



## COURSE HANDOUT (ABRIDGED)

**Session:** 2021-2022

**Sub Session:** Semester II (Jan-Jun)

**Course Name:** Data Structures (CS 102)

**L/T/P/C:** 3/0/3/4

### Course Description

This course aims to provide the students with solid foundations in the basic concepts of programming: data structures and algorithms. This course offers the students a mixture of theoretical knowledge and practical experience. The study of data structures is carried out within an object-oriented framework with implementations in Python programming language.

### Course Outcomes

S.No.	Description
CO1	To introduce common structures for storing collections of data and the associated relations along with algorithms for retrieving/modifying the data.
CO2	To introduce techniques for designing and implementing data structures – on modern computers using Python programming language
CO3	To introduce formal and experimental techniques for analyzing the performance (time and space requirements) of such data structures
CO4	To apply the acquired knowledge to solve engineering and research problems

### Course outcome mapping with Programme Outcomes:

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	3	3	2	2	3	3	2	3	2	2	1	3
CO2	3	3	2	2	3	3	2	3	3	2	2	2
CO3	3	2	3	2	3	3	2	2	3	2	2	2
CO4	3	2	3	2	3	3	2	2	2	2	3	3
Max.	3	3	3	2	3	3	2	3	3	2	3	3

3 is High, 2 is Moderate, 1 is Low & - is Not Applicable

### List of Tentative Practical

- P1. Array and its Operations- Insertion, Deletion, Union, Intersection, Searching
- P2. Stacks Operations- Push and Pop Operation
- P3. Queues- Enqueue and Dequeue Operation
- P4. Linked List and its Operations- Insertion, Deletion, Union, Intersection, Searching
- P5. Trees- Implementation of basic tree operation, Pre order traversal, Post order Traversal, In order Traversal
- P6. Graphs- Implementation of basic graph operation, Graph traversal- BFS and DFS, Prims and Kruskal Algorithm
- P7. Searching algorithms: Linear searching and Binary searching
- P8. Sorting: Insertion, Selection, Bubble, Quick, Merge, Heap, Comparison of Sorting Methods.

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## COURSE HANDOUT (ABRIDGED)

Session: 2021-2022

Sub Session: Semester II (Jan-Jun)

Course Name: Chemistry (CHM 111)

L/T/P/C: 3/0/3/4

### Course Description

This course continues the study of the fundamental principles and laws of chemistry and biology. Topics include Reactions of Organic Compounds, separation and purification- identification of organic compounds by spectroscopic techniques, oxidation and reduction reactions, photochemistry, supra molecular chemistry, nanoparticles and nano materials, green chemistry, recombinant DNA technology and computational molecular biology. Upon completion, students should be able to demonstrate an understanding of chemical and biological concepts as needed to pursue further study in chemistry or biology related professional fields. Laboratory experiments and computer-based exercises augment and reinforce the basic principles discussed in lecture as well as provide practical examples.

### Course Outcomes

S.No.	Description
CO1	Students will be skilled in problem solving, critical thinking and analytical reasoning as applied to scientific problems.
CO2	Plan to apply the techniques to different types of samples and fulfill research objectives, including selection of the most appropriate technique/instrumentation.
CO3	Understand the role of supramolecular chemistry in organic chemistry, chemical biology, materials science and nanotechnology.
CO4	Understand stoichiometric calculations and relate them to green process metrics. They learn alternative solvent media and energy sources for chemical processes. Students will appreciate the central role of chemistry in our society and use this as a basis for ethical behavior in issues facing chemists including an understanding of safe handling of chemicals, environmental issues and key issues facing our society in energy, health and medicine.
CO5	Understand a basic knowledge of modern molecular biology and genomics. To understand the advantages and disadvantages of different machine learning techniques in bioinformatics and how the relative merits of different approaches can be evaluated by correct bench-marking techniques. To understand how theoretical approaches can be used to model and analyze complex biological systems

### Course outcome mapping with Programme Outcomes:

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	3	2	1	2	2	2	3	1	1	2	1	2
CO2	3	2	2	2	2	2	2	1	1	1	1	2
CO3	3	2	1	2	2	2	2	1	1	1	1	1
CO4	3	2	1	2	2	2	2	1	1	1	1	1
CO5	3	2	2	2	2	2	2	1	1	1	1	1
Max.	3	2	2	2	2	2	3	1	1	2	1	2

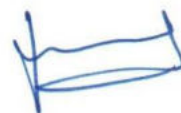
3 is High, 2 is Moderate, 1 is Low &amp; - is Not Applicable

  
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### List of Tentative Practical

CHM 111 Practical:

1. Quantification of DNA using spectrophotometry: In this practical we will be discussing about the methodology and calculating the concentration/quantity of DNA using values that were previously determined using the spectrometry.
2. Accessing Protein and DNA data bases: In this practical, we will be learning about how to access and retrieve the protein and the DNA databases that are available on online servers. (Links: Protein: <https://www.ncbi.nlm.nih.gov/protein/> and DNA/Gene: <https://www.ncbi.nlm.nih.gov/gene/>)
3. Sequence similarity analysis using BLAST: In this practical, we will be learning about how to use the sequence of the protein and the DNA that we retrieved in Practical 2, for doing sequence similarity searches using BLASTP and BLASTN tools.  
(Links: Protein: [https://blast.ncbi.nlm.nih.gov/Blast.cgi?PROGRAM=blastp&PAGE\\_TYPE=BlastSearch&LINK\\_LOC=blasthome](https://blast.ncbi.nlm.nih.gov/Blast.cgi?PROGRAM=blastp&PAGE_TYPE=BlastSearch&LINK_LOC=blasthome)  
DNA/Gene: [https://blast.ncbi.nlm.nih.gov/Blast.cgi?PROGRAM=blastn&PAGE\\_TYPE=BlastSearch&LINK\\_LOC=blasthome](https://blast.ncbi.nlm.nih.gov/Blast.cgi?PROGRAM=blastn&PAGE_TYPE=BlastSearch&LINK_LOC=blasthome))
4. Multiple sequence alignment using CLUSTALO: Here in this practical, we will be doing multiple alignment of protein and/or DNA/Gene sequences for a better understanding about how these multiple sequences of genes or proteins are related to each other. (Link: <https://www.ebi.ac.uk/Tools/msa/clustalo/>)
5. Correlate the Spectroscopic data with organic compound.
6. Determine the structure and give the name of organic compound using spectroscopic data.
7. Application of chemistry based software chemical structure drawing.  
(<https://www.acdlabs.com/resources/freeware/chemsketch/>)
8. Acid-Base Titration experiment. (<https://vlab.amrita.edu/?sub=2&brch=193&sim=352&cnt=2>)
9. Online Thin Layer Chromatography experiment. (<https://vlab.amrita.edu/?sub=3&brch=63&sim=154&cnt=1>)



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## COURSE HANDOUT (ABRIDGED)

**Session:** 2021-2022

**Sub Session:** Semester I (Jul-Dec)

**Course Name:** Capstone Project II (BT 4121)

**L/T/P/C:** 1/0/6/4

### Course Description

Capstone project II supports biotech students with entrepreneurial spirit, desire for creativity, and zest for innovation. In this capstone project student will work individually or in a team to develop an outstanding business plan for a new biotechnology company, a ground-breaking drug, or an emerging technology such as a diagnostic or medical device. The business plan will include background research on the idea and investigation of the following: market opportunity, market strategy, funding, intellectual property, patents and management.

