Teaching and Examination Scheme:**

| Teaching Scheme (Hours) | | | Credits | Theory Marks | | | Tutorial / Practical Marks | | Total Marks |
|---|---|---|---|---|---|---|---|---|---|
| | | | | E | I | | V | T | |
| Theory | Tutorial | Practical | | ESE | IA | CSE | Viva | Term Work | |
| 03 | 00 | 00 | 03 | 50 | 30 | 20 | 25 | 25 | 150 |

The course is offered with the objective of credit transfer by learning through MOOC course. The selection of the online course should reflect the syllabus content, mentioned below. The MOOC course must be of minimum 36 hours with appropriate assessment scheme.

**Content Overview:**
Introduction to Object Oriented Modelling, Object Oriented Modelling, Characteristics Object Oriented Modelling, Class and Objects Links and Association, UML: Introduction, Object Model Notations: Basic Concepts, Structural Diagrams, Behavioural Diagrams, Modelling with Objects, System Design: System Design: An Object Oriented Approach, Breaking into Subsystems, Objects, Handling Boundary Conditions. Object Design for Processing Defining Classes and delegation of

Responsibilities to Methods, Advance Modelling Concepts, Dynamic Modelling, Events, State and State Diagram, Functional Models, Data Flow Diagrams, Features of a DFD, Design flaws in DFD A Functional model.

**Suggested Theory distribution:**

The suggested theory distribution as per Bloom's taxonomy is as per follows. This distribution serves asguidelines for teachers and students to achieve effective teaching-learning process.

| Distribution of Theory for course delivery and evaluation | | | | | |
|---|---|---|---|---|---|
| Remember | Understand | Apply | Analyze | Evaluate | Create |
| 10% | 20% | 40% | 30% | - | - |

# Subject Code: 01CT0822
# Subject Name: Soft Computing
# (MOOC Credit)
# B. Tech. Year – IV (Semester VIII)

**Objective:**
Students completing this course will gain a broad understanding of soft computing theories and basics as well as the fundamentals of cutting-edge technologies and methods for tackling challenging problems in the real world.

**Credits Earned:** 03 Credits

**Course Outcomes:** After completion of this course, student will be able to:
1. Understand the basic concepts of soft computing.
2. Use the concepts of Fuzzy logic in various other domains.
3. Apply the techniques of Genetic Algorithms.
4. Understand the methods for optimizations of algorithms.
5. Apply the neural network and its architecture in different real-world problems.

**Pre-requisite of course:**
Students should have critical thinking and problem solving skills. They should have knowledge of Object Oriented Programming.

**Teaching and Examination Scheme:**

| Teaching Scheme (Hours) | | | Credits | Theory Marks | | | Tutorial / Practical Marks | | Total Marks |
|---|---|---|---|---|---|---|---|---|---|
| | | | | E | I | | V | T | |
| Theory | Tutorial | Practical | | ESE | IA | CSE | Viva | Term Work | |
| 03 | 00 | 00 | 03 | 50 | 30 | 20 | 25 | 25 | 150 |

The course is offered with the objective of credit transfer by learning through MOOC course. The selection of the online course should reflect the syllabus content, mentioned below. The MOOC course must be of minimum 36 hours with appropriate assessment scheme.

**Content Overview:**
Introduction to soft computing techniques, Basic concepts of fuzzy logic, artificial neural networks, Fuzzy Systems: Fuzzy sets, Fuzzy Relations and Fuzzy reasoning, Fuzzy decision making, Neuro - Fuzzy Modelling, Concept of "Genetics" and "Evolution" and its application to probabilistic search techniques, Encoding, Crossover, Selection, Mutation, Multi-objective Optimization Problem Solving, Pareto-based approaches to

solve MOOPs. Some applications with MOEAs, Artificial Neural Networks, Basic concepts - Single layer perception - Multilayer Perception -Supervised and Unsupervised learning, Application of Soft Computing.

**Suggested Theory distribution:**

The suggested theory distribution as per Bloom's taxonomy is as per follows. This distribution serves asguidelines for teachers and students to achieve effective teaching-learning process.

| Distribution of Theory for course delivery and evaluation | | | | | |
|---|---|---|---|---|---|
| Remember | Understand | Apply | Analyze | Evaluate | Create |
| 10% | 20% | 40% | 30% | - | - |

**Marwadi University**
**Faculty of Technology**
**Department of Information and Communication Technology**

# Subject Code: 01CT0823
# Subject Name: Cloud Technical Essentials
# (MOOC Credit)
# B. Tech. Year – IV (Semester VIII)

**Objective:**
The Objective of this course is to give students a basic understanding of cloud computing, services, applications and uses. Students will build highly available, scalable, and cost-effective application step-by-step.