### Course Outcomes

S.No.	Description
CO1	Identification and evaluation of industry and market opportunities, financial support, and seeding of a new business idea.
CO2	Recognize the interactive manner of steps in business model development and its functioning.
CO3	Advancement of leadership qualities, teamwork to show integrity, courtesy, reliability, and respect for others.
CO4	Progression of critical thinking, data analysis, decision-making and other professional skills immensely required by the biotech industries.
CO5	Ability to communicate, create and present an evidence-based entrepreneurship approach.

### Course outcome mapping with Programme Outcomes:

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	3	3	3	3	3	3	2	3	3	3	3	3
CO2	2	2	3	2	1	3	1	1	3	3	2	3
CO3	2	1	1	1	1	3	2	3	3	3	2	3
CO4	2	3	3	3	2	1	3	1	2	2	3	3
CO5	3	2	2	1	2	3	1	2	3	3	3	3
Max.	3	3	3	3	3	3	3	3	3	3	3	3

3 is High, 2 is Moderate, 1 is Low & - is Not Applicable

### List of Tentative Practical

All experiments need be to perform in lab to achieve the preliminary objective of idea generation. Referring to relevant case studies for build up of the entire business plan.

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## COURSE HANDOUT (ABRIDGED)

**Session:** 2021-2022

**Sub Session:** Semester II (Jan-Jun)

**Course Name:** Nanotechnology (BT 421)

**L/T/P/C:** 3/0/2/4

### Course Description

Nanotechnology is an area of scientific and technological opportunity that applies the tools and processes of nanofabrication to advance research in sciences. This course unlocks new promising avenue for students and enable them to create new micro- and nanoscale devices for better understanding the life processes at nanoscale level. The most important objective of this course is to apply nanotools to solve relevant medical/biological problems and refining these applications. Developing new tools in the field of bioenergy and environment is another primary objective in nanotechnology.

### Course Outcomes

S.No.	Description
CO1	Relevance of nanotechnology in the modern era of science and technology
CO2	Synthesis of nanoparticles from various sources and their characterization
CO3	Application of nanomaterials in the field of medical, bioenergy and bioremediation
CO4	Effect of nanoparticles on living systems and environment

### Course outcome mapping with Programme Outcomes:

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	3	3	3	3	3	3	3	2	3	3	3	3
CO2	3	3	3	3	3	3	3	2	3	2	3	3
CO3	3	3	3	3	3	3	3	3	3	3	3	3
CO4	3	2	3	3	3	3	3	3	3	3	3	3
Max.	3	3	3	3	3	3	3	3	3	3	3	3

3 is High, 2 is Moderate, 1 is Low & - is Not Applicable

### List of Tentative Practical

- P1: Preparation of the Fe nanoparticles under different pH condition
- P2: Preparation of the Fe nanoparticles under different temperature range
- P3: Synthesis of silver nanoparticle by chemical method
- P4: To fabricate gas sensing device using ZnO nanoparticles
- P5: Biosynthesis of silver nanoparticles by bacteria
- P6: Biosynthesis of CuO nanoparticles by bacteria
- P7: Biosynthesis of TiO<sub>2</sub> nanoparticles by bacteria
- P8: Assessment of toxic effects of nanoparticle towards bacteria by growth inhibition method
- P9: Assessment of toxic effects of nanoparticle towards bacteria by colony forming unit

  
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## COURSE HANDOUT (ABRIDGED)

**Session:** 2021-2022

**Sub Session:** Semester II (Jan-Jun)

**Course Name:** Microbiology (BIO 112)

**L/T/P/C:** 3/0/3/4

### Course Description

The objective of this course is to develop comprehensive knowledge of the microbial world and its components. This course introduces various principles, tools and techniques of microbiology that involves examining and characterising the microbes that inhabit our planet. This course will educate students about the vital role of microbiology to understand pathogenic potential of any microorganism and functioning of immune system. This course will also enhance the fundamental understanding of the microbial impact on our ecosystem as well as the 21st century challenges and opportunities that arise from our changing relationship with the microbes.

### Course Outcomes

S.No.	Description
CO1	Various classifications and components of microbial community
CO2	Tools and techniques to study and characterise microbial cultures for their potential beneficial and maleficent role
CO3	Role of microbiology to understand influence of microbes on immunity
CO4	Various kinds of microbial interactions and scope of microbiology in 21th century

### Course outcome mapping with Programme Outcomes:

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

3 is High, 2 is Moderate, 1 is Low & - is Not Applicable

### List of Tentative Practical

- P1: Culturing of microbes Plating, Streaking, Dilution plating.
- P2: Enumeration of microbial community in air, soil and H<sub>2</sub>O.
- P3: Characterisation of microbes from waste waters
- P4: Staining of microbes (Gram staining, Spore staining).
- P5: Growth curve and characteristics, (Optical density, Protein, CFU)
- P6: Enzymatic reactions for identifications of microbes.
- P7: Estimation of glucose
- P8: Estimation of protein.
- P9: Enzyme assays for extracellular enzymes, (Cellulase, Xylanase).
- P10: Isolation of DNA (Chromosome and Plasmid)

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## COURSE HANDOUT (ABRIDGED)

**Session:** 2021-2022

**Sub Session:** Semester I (Jul-Dec)

**Course Name:** Integrated Electronics (EL 301)

**L/T/P/C:** 3/0/2/4

### Course Description

This course introduces the fundamentals of MOS transistors. Designing of various VLSI circuits like multiplexer, flip-flop, latches, registers and optimization of various combinational & sequential digital circuits.

Course Contents:

Basic MOS transistors, Enhancement and Depletion Mode transistor action, NMOS and CMOS fabrication technology,  $I_{ds}$  versus  $V_{ds}$  relationship, threshold voltage, Transconductance  $g_m$ , NMOS and CMOS inverter, Pull up to Pull-down ratio, MOS transistor circuit Model, Noise Margin, CMOS logic circuits (NAND Gate, NOR gate, Compound Gates, 2 input CMOS Multiplexer, Memory latches and registers, Transmission Gate), Gate delays, CMOS-Gate Transistor sizing, Power dissipation, Layout for inverter, NAND, NOR Gates and Complex Logic gates, Layout optimization for performance, Introduction to HDL's & other design tools, VHDL/Verilog Code for combinational & Sequential digital circuits. CMOS Cascode amplifier, Current Mirror Sources, Cascode Current mirror, Wilson Curr

### Course Outcomes

S.No.	Description
CO1	Understand the working of the MOS transistor and will come to learn the CMOS technology.
CO2	Designing the low power, high-speed digital CMOS design.
CO3	Analyze and design gate-level combinational and sequential logic circuits using Boolean algebra.
CO4	Explore the Hardware Description Language to design the basic combinational and sequential digital circuits.

### Course outcome mapping with Programme Outcomes:

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	3	3	3	3	3	3	3	2	3	3	3	3
CO2	3	3	3	3	2	3	3	3	2	3	2	3
CO3	3	2	3	3	2	3	3	3	3	3	3	3
CO4	3	2	3	3	3	3	3	3	3	3	3	3
Max.	3	3	3	3	3	3	3	3	3	3	3	3

3 is High, 2 is Moderate, 1 is Low & - is Not Applicable

### List of Tentative Practical

Exp01: Simulation of  $I_d$ - $V_{ds}$  and  $I_d$ - $V_{gs}$  characteristics of nMOS Enhancement MOSFET

Exp02. Design and simulation of nMOS/CMOS inverter using LT spice and compare their characteristics

Exp03. Design and simulate 2-input NAND/NOR Gate using LT spice

Exp04. Design and simulate Full adder CMOS circuit using LT spice

Exp05. Design and simulate SRAM cell

Exp06: Design CMOS inverter using VHDL/Verilog

Exp 07. Analyze SRAM using VHDL

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## COURSE HANDOUT (ABRIDGED)

**Session:** 2021-2022

**Sub Session:** Semester I (Jul-Dec)

**Course Name:** Digital Image Processing (EL 302)

**L/T/P/C:** 3/0/2/4

### Course Description

Digital Image Processing course at UG level introduces the fundamentals of Image Processing. The course will cover a wide range of Image Processing techniques in time and frequency domain. Apart from image processing, video handling will also get covered in the course.