**Credits Earned:** 03 Credits

**Course Outcomes:** After completion of this course, student will be able to:
1. Apply the informed decision about when and how to use core AWS services.
2. Use the AWS services to compute, storage, and database to different use cases.
3. Understand the cloud security with a review of AWS' shared responsibility mode.
4. Understand the AWS Identity and Access Management (IAM).
5. Use the AWS to optimize the cloud infrastructure.

**Pre-requisite of course:** NA

**Restrictions:** This course is only offered to the students who have not taken the elective course of Cloud Computing during their Semester 6 and Cloud developing their semester 7.

**Teaching and Examination Scheme:**

<table>
<tr><th colspan="3" rowspan="2">Teaching Scheme (Hours)</th><th rowspan="3">Credits</th><th colspan="3">Theory Marks</th><th colspan="2">Tutorial / Practical Marks</th><th rowspan="3">Total Marks</th></tr>
<tr><th>E</th><th colspan="2">I</th><th>V</th><th>T</th></tr>
<tr><th>Theory</th><th>Tutorial</th><th>Practical</th><th>ESE</th><th>IA</th><th>CSE</th><th>Viva</th><th>Term Work</th></tr>
<tr><td>03</td><td>00</td><td>00</td><td>03</td><td>50</td><td>30</td><td>20</td><td>25</td><td>25</td><td>150</td></tr>
</table>

The course is offered with the objective of credit transfer by learning through MOOC course. The selection of the online course should reflect the syllabus content, mentioned below. The MOOC course must be of minimum 36 hours with appropriate assessment scheme.

**Content Overview:**
AWS Overview and Security, definition of cloud computing, cloud value proposition, differentiate between workloads that run on-premises versus in the cloud, how to create an

AWS account, Amazon Web Services, basic components of Amazon Elastic Compute Cloud (Amazon EC2) architecture, how to differentiate between a container and a virtual machine, features and advantages of using serverless technologies, Amazon Virtual Private Cloud (Amazon VPC), Storage & Databases on AWS, how to optimize solutions on AWS, how to differentiate between vertical scaling and horizontal scaling, Amazon EC2 Auto Scaling, Configure High Availability for your Application.

**Suggested Theory distribution:**

The suggested theory distribution as per Bloom's taxonomy is as per follows. This distribution serves asguidelines for teachers and students to achieve effective teaching-learning process.

| Distribution of Theory for course delivery and evaluation | | | | | |
|---|---|---|---|---|---|
| Remember | Understand | Apply | Analyze | Evaluate | Create |
| 10% | 20% | 40% | 30% | - | - |

# Subject Code: 01CT0824
# Subject Name: Security Essentials
# (MOOC Credit)
# B. Tech. Year – IV (Semester VIII)

**Objective:**
The Objective of this course is to give students an understanding of cryptography, various techniques of cryptography. Students will be able to apply the knowledge to protect sensitive information and ensure the integrity of industrial control processes that has placed a premium on cybersecurity skills in today's information technology market.

**Credits Earned:** 03 Credits

**Course Outcomes:** After completion of this course, student will be able to:
1. Understand the classical cryptosystems and concepts.
2. Understand the various ciphers like monoalphabetic, polyalphabetic and Vigenère.
3. Apply the various mathematical functions such as GCD, Multiplicative inverse, Chinese remainder theorem.
4. Understand the working of Block Cipher, DES.
5. Understand and apply the Public Key Cryptography.

**Pre-requisite of course:**
Basic knowledge of OOP.

**Restrictions:** This course is only offered to the students who have not taken the elective course of Information and web security during their Semester 5, and cyber security in Semester 6.

**Teaching and Examination Scheme:**

| Teaching Scheme (Hours) | | | Credits | Theory Marks | | | Tutorial / Practical Marks | | Total Marks |
|---|---|---|---|---|---|---|---|---|---|
| | | | | E | I | | V | T | |
| Theory | Tutorial | Practical | | ESE | IA | CSE | Viva | Term Work | |
| 03 | 00 | 00 | 03 | 50 | 30 | 20 | 25 | 25 | 150 |

The course is offered with the objective of credit transfer by learning through MOOC course. The selection of the online course should reflect the syllabus content, mentioned below. The MOOC course must be of minimum 36 hours with appropriate assessment scheme.