### Course Outcomes

S.No.	Description
CO1	Examine various types of images, intensity transformations and spatial filtering.
CO2	Develop Fourier transform for image processing in frequency domain.
CO3	Evaluate the methodologies for image segmentation, restoration, color image processing etc.
CO4	Apply image processing algorithms in practical applications.
CO5	Implement image process and analysis algorithms.

### Course outcome mapping with Programme Outcomes:

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	3	2	2	2	2	2	2	2	1	2	1	3
CO2	3	3	2	2	3	1	3	3	3	3	1	3
CO3	3	3	2	2	1	2	3	2	3	2	3	3
CO4	2	3	3	3	2	2	2	2	2	2	3	3
CO5	1	3	1	3	2	3	3	3	3	1	2	1
Max.	3	3	3	3	3	3	3	3	3	3	3	3

3 is High, 2 is Moderate, 1 is Low & - is Not Applicable

### List of Tentative Practical

- Exp01. Reading and Writing an Image.
- Exp02: Color to Gray scale conversion.
- Exp03: Creating Black and White Image.
- Exp04: Intensity range adjustment.
- Exp05: Contrast Stretching and Bit plane slicing.
- Exp06: Intensity transformations: Anti-log, log, negative, nth root, power.
- Exp07: Affine Transformations: Scaling, Shear, Translation.
- Exp08: Histogram: stem histogram, plot histogram, histogram using imhist, histogram equalization.
- Exp09. Correlation and Convolution in Filtering.
- Exp10. Smoothing Filters-Gaussian, avg, median filters.
- Exp11. Gradient Filters - prewitt, Sobel, Roberts filters.
- Exp12. Morphological processing: Erosion, dilation, closing, Opening, boundary detection

  
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## COURSE HANDOUT (ABRIDGED)

**Session:** 2021-2022

**Sub Session:** Semester II (Jan-Jun)

**Course Name:** Digital Signal Processing (EL 311)

**L/T/P/C:** 3/0/2/4

### Course Description

Digital Signal Processing Course at Fourth semester UG level introduces introduction to the digital signals and Systems. The course is designed to explain how analog signals are represented by their discrete-time samples, and how to represent discrete-time signals in the frequency domain. The course will illustrate how discrete time, linear shift invariant systems can be characterized using linear difference equations and the impulse response and show how tools such as the z-transform and discrete Fourier transform can be used in the design and analysis of such systems. The course will illustrate how to design filters with desired frequency response. To facilitate the learning, a complete model of a DSP system will be analyzed through all the stages, including input, signal conditioning, anti-aliasing filter, analog-to-digital and digital-to-analog conversion, output smoothing filter, and signal output.

### Course Outcomes

S.No.	Description
CO1	Understand the types and classification of various types of Signals and Systems.
CO2	Describe and demonstrate the frequency response, impulse response, and Z transform of digital signals.
CO3	Describe and demonstrate the DTFT, DFT and FFT Transform Techniques.
CO4	Describe the various types of Analog and Digital Filtering Techniques, Design approximation and structural representation of filters in digital and analog domain.
CO5	Design and simulate various Modulation technique on Digital Communication Trainer Kit and Simulation done on MATLAB software.

### Course outcome mapping with Programme Outcomes:

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	3	2	3	3	3	2	3	3	3	3	3	3
CO2	3	3	2	3	3	2	3	3	3	3	2	3
CO3	3	3	3	3	3	2	3	3	3	3	2	3
CO4	3	2	3	3	2	2	3	3	3	2	3	2
CO5	3	2	3	2	2	3	2	1	2	2	3	2
Max.	3	3	3	3	3	3	3	3	3	3	3	3

3 is High, 2 is Moderate, 1 is Low & - is Not Applicable

  
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### List of Tentative Practical

Exp01: Introduction to MATLAB for Signal Processing.

Exp 02: WAP of Signal manipulation, convolution and correlation in MATLAB.

Exp 03: (a) WAP to find a circular convolution using MATLAB. (b) WAP to study and Analysis the response of Low Pass Filter, High Pass Filter & Band Pass Filter (using hardware and MATLAB).

Exp 04: WAP to find a DFT of a discrete signal using FFT command.

Exp 05: Study the features of DSP Training Kit (TMS 320 X 6745).

Exp 06. WAP of Convolution, Correlation on DSP Training Kit (TMS 320 X 6745).

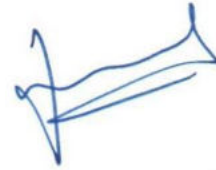
Exp07. WAP of LED Matrix Interface and Switch LEDs on DSP training KIT. (TMS 320 X 6745).

Exp 08. WAP to Study Impulse Response and Frequency Response of analog and digital filtering systems in MATLAB.

Exp 09. WAP to Design and Visualize the LPF, HPF, BPF, BSF using FDA tool FV tool in MATLAB.

Exp 10. WAP to Design and Visualize the FIR filters using Different windowing Techniques in MATLAB (a) Rectangular Window (b) Triangular Window (c) Kaiser Window.

Exp 11. WAP to Design and Visualize the Chebyshev, Butterworth and Elliptic Filter in MATLAB.



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## COURSE HANDOUT (ABRIDGED)

**Session:** 2021-2022

**Sub Session:** Semester I (Jul-Dec)

**Course Name:** Advanced Embedded Systems (EL 312)

**LT/P/C:** 3/0/2/4

### Course Description

This course is intended for those ECE and CSE students who have already gone through a course on 8-bit microcontrollers. The course will focus on 32-bit embedded systems with real-time operating system (RTOS) and their applications in diverse areas. The course also covers important communication protocols such as USB and Controller-Area Network.

### Course Outcomes

S.No.	Description
CO1	Understanding the architecture and instruction set of ARM7-based 32-bit microcontrollers
CO2	Understanding basics of Real-time Operating Systems
CO3	Understanding the needed for boundary scan in testing, debugging and programming (IEEE 1149.1)
CO4	Getting to know communication interfaces (I2C, USB and CAN) commonly used in embedded systems
CO5	Building familiarity with Embedded Systems in areas such as transportation, medical instrumentation etc.