**Content Overview:**

Introduction to Cryptography, Codes and Ciphers, Cryptanalysis, Modern Guiding Principles in Cryptography, Types of Cryptanalytic Attacks, Frequency Analysis of Monoalphabetic Ciphers, Multi-Character Frequency Analysis, Frequency Analysis of Monoalphabetic Ciphers – Example, Key Length Determination in Polyalphabetic Ciphers, Example of Cracking a Vigenere Cipher, Divisibility, Primes, GCD, Modular Arithmetic, Multiplicative Inverses, Extended Euclidean Algorithm, Eulers Totient Function, Discrete Logarithms, Chinese Remainder Theorem, Block Cipher and DES, Double-DES and Meet-in-the-Middle Attack, Triple DES, Advanced Encryption Standard (AES), Cipher Block Chaining (CBC), Cipher Feedback (CFB), Output Feedback (OFB)Counter (CTR), Asymmetric Cryptography, Asymmetric Encryption for Message Confidentiality, RSA, Key Distribution and Management.

**Suggested Theory distribution:**

The suggested theory distribution as per Bloom’s taxonomy is as per follows. This distribution serves as guidelines for teachers and students to achieve effective teaching-learning process.

| Distribution of Theory for course delivery and evaluation | | | | | |
|---|---|---|---|---|---|
| Remember | Understand | Apply | Analyze | Evaluate | Create |
| 10% | 20% | 40% | 30% | - | - |

# Subject Code: 01CT0825

# Subject Name: Machine Learning Essentials

# (MOOC Credit)

# B. Tech. Year – IV (Semester VIII)

**Objectives:** Machine Learning concern with designing and developing of algorithms that allow machines, essentially computers, to evolve realistic or human like behavior based on the empirical data available. This course aims to discuss the building blocks of machine intelligence. The focus would be on how to develop algorithms that can automatically learn and recognize the complex pattern from the available date to make an intelligent decision which will be accepted to the users.

**Credits Earned:** 03 Credits

**Course Outcomes:** After completion of this course, student will be able to:

1. Apply the fundamentals of probability theory and algebra to perceive the gist of supervised machine learning algorithms
2. Understand and apply unsupervised algorithm for clustering
3. Evaluate various machine learning algorithms with appropriate evaluation metrices
4. Implement appropriate machine learning algorithms for the given case study

**Pre-requisite of course:** Programming using Python, Linear Algebra, Probability

**Restrictions:** This course is only offered to the students who have not taken the elective course of Machine Learning during their Semester 5.

**Teaching and Examination Scheme:**

<table>
<tr><th colspan="3" rowspan="2">Teaching Scheme (Hours)</th><th rowspan="3">Credits</th><th colspan="3">Theory Marks</th><th colspan="2">Tutorial / Practical Marks</th><th rowspan="3">Total Marks</th></tr>
<tr><th>E</th><th colspan="2">I</th><th>V</th><th>T</th></tr>
<tr><th>Theory</th><th>Tutorial</th><th>Practical</th><th>ESE</th><th>IA</th><th>CSE</th><th>Viva</th><th>Term Work</th></tr>
<tr><td>3</td><td>0</td><td>0</td><td>03</td><td>50</td><td>30</td><td>20</td><td>00</td><td>00</td><td>100</td></tr>
</table>

The course is offered with the objective of credit transfer by learning through MOOC course. The selection of the online course should reflect the syllabus content, mentioned below. The MOOC course must be of minimum 36 hours with appropriate assessment scheme.

**Content Overview:**

Machine Learning Languages, Types, and Examples, Applications of Machine Learning, Machine Learning vs Statistical Modelling, Supervised vs Unsupervised Learning, Difference between Detection, Prediction and Generation, Basic types of data, exploring structure of data, plotting and exploring numerical data, categorical data, Data Quality and Remediation, data preprocessing, Importance of performance measurement, confusion matrix, Training Data Set, Testing Data Set, Validation Data Set, Overfitting, Underfitting, Bias, Variance, Supervised ad Unsupervised Learning Techniques. The course includes understanding the implementation of Machine Learning concepts to predict, classify or cluster the real time data dealing with different fields like Bioinformatics, Transportation, Logistics, Security, Education, Healthcare, Environment, Military, etc.

**Suggested Theory distribution:**

The suggested theory distribution as per Bloom's taxonomy is as per follows. This distribution serves as guidelines for teachers and students to achieve effective teaching-learning process.

| Distribution of Theory for course delivery and evaluation | | | | | |
|---|---|---|---|---|---|
| Remember | Understand | Apply | Analyze | Evaluate | Create |
| 10% | 20% | 40% | 30% | - | - |

# Subject Code: 01CT0826
# Subject Name: Human Computer Interaction (MOOC Credit)
# B. Tech. Year – IV (Semester VIII)

**Objective:**
The Objective of this course is to give students an understanding of an interface and what role a designer plays in creating a user interface. They will learn how to design and articulate meaning using color, type, and imagery is essential to making interfaces function clearly and seamlessly. Students will build solutions for problems in society, understanding needs of the people, finding gaps in needs and existing technological solutions.

**Credits Earned:** 03 Credits

**Course Outcomes:** After completion of this course, student will be able to:
1. Understand the key formal elements of clear, consistent, and intuitive UI design.
2. Apply the learned skills to the design of a static screen-based interface.
3. Use the elements of UI/UX.
4. Integrate the elements of UI/UX.
5. Understand black-box and white-box testing, describing the benefits and use of both black-box and white-box testing.

**Pre-requisite of course:** Basic knowledge of OOP.

**Teaching and Examination Scheme:**

| Teaching Scheme (Hours) | | | Credits | Theory Marks | | | Tutorial / Practical Marks | | Total Marks |
|---|---|---|---|---|---|---|---|---|---|
| | | | | E | I | | V | T | |
| Theory | Tutorial | Practical | | ESE | IA | CSE | Viva | Term Work | |
| 03 | 00 | 00 | 03 | 50 | 30 | 20 | 25 | 25 | 150 |

The course is offered with the objective of credit transfer by learning through MOOC course. The selection of the online course should reflect the syllabus content, mentioned below. The MOOC course must be of minimum 36 hours with appropriate assessment scheme.

**Content Overview:**
Introduction to Human Centered Design, Human Centered Design Process, Welcome to the UI/UX Design Specialization, Peer Review, Peer Review Tips, How to apply feedback, Required Tools, About CalArts and the Program in Graphic Design, Instructor Presence and Staff Support, Share stories and learn from user research, find

themes and cluster them, User Interface The Relationship Between UI and UX , Roles in UI/UXA Brief Historical Overview of Interface Design, Interface Conventions: Theory Interface Conventions: Application Template vs Content Aesthetics & Functionality, Mapping, Testing, Envisioning Mapping Content Mapping Interaction Non-Visual Paper Prototyping Non-Visual User Testing Sitemap Look and Feel/Visual Research, Design Before Design, Look and Feel, Language as a design tool, Color and Shape, Imagery, Typography, Icons, Functionality, Speed and Style, Composition and Structure, Buttons, Not Buttons, States and Changes, Conventions and Expectations, Structure and Grids, Platforms and Screen Sizes.

**Suggested Theory distribution:**

The suggested theory distribution as per Bloom's taxonomy is as per follows. This distribution serves asguidelines for teachers and students to achieve effective teaching-learning process.

| Distribution of Theory for course delivery and evaluation | | | | | |
|---|---|---|---|---|---|
| Remember | Understand | Apply | Analyze | Evaluate | Create |
| 10% | 20% | 40% | 30% | - | - |

**Marwadi University**
**Faculty of Technology**
**Department of Information and Communication Technology**

## Subject Code: 01CT0827
## Subject Name: Software Testing
## (MOOC Credit)
## B. Tech. Year – IV (Semester VIII)

**Objective:**
The Objective of this course is to give students an understanding of fundamental principles and processes of software testing. Students will learn about creation of test cases and run them using an automated testing tool. They will also be able to write and recognizing good test cases, including input data, and expected outcomes.

**Credits Earned:** 03 Credits

**Course Outcomes:** After completion of this course, student will be able to:
1. Understanding the goal of testing.
2. Use appropriate test terminology in communication, specifically: test fixture, logical test case, concrete test case, test script, test oracle, and fault.
3. Measure test adequacy using statement and branch coverage.
4. Assess the fault-finding effectiveness of a functional test suite using mutation testing.
5. Understand black-box and white-box testing, describing the benefits and use of each within the greater development effort.
6. Craft unit and integration test cases to detect defects within code and automate these tests using JUnit.