### Course outcome mapping with Programme Outcomes:

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	3	3	3	2	3	2	2	2	2	2	1	2
CO2	3	3	3	3	3	2	2	2	2	2	2	3
CO3	3	2	2	3	3	1	1	2	1	1	1	2
CO4	3	3	3	2	3	1	1	1	1	1	1	2
CO5	2	3	3	3	3	3	3	2	3	2	2	3
Max.	3	3	3	3	3	3	3	2	3	2	2	3

3 is High, 2 is Moderate, 1 is Low & - is Not Applicable

### List of Tentative Practical

1. Getting familiar with ARM Cortex Software Development Environment and the lab hardware
2. Writing ARM7 assembly program for understanding instruction set of STM32F103 family of microcontrollers ((e.g. three-operand instructions, use of shifter-operand, IT Block etc.)
3. Analyzing and modifying existing CMSIS program for GPIO manipulation
4. Using STM32 timer in CMSIS framework to generate single pulse of given duration and extending it to generate square wave of given frequency
5. Generating a PWM waveform using the timer peripheral of STM32 microcontroller
6. Using CMSIS framework to establish serial communication link with the host PC and communicate ADC readings over this link.
7. Debug a given STM32 program
8. Using RTOS functions to create and execute three processes on a 8-bit microcontroller
9. Writing program to demonstrate usage of semaphores for process synchronization in RTOS
10. Setting up a Controller Area Network with three nodes
11. Observing and analyzing the USB transactions between a host and a peripheral using a software protocol analyzer

  
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## COURSE HANDOUT (ABRIDGED)

**Session:** 2021-2022

**Sub Session:** Semester II (Jan-Jun)

**Course Name:** Electromagnetic Theory (EL 321)

**L/T/P/C:** 3/1/0/4

### Course Description

This course deals essentially with electricity and magnetism. Throughout the course the emphasis will be on electromagnetic waves as they play an important role in the theory of communication

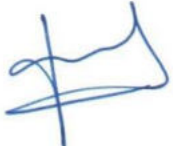
### Course Outcomes

S.No.	Description
CO1	Understand the potential problems within electrostatics, magnetostatics and static current distributions in isotropic media.
CO2	Derive terms for the energy associated with both the electrostatic and magneto-static fields.
CO3	Demonstrate an understanding of Maxwells equations and their derivation from the empirical laws of electromagnetism.
CO4	Explain the propagation of plane electromagnetic waves in vacuum and in simple media.
CO5	Understand the detailed analysis of Transmission Lines and related applications.

### Course outcome mapping with Programme Outcomes:

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	3	1	1	1	1	1	1	2	1	1	1	2
CO2	2	3	1	1	2	1	1	1	1	1	1	2
CO3	3	3	3	1	2	1	1	1	1	1	2	3
CO4	3	2	2	3	1	1	1	2	2	1	2	3
CO5	3	2	3	3	2	1	1	1	2	1	2	3
Max.	3	3	3	3	2	1	1	2	2	1	2	3

3 is High, 2 is Moderate, 1 is Low & - is Not Applicable

  
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## COURSE HANDOUT (ABRIDGED)

**Session:** 2021-2022

**Sub Session:** Semester II (Jan-Jun)

**Course Name:** Industrial Control, Robotics and Automation  
(EL 322)

**L/T/P/C:** 3/0/2/4

### Course Description

Introduction, Architecture and dynamics of Industrial Automation and Robotics, Measurements of Physical parameters- Temperature, Pressure, Force Sensor, Motion sensing, Signal Conditioning- ADC / DAC, Noise filtering, Signal strength enhancement and Estimation.

Introduction to Automatic Control -PID, Feed Forward, and Feedback Control, Supervisory Control and Data Acquisition (SCADA) in Industrial Process, Concepts of Sequence control and ladder structure .

Phase-locked Loop ( PLL) Controller- Phase Comparator, Loop Filter , Voltage Controlled Oscillator (VCO), Relay Ladder Logic ( RLL) for Industrial Control , Ladder Logic to program Programmable Logic Circuits ( PLC) – Logical AND , Logical AND with NOT , Industrial STOP/ START , Complex Logic , Syntax and semantics of software for RLL based Industrial Control

### Course Outcomes

S.No.	Description
CO1	Acquire knowledge about Automatic Control , Define and explain feedback and feed-forward control architecture and discuss the importance of performance, robustness and stability in control design
CO2	Acquire knowledge about the working Measurements of Physical parameters
CO3	Familiarize with different industrial power and automation equipment
CO4	Acquire knowledge about SCADA system components: remote terminal units, PLCs, intelligent electronic devices, HMI systems, SCADA server Acquire knowledge about PLC , communication, various industrial communication technologies, open standard communication protocols

### Course outcome mapping with Programme Outcomes:

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	3	3	3	3	3	2	3	2	3	3	3	2
CO2	3	3	2	2	3	3	2	3	3	3	2	3
CO3	3	3	3	3	2	3	3	3	3	2	2	2
CO4	3	3	3	2	2	3	2	2	3	3	3	2
Max.	3	3	3	3	3	3	3	3	3	3	3	3

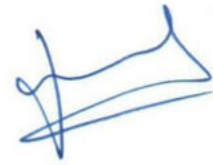
3 is High, 2 is Moderate, 1 is Low & - is Not Applicable

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### List of Tentative Practical

#### List of Experiments:

- (i). To Control Speed of Stepper motor using PLC Controller
- (ii) To Control Speed of AC Servomotor using PLC Control
  - (iii) Study hardware and software used in PLC ;Implementation Logic Gates;Implementation Of DOL Starter
  - (iv) Study hardware and software used in PLC ;Implementation Of On-Delay Timer;Implementation Of Off-Delay Timer
- (v) Study hardware and software used in PLC Implementation Of Up-Down Counter;Implementation Of PLC Arithmetic Instructions : Implementation Of PID Controller
  
- (v) Logic implementation for traffic Control Application
- (vi) Logic implementation for Bottle Filling Application
- (vii) To study Online parameter Estimation and Adaptive Control Performance (vii) To Simulate and Study Automated Driving System: Adaptive Cruise Control
- (viii) To Simulate and Study the Adaptive Control System for Temperature and Fan
  - (ix) To study water level Controller performance using PLC
  - (x) To determine and Communicate Set points for PLC using SCADA
  - (xi) To determine Locking range of PLL Controller for audio frequency range
  - (xii) To determine Gear teeth ratio and Diameters and establish relation with RPM Using PLC



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## COURSE HANDOUT (ABRIDGED)

**Session:** 2021-2022

**Sub Session:** Semester II (Jan-Jun)

**Course Name:** IOT and Sensor Networks (EL 332)

**L/T/P/C:** 3/0/2/4

### Course Description

Internet of Things (IoT) is a system of interrelated computing devices, mechanical and digital machines, or objects that are provided with unique identifiers and the ability to transfer data over a network without requiring human-to-human or human-to-computer interaction. IoT cuts across different application domain ranging from civilian to defence sectors. These domains include agriculture, space, healthcare, manufacturing, construction, water, etc which are presently transitioning their legacy infrastructure to support IoT. IoT-based applications such as innovative shopping system, infrastructure management in both urban and rural areas, remote health monitoring systems, and transportation systems, are gradually relying on IoT based systems. Therefore, it is very important to understand the fundamentals of this emerging technology. The objective of this course module is to acquaint the students with the basics of IoT. This course gets them familiar with various sensors and actuators.

### Course Outcomes

S.No.	Description
CO1	Understand the IoT and its characteristics
CO2	Analyze the combination of AI and IoT with its impact on society.
CO3	Understand and analyze the design and architecture of sensors as well as actuators and their role in IoT,
CO4	Explore the various IoT device architecture, protocols, Fog and cloud computing along with edge computing in IoT.
CO5	Understand the various applications of IoT in farming, industry etc.

### Course outcome mapping with Programme Outcomes:

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

3 is High, 2 is Moderate, 1 is Low & - is Not Applicable

### List of Tentative Practical

will inform the student in advance

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## COURSE HANDOUT (ABRIDGED)

**Session:** 2021-2022

**Sub Session:** Semester II (Jan-Jun)

**Course Name:** Capstone Project I (CS 392)

**LT/PIC:** 1/0/6/4

### Course Description

By empowering students with the skills necessary to access, understand and evaluate Information, Capstone Project will support students in the achievement of 21st century learning expectations. Students work in teams to develop or implement a real-world IT solution.

- Address a typical business and organizational need such as data management, application development, system deployment, or security analysis.
- Usage of HTML, CSS, JavaScript, JQuery and BootStrap along with Web Application Framework.
- Apply information technologies, applications, best practices, and standards in technical design, development, and implementation.
- Practice soft skills in a real-world IT project, including project planning and management, research and learning, communication, writing, presentation, and teamwork.

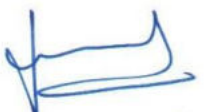
### Course Outcomes

S.No.	Description
CO1	Django is a Python based web development framework that assists in building and maintaining quality web applications. Django helps eliminate repetitive tasks making the development process an easy and time saving experience. Students will learn to use Django Framework in building Web Application.
CO2	Flask is a web application framework written in Python. Flask is also easy to get started as there is little boilerplate code for getting a simple app up and running.
CO3	Introduction to software estimation. Preparing for a demonstration of the project.
CO4	Writing Test Cases.

### Course outcome mapping with Programme Outcomes:

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	1	1	2	1	3	2	1	3	3	3	3	3
CO2	1	1	2	1	3	2	1	3	3	3	3	3
CO3	1	1	1	1	3	2	1	3	3	3	3	3
CO4	1	1	1	1	3	2	1	3	3	3	3	3
Max.	1	1	2	1	3	2	1	3	3	3	3	3

3 is High, 2 is Moderate, 1 is Low & - is Not Applicable

  
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## COURSE HANDOUT (ABRIDGED)

**Session:** 2021-2022

**Sub Session:** Semester I (Jul-Dec)

**Course Name:** Artificial Neural Network (CS 342)

**L/T/P/C:** 3/0/2/4

### Course Description

- This course is an introduction to Artificial Neural Networks.
- It will focus on the computational fundamentals of artificial neural networks and their applications.

### Course Outcomes

S.No.	Description
CO1	Understand various concepts of ANN
CO2	Understand the mathematical background of ANN
CO3	Learn to write basic algorithms for implementing ANN
CO4	Learn to develop applications of neural networks to solve various computational and research problem

### Course outcome mapping with Programme Outcomes:

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	3	3	3	3	2	1	1	1	1	1	1	3
CO2	3	3	3	3	2	1	1	1	1	1	1	3
CO3	3	3	3	3	3	3	3	1	1	1	1	3
CO4	3	3	3	3	3	1	3	3	3	3	1	3
Max.	3	3	3	3	3	3	3	3	3	3	1	3

3 is High, 2 is Moderate, 1 is Low & - is Not Applicable

### List of Tentative Practical

Project topics would be discussed and finalized after group formation. The project should be based on the concepts of Artificial Neural Network or its applications. Practical assignments will be announced in lab sessions.

  
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## COURSE HANDOUT (ABRIDGED)

**Session:** 2021-2022

**Sub Session:** Semester I (Jul-Dec)

**Course Name:** Real-Time Operating Systems (EL 352)

**L/T/P/C:** 3/0/2/4

### Course Description

The objective of the course is to introduce the principles shared by many real-time operating systems, and their use in the development of embedded multitasking application software

### Course Outcomes

S.No.	Description
CO1	Explain fundamental principles Real Time Operating System for embedded application.
CO2	Account for how real time operating systems is designed and functions
CO3	Decide the optimum use of real time system for real time applications meets the requirement in a time constrain environment. In other sense, students will know suitable deployment technique.

### Course outcome mapping with Programme Outcomes:

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	2	2	2	2	2	2	2	1	1	2	1	1
CO2	2	3	2	2	3	2	3	1	1	3	2	2
CO3	3	3	3	3	3	3	3	2	2	3	2	3
Max.	3	3	3	3	3	3	3	2	2	3	2	3

3 is High, 2 is Moderate, 1 is Low & - is Not Applicable

### List of Tentative Practical

- Expt1- Basic understanding of Operating system understanding.
- Expt2- Use of Karnal.
- Expt3- Scheduling of task.
- Expt4- Use of RTOS library for PIC18F series of microcontrollers. (Integrated with Embedded System Lab.)
- Expt5- ARM7 as a real time embedded platform. (Integrated with Embedded System Lab.)
- Expt6- Application of RTOS in embedded computing. (Integrated with Embedded System Lab.)

  
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## COURSE HANDOUT (ABRIDGED)

**Session:** 2021-2022

**Sub Session:** Semester I (Jul-Dec)

**Course Name:** Kinematics of Robotics (EL 362)

**L/T/P/C:** 3/1/0/4

### Course Description

This course is design to enable students acquire knowledge regarding mechanics and dynamical behaviour of various types of robot, kinematic analysis of planar closed-loop and open- loop chains, coordinate transformation, direct and inverse kinematics, Denavit- Hertenberg parameterization, velocity, acceleration and force analysis, Parametrization and Inverse Kinematics of Robots, Independent joint and multivariable Control, Feedback liniarization , Adaptive and Optimal Control

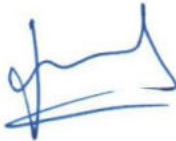
### Course Outcomes

S.No.	Description
CO1	Introduction to Kinematics of Robots.
CO2	Mechanics and Dynamical behavior of Robots
CO3	Analysis of closed loop and open loop chains
CO4	Acceleration , Force and parametrization
CO5	Inverse Kinematics of Robots

### Course outcome mapping with Programme Outcomes:

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	3	3	2	2	3	1	2	1	1	3	1	1
CO2	3	3	3	2	2	2	2	3	1	1	1	1
CO3	2	3	3	2	2	1	1	2	2	2	2	2
CO4	2	2	3	3	3	2	2	1	2	1	2	1
CO5	3	2	3	3	3	2	2	3	1	1	2	1
Max.	3	3	3	3	3	2	2	3	2	3	2	2

3 is High, 2 is Moderate, 1 is Low & - is Not Applicable

  
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## COURSE HANDOUT (ABRIDGED)

**Session:** 2021-2022

**Sub Session:** Semester I (Jul-Dec)

**Course Name:** Architecture, Protocols and Design Principles  
of IOT (EL 372)

**L/T/P/C:** 3/0/2/4

### Course Description

The course enables student to understand the basics of Internet of things Architecture and protocols. It introduces some of the application areas where Internet of Things can be applied. The course also helps to understand the IoT Reference Architecture and Real World Design Constraints. The course also give the insights of the various embedded and cloud security concepts.