**Pre-requisite of course:**
Basic knowledge of OOP.

**Teaching and Examination Scheme:**

<table>
<tr><th colspan="3" rowspan="2">Teaching Scheme (Hours)</th><th rowspan="3">Credits</th><th colspan="3">Theory Marks</th><th colspan="2">Tutorial / Practical Marks</th><th rowspan="3">Total Marks</th></tr>
<tr><th>E</th><th colspan="2">I</th><th>V</th><th>T</th></tr>
<tr><th>Theory</th><th>Tutorial</th><th>Practical</th><th>ESE</th><th>IA</th><th>CSE</th><th>Viva</th><th>Term Work</th></tr>
<tr><td>03</td><td>00</td><td>00</td><td>03</td><td>50</td><td>30</td><td>20</td><td>25</td><td>25</td><td>150</td></tr>
</table>

The course is offered with the objective of credit transfer by learning through MOOC course. The selection of the online course should reflect the syllabus content, mentioned below. The MOOC course must be of minimum 36 hours with appropriate assessment scheme.

**Content Overview:**

Introduction, challenges of software testing, Test, Automation: Using a test framework, Automation: Writing JUnit tests, Testing Foundations, Dependability Definitions, Testing Principles, The "V Model" of Software Development, Validation and Verification in the "V Model", Structural Testing, Mutation Testing, Test Plan, Stages of Software Testing Process, Risk-based Test Planning, Software Defect Reports: Analysis and Report, Software Defect Reports: Track, Retest, and Close, Test Doubles: Introduction, Test Doubles: Input, Test Doubles: Output, Assessing Adequacy and Code Coverage Analysis with JaCoCo, Flakey Tests and How to Avoid Them. Web and Mobile Testing with Selenium.

**Suggested Theory distribution:**

The suggested theory distribution as per Bloom's taxonomy is as per follows. This distribution serves asguidelines for teachers and students to achieve effective teaching-learning process.

| Distribution of Theory for course delivery and evaluation | | | | | |
|---|---|---|---|---|---|
| Remember | Understand | Apply | Analyze | Evaluate | Create |
| 10% | 20% | 40% | 30% | - | - |

Marwadi University
Faculty of Technology
Department of Information and Communication Technology

## Subject Code: 01CT0828
## Subject Name: Cloud Architecture
## (MOOC Credit)
## B. Tech. Year – IV (Semester VIII)

**Objective:**
The Objective of this course is to give students an understanding of cloud architecture and its security issues.

**Credits Earned:** 03 Credits

**Course Outcomes:** After completion of this course, student will be able to:
1. Make architectural decisions based on AWS architectural principles and best practices.
2. Use AWS services to make infrastructure scalable, reliable, and highly available.
3. Use AWS managed services to enable greater flexibility and resiliency in an infrastructure.
4. Increase performance and reduce cost of a cloud infrastructure built on AWS.
5. Use the AWS Well-Architected Framework to improve architectures that use AWS solutions.

**Pre-requisite of course:**
Basic Knowledge of Cloud Computing.

**Teaching and Examination Scheme:**

| Teaching Scheme (Hours) | | | Credits | Theory Marks | | | Tutorial / Practical Marks | | Total Marks |
|---|---|---|---|---|---|---|---|---|---|
| | | | | E | I | | V | T | |
| Theory | Tutorial | Practical | | ESE | IA | CSE | Viva | Term Work | |
| 03 | 00 | 00 | 03 | 50 | 30 | 20 | 25 | 25 | 150 |

The course is offered with the objective of credit transfer by learning through MOOC course. The selection of the online course should reflect the syllabus content, mentioned below. The MOOC course must be of minimum 36 hours with appropriate assessment scheme.

**Content Overview:**
Welcome to AWS Academy Cloud Architecting, Introducing Cloud Architecting, Define cloud architecture, Define how to design and evaluate architectures using the AWS Well-Architected Framework, Adding a Storage Layer, Recognize the various Amazon S3 storage classes and cost Considerations, Adding a Compute Layer, Adding a Database

Layer, Creating a Networking Environment, Connecting Networks, Securing User and Application Access, Implementing Elasticity, High Availability, and Monitoring, Automating Your Architecture, Caching Content, Building Decoupled Architectures, Building Microservices and Serverless
Architectures, Planning for Disaster.

**Suggested Theory distribution:**

The suggested theory distribution as per Bloom's taxonomy is as per follows. This distribution serves asguidelines for teachers and students to achieve effective teaching-learning process.

| Distribution of Theory for course delivery and evaluation | | | | | |
|---|---|---|---|---|---|
| Remember | Understand | Apply | Analyze | Evaluate | Create |
| 10% | 20% | 40% | 30% | - | - |