### Course Outcomes

S.No.	Description
CO1	Understand the IoT architecture, XaaS, M2M and IoT analytics
CO2	Analyze different types of IoT network protocols
CO3	Understand IoT transport, session and Service layer
CO4	Explore the security threat in embedded IoT system and recovery .
CO5	Understand the security issues in Zigbee, embedded security design and its principle

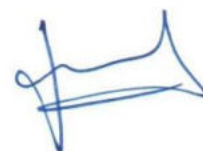
### Course outcome mapping with Programme Outcomes:

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

3 is High, 2 is Moderate, 1 is Low & - is Not Applicable

### List of Tentative Practical

This semester due to online mode, there will be no structured lab



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## COURSE HANDOUT (ABRIDGED)

**Session:** 2021-2022

**Sub Session:** Semester II (Jan-Jun)

**Course Name:** Cellular and Mobile Communication (EL 421)

**L/T/P/C:** 3/0/2/4

### Course Description

This course provides fundamental concepts of Mobile Communication and specifics of current and proposed Cellular Systems. The course explains to study the layers of system model, access methods and networks to service platforms. The aim of this course is to understand the various terminologies, devices, schemes, concepts, algorithms and different methodologies used in Cellular communication Networks. The course explains to analyze how various Communication model layers are working in the Mobile Communication Environment. The course also help to understand the 3G and 4G Wireless Standards and explains the detailed study of the Mobile Network and Transport layer, Mobile Agents and protocols. The course will also illustrate the use of various Data Services, Device management and Language support, GPRS, Wireless devices and their Operating system in Cellular Environment

### Course Outcomes

S.No.	Description
CO1	to study the layers of system model, access methods and networks to service platforms
CO2	to understand the various terminologies, devices, schemes, concepts, algorithms and different methodologies used in Cellular communication
CO3	explains to analyze how various Communication model layers are working in the Mobile Communication Environment
CO4	course will also illustrate the use of various Data Services, Device management and Language support, GPRS, Wireless devices and their Operating system in Cellular Environment
CO5	also help to understand the 3G and 4G Wireless Standards and explains the detailed study of the Mobile Network and Transport layer, Mobile Agents and protocols

### Course outcome mapping with Programme Outcomes:

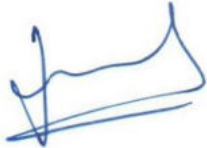
CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	3	3	3	3	2	2	3	2	-	3	-	3
CO2	3	3	3	3	3	2	3	2	-	3	1	3
CO3	3	3	3	3	3	3	3	3	1	3	1	3
CO4	3	3	3	3	3	3	3	3	-	3	-	3
CO5	3	2	2	1	2	3	2	3	-	2	-	3
Max.	3	3	3	3	3	3	3	3	1	3	1	3

3 is High, 2 is Moderate, 1 is Low & - is Not Applicable

### List of Tentative Practical

Tentative List of Experiment:

- Expt01 – Understanding Fading
- Expt02 – Analyzing effect of various fading (Part-I)
- Expt03 - Analyzing effect of various fading (Part-II).
- Expt04 – Analyzing effect of various fading (Part-III).
- Expt05 – Propagation channel property and propagation profile.
- Expt06 - Analysis of signal strength and error rate.
- Expt07 – MATLAB simulation of LTE.

  
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## COURSE HANDOUT (ABRIDGED)

**Session:** 2021-2022

**Sub Session:** Semester II (Jan-Jun)

**Course Name:** English Literature (ENG 102)

**L/T/P/C:** 3/0/0/3

### Course Description

With time and advent of new technologies human kind is losing touch with the wisdom that comes from reading books. The new torch bearers of the world, the younger generation is often seen completely oblivious to the benefits of reading a good book in their leisure time. This course aims at encouraging the healthy habit of reading books in the young generation. The books can be from any genre but will surely give them some food for thought at the end of the day.


### Course Outcomes

S.No.	Description
CO1	Gain better insight into human nature and character through the study of scientific, historical or purely literary texts.
CO2	Interpret and examine a variety of texts and express themselves effectively in a variety of verbal and written forms.
CO3	Identify the salient features of literary/historical/scientific texts from a broad range of Asian, European and American writings.
CO4	Employ knowledge of literary traditions to produce imaginative as well as interpretive explanatory writing.
CO5	Demonstrate critical reading, writing, and thinking skills through analysis, synthesis, and evaluation of important ideas

### Course outcome mapping with Programme Outcomes:

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

3 is High, 2 is Moderate, 1 is Low & - is Not Applicable

  
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## COURSE HANDOUT (ABRIDGED)

**Session:** 2021-2022

**Sub Session:** Semester II (Jan-Jun)

**Course Name:** Environmental Science (ENV 301)

**L/T/P/C:** 3/0/0/3

### Course Description

The Multidisciplinary Nature of Environmental Studies- Definition, scope and importance  
Need for public awareness.

### Course Outcomes

S.No.	Description
CO1	To consider how the natural and built environments shape and are shaped by multiple socio-cultural and political factors.
CO2	To think across and beyond existing disciplinary boundaries, mindful of the diverse forms of knowledge and experience that arise from human interactions with the world around them.
CO3	To live responsibly and appreciate the environmental and cultural histories of the places they inhabit.
CO4	To cultivate compassion, curiosity, collaboration, and hope
CO5	To nurture knowledge, respect, and love for the natural and human communities of central Maine, the place where they spend four formative years of their lives.

### Course outcome mapping with Programme Outcomes:

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

3 is High, 2 is Moderate, 1 is Low & - is Not Applicable

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## COURSE HANDOUT (ABRIDGED)

**Session:** 2021-2022

**Sub Session:** Semester II (Jan-Jun)

**Course Name:** Environment and Sustainability (ENV 311)

**L/T/P/C:** 3/0/0/3

### Course Description

This course aims at making students learn the implication of sustainable development and how the practices to make development sustainable are managed in various settings around the globe. This course will give the students an opportunity to learn about global trends that influence our environment and the living conditions and how different management systems and approaches that are used in various parts of the world which help us manage the environment. The course is intended to make students learn how to meet the demands of present and future as a decision-makers and to analyze ethical challenges associated with environmental dilemmas and apply different decision-making tools relevant to environmental management and regulation.

This course will enable the students to understand various approaches of Sustainability and to explore the ways our society may endure in the face of global change, ecosystem degradation and resource limitations. The course aims at delivering key knowledge areas of sustainability theory and practice so to ensure the effectiveness of principles of the long-term welfare of all the habitats of the planet.

### Course Outcomes

S.No.	Description
CO1	Understanding that the concept of sustainability is composed of three pillars: economic, environmental, and social—also known informally as profits, planet, and people.
CO2	Climate change can alter where species live, how they interact, and the timing of biological events, which could fundamentally transform current ecosystems and food webs. Climate change can overwhelm the capacity of ecosystems to mitigate extreme events and disturbance, such as wildfires, floods, and drought.
CO3	The Global Trends help organisations to ensure they are ready for the future by understanding the disruptive forces that they face and guiding them to take advantage of the opportunities.
CO4	Sustainability is measured by assessing performance of Social, Environmental, and Economic principles. While a balanced treatment of all three is an ideal goal, it is not always achievable.
CO5	Environmental Policies are the sum total of the values to which a person or a group of persons or institutions social, legal and governmental – consider as important in their relationships with one another.

### Course outcome mapping with Programme Outcomes:

CO	PO1	PO2	PO3	PO4	PO5
CO1	3	2	2	2	2
CO2	1	3	2	3	2
CO3	2	1	3	1	2
CO4	2	2	1	3	1
CO5	2	2	3	1	3
Max.	3	3	3	3	3

3 is High, 2 is Moderate, 1 is Low & - is Not Applicable

  
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## COURSE HANDOUT (ABRIDGED)

**Session:** 2021-2022

**Sub Session:** Semester I (Jul-Dec)

**Course Name:** Learning Technologies Project Course (ET 401)

**L/T/P/C:** 0/0/1/4

### Course Description

It is within above framework and in pursuit of knowledge, skill and motivation for effective Teaching-Learning that the course is then designed to engage students in Learning Technologies Projects as drawn from individual students' specialization subject domains from engineering & technology, sciences, management, social sciences, humanities and green environment. Primarily, the learning technologies project categories will cover Projects in Designing System Development Life Cycle (SDLC) and Project-Based Learning.

### Course Outcomes

S.No.	Description
CO1	skill enhancement
CO2	learning engagement
CO3	specialization in subjects
CO4	additive curriculum courses

### Course outcome mapping with Programme Outcomes:

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

3 is High, 2 is Moderate, 1 is Low & - is Not Applicable

### List of Tentative Practical

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## COURSE HANDOUT (ABRIDGED)

**Session:** 2021-2022

**Sub Session:** Semester II (Jan-Jun)

**Course Name:** Financial Management I (FIN 112)

**L/T/P/C:** 3/0/0/3

### Course Description

This course aims at familiarizing the students with the financial environment of business, especially the financial markets, Inculcating knowledge about the decisions and decision variables involved in building the liability side of balance sheet of the firm, Developing the analytical skills by associating the tools and techniques with the situation, Developing skills for interpretation of business information and application of financial theory in financing related decisions.


### Course Outcomes

S.No.	Description
CO1	Understand the scope of financial management and role of Finance Manager and inter-relationship with other functions
CO2	To demonstrate the ability to organize, analyze and draw appropriate conclusions from financial information using numerical and financial data.
CO3	To demonstrate the ability to apply financial concepts to recommend and justify solutions to financial problems of short term and long-term financial decisions.
CO4	Ability to integrate the understanding of the various aspects of corporate financial decision making.

### Course outcome mapping with Programme Outcomes:

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	3	3	3	3	3	2	2	1	1	1	1	3
CO2	2	3	2	3	2	3	1	2	3	2	3	3
CO3	2	2	3	3	3	2	3	2	2	2	2	2
CO4	2	1	2	3	2	1	2	3	2	2	1	2
Max.	3	3	3	3	3	3	3	3	3	2	3	3

3 is High, 2 is Moderate, 1 is Low & - is Not Applicable

  
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## COURSE HANDOUT (ABRIDGED)

**Session:** 2021-2022

**Sub Session:** Semester I (Jul-Dec)

**Course Name:** Financial Management II (FIN 201)

**L/T/P/C:** 3/0/0/3

### Course Description

This course aims at familiarizing the students with the financial environment of business, Inculcating knowledge about the decisions and decision variables involved in building the liability side of balance sheet of the firm, Developing the analytical skills by associating the tools and techniques with the situation, Developing skills for interpretation of business information and application of financial theory in financing related decisions.

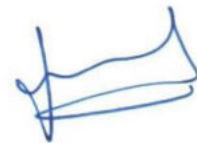
### Course Outcomes

S.No.	Description
CO1	Understand the nature of leverages in corporate set up and its significance.
CO2	Understand the various capital structure theories and determinants of capital structures in a corporate.
CO3	Understand the various dividend policies and their significance.
CO4	understand the management of working capital in a corporate set up and to design the appropriate policy.
CO5	Demonstrate the ability to take the appropriate financial decision with respect to choosing the right capital mix.
CO6	Ability to integrate the understanding of the various aspects of corporate financial decision making.
CO7	Willingness to understand the various aspects of the corporate finance domain.

### Course outcome mapping with Programme Outcomes:

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	3	2	1	2	2	1	2	2	1	3	1	1
CO2	3	2	1	2	1	1	2	2	1	2	1	-
CO3	3	2	1	1	2	2	3	2	1	2	2	-
CO4	3	3	2	2	2	1	2	2	-	1	1	2
CO5	3	2	1	2	2	1	2	1	1	2	1	1
CO6	3	3	1	1	2	2	2	2	-	2	1	2
CO7	3	2	1	1	2	2	2	1	-	2	2	2
Max.	3	3	2	2	2	2	3	2	1	3	2	2

3 is High, 2 is Moderate, 1 is Low & - is Not Applicable



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## COURSE HANDOUT (ABRIDGED)

**Session:** 2021-2022

**Sub Session:** Semester II (Jan-Jun)

**Course Name:** Introduction to Banking & Financial Services Industry (FIN 302)

**L/T/P/C:** 3/0/0/3

### Course Description

Unit 1. Introduction to Banking System and Financial Services Industry which consists of financial markets, financial intermediation and financial instruments or financial products.

Unit 2. Working of commercial banks, co-operative banks, regional rural banks (RRBs), all-India financial institutions (AIFIs), non-banking financial companies (NBFCs) and microfinance institutions.

Unit 3. Introduction to the banking sector which forms the bedrock of the Indian financial system, and the regulatory role and functions of the Reserve Bank of India (under the provisions of the Banking Regulation Act, 1949 and the Reserve Bank of India Act, 1934).

Unit 4. The financial markets in India to be covered in brief will include the money market, the Government securities market, the foreign exchange market, the capital Market and the credit market, derivative markets the major players as well as the regulatory bodies.

Unit 5: Financial Services such as Venture Capital Financing, Factoring and Forfaiting, Merchant Banking, Mutual Funds, Small Savings, Provident Fund & Pension Fund, Mutual Funds, Insurance and other financial Services.

### Course Outcomes

S.No.	Description
CO1	Understand the importance and role of Banking and Financial Service Industry.
CO2	Understanding models and framework of Banking and Financial Service Industry.
CO3	Identify the various constituents of the Banking System and understand their nature and characteristics.
CO4	Understand the nature, types and characteristics of various Financial Services, instruments, and the markets they are traded in.
CO5	Understand the functioning of regulatory bodies and their overall importance in the financial system.

### Course outcome mapping with Programme Outcomes:

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	2	2	3	3	2	1	2	1	2	3	1	3
CO2	2	3	2	3	3	1	2	2	1	3	2	2
CO3	3	2	1	2	2	1	1	1	2	3	2	3
CO4	2	3	2	3	3	2	2	1	3	3	3	2
CO5	2	2	2	3	2	3	2	3	3	3	2	3
Max.	3	3	3	3	3	3	2	3	3	3	3	3

3 is High, 2 is Moderate, 1 is Low & - is Not Applicable

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## COURSE HANDOUT (ABRIDGED)

**Session:** 2021-2022

**Sub Session:** Semester I (Jul-Dec)

**Course Name:** Designing Financial Products (FIN 401)

**L/T/P/C:** 3/0/0/3

### Course Description

The course deals with the aspects of Financial Engineering. The course contains details of instruments, markets, and financial market practices. The pricing issues are also dealt with, focus is more on engineering dimensions. The objective of the course is how existing markets and market practices have changed and outline new financial engineering trends and products.

### Course Outcomes

S.No.	Description
CO1	Understanding Problems in Financial Products
CO2	Understanding Modern Financial Products
CO3	Understanding Mechanisms of Financial products
CO4	Understanding combination of financial products to achieve targeted risk and returns
CO5	Implementing avoidance mechanisms for risks and creating products responsible for principal protection.

### Course outcome mapping with Programme Outcomes:

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	3	-	-	-	-	3	-	-	-	-	-	-
CO2	3	-	-	-	-	3	-	-	-	-	-	-
CO3	3	-	3	-	-	-	-	-	3	-	-	-
CO4	3	-	3	-	3	-	3	-	3	-	3	-
CO5	3	-	3	-	3	-	3	-	-	-	3	-
Max.	3	-	3	-	3	3	3	-	3	-	3	-

3 is High, 2 is Moderate, 1 is Low & - is Not Applicable

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## COURSE HANDOUT (ABRIDGED)

**Session:** 2021-2022

**Sub Session:** Semester I (Jul-Dec)

**Course Name:** Introduction to Blockchain Technology (FIN 411)

**L/T/P/C:** 3/0/0/3

### Course Description

After great financial crisis of 2008, the basic market structure of banking and business system was challenged. The business enterprises used emerging technologies to create value around existing monolith enterprise and industry structure. Satoshi Nakamoto a pseudo name who was brainchild behind the block chain technology, gained prominence with invention of bitcoin the digital currency built on block chain frameworks. The block chain technology grew with adaptation by various industry verticals including banking and finance. DEFI, DLT , Bitcoin , payments and lending , trade finance , Insurance and clearing and settlement are some important sub areas which are getting disrupted.

### Course Outcomes

S.No.	Description
CO1	Understand theory of disruptive innovation and application in creating new FinTech products.
CO2	Learn enterprise architecture to create agile and scalable products.
CO3	Understand Block chain technology and its application in industry.
CO4	Apply framework of blockchain in use cases of bitcoin, Ethereum.
CO5	Learn block chain applications in business.

### Course outcome mapping with Programme Outcomes:

CO	PO1	PO2	PO3	PO4	PO5
CO1	3	3	3	3	3
CO2	3	3	2	2	3
CO3	3	2	2	3	3
CO4	3	2	2	3	3
CO5	3	2	2	3	3
Max.	3	3	3	3	3

3 is High, 2 is Moderate, 1 is Low & - is Not Applicable

  
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## COURSE HANDOUT (ABRIDGED)

**Session:** 2021-2022

**Sub Session:** Semester I (Jul-Dec)

**Course Name:** Geospatial Field Techniques & Application  
Integration (GIS 532)

**L/T/P/C:** 2/0/4/4

### Course Description

Geospatial field techniques are increasingly being used to validate the results from remote sensing observations that are used to solve complex environmental problems. This course aims to provide first-hand experience of geospatial data collection as well as processing and managing the data thereof. The course consists of conceptual lectures, practical exercises and field based observations and managements. The course covers importance of geospatial measurements, methods and tools used for measuring the geographical space, organization and processing of geospatial data for drawing meaningful information and finally its integration in various application domains/areas.

### Course Outcomes

S.No.	Description
CO1	To provide first-hand experience of geospatial data collection as well as processing and managing the data thereof.
CO2	To provide conceptual lectures, practical exercises and field based observations and managements.
CO3	To develop understanding about the importance of geospatial measurements, methods and tools used for measuring the geographical space, organization and processing of geospatial data for drawing meaningful information and finally its integration in various application domains/areas.

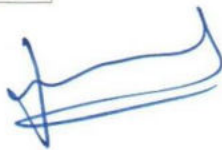
### Course outcome mapping with Programme Outcomes:

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	3	1	2	1	3	1	2	1	1	1	1	2
CO2	1	3	2	2	3	3	2	3	3	3	3	3
CO3	1	1	2	3	3	3	2	3	3	2	2	3
Max.	3	3	2	3	3	3	2	3	3	3	3	3

3 is High, 2 is Moderate, 1 is Low & - is Not Applicable

### List of Tentative Practical

Will be announced by the faculty

  
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## COURSE HANDOUT (ABRIDGED)

Session: 2021-2022

Sub Session: Semester I (Jul-Dec)

Course Name: Calculus (MAT 112)

LT/P/C: 3/1/0/4

### Course Description

This course includes the fundamentals and applications of differential calculus, integral calculus, vector calculus, and complex analysis. These concepts seem to have lots of applications in computer science engineering, electronics and communication engineering, among other branches of mathematics and engineering.

### Course Outcomes

S.No.	Description
CO1	Determine the convergence of a given sequence/series. Find the radius of convergence and interval of convergence of a power series. Represent a function with a power series within the radius of convergence.
CO2	Understand the limit, continuity, and differentiability of a function of two/three variables. Find the absolute and relative extreme of a function of two/three variables. Use Lagrange Multipliers to solve constrained optimization problems.
CO3	Integrate functions of two/three variables over curves and surfaces. Use double integrals to represent the volume of a solid region and to find surface area. Use a triple integral to find the volume of a solid region.
CO4	Use Green's theorem, Stoke's theorem and the Divergence theorem to compute integrals. Apply the integrals and vector field concepts to diverse situations in physics, engineering and other mathematical contexts.
CO5	Evaluate a contour integral using parametrization, fundamental theorem of calculus, and Cauchy's integral formula; find the Taylor series of a complex function and determine its circle or annulus of convergence; compute the residue of a complex function and use the residue theory to evaluate a contour integral or an integral over the real line.
CO6	Understand and appropriately use the technical vocabulary of the topics covered such as sequence, series, convergence, absolute and conditional convergence, continuity, differentiability, Lagrange multipliers, extreme values, vector, vector-valued function, tangent vector, gradient, curl, divergence of vector field, work, circulation, flux, path independence, conservative field, potential functions, mass, moments, moments of inertia, radius of gyration, double integral, triple integral, Jacobian, line integral, surface area, surface integral, complex function, analytic function, singularities, and residues.

### Course outcome mapping with Programme Outcomes:

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	3	3	3	2	3	1	1	1	2	2	2	3
CO2	3	3	3	3	3	2	2	1	1	2	1	3
CO3	3	3	3	3	3	1	1	1	2	2	2	3
CO4	3	3	3	3	3	2	2	1	2	2	2	3
CO5	3	3	2	3	3	2	2	1	1	1	2	3
CO6	3	3	3	3	3	2	1	2	2	3	3	3
Max.	3	3	3	3	3	2	2	2	2	3	3	3

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## COURSE HANDOUT (ABRIDGED)

**Session:** 2021-2022

**Sub Session:** Semester II (Jan-Jun)

**Course Name:** Microbiology (BIO 112)

**L/T/P/C:** 3/0/3/4

### Course Description

The objective of this course is to develop comprehensive knowledge of the microbial world and its components. This course introduces various principles, tools and techniques of microbiology that involves examining and characterising the microbes that inhabit our planet. This course will educate students about the vital role of microbiology to understand pathogenic potential of any microorganism and functioning of immune system. This course will also enhance the fundamental understanding of the microbial impact on our ecosystem as well as the 21st century challenges and opportunities that arise from our changing relationship with the microbes.

### Course Outcomes

S.No.	Description
CO1	Various classifications and components of microbial community
CO2	Tools and techniques to study and characterise microbial cultures for their potential beneficial and maleficent role
CO3	Role of microbiology to understand influence of microbes on immunity
CO4	Various kinds of microbial interactions and scope of microbiology in 21th century

### Course outcome mapping with Programme Outcomes:

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

3 is High, 2 is Moderate, 1 is Low & - is Not Applicable

### List of Tentative Practical

- P1: Culturing of microbes Plating, Streaking, Dilution plating.
- P2: Enumeration of microbial community in air, soil and H<sub>2</sub>O.
- P3: Characterisation of microbes from waste waters
- P4: Staining of microbes (Gram staining, Spore staining).
- P5: Growth curve and characteristics, (Optical density, Protein, CFU)
- P6: Enzymatic reactions for identifications of microbes.
- P7: Estimation of glucose
- P8: Estimation of protein.
- P9: Enzyme assays for extracellular enzymes, (Cellulase, Xylanase).
- P10: Isolation of DNA (Chromosome and Plasmid)

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## COURSE HANDOUT (ABRIDGED)

**Session:** 2021-2022

**Sub Session:** Semester I (Jul-Dec)

**Course Name:** GIS Programming (GIS 541)

**L/T/P/C:** 2/0/4/4

### Course Description

This course focuses on introducing students to basic programming concepts. To further meet the challenging requirement of GIS developers in the industry, they will be given exposure to the structure of a core .Net program. The course also offers delivering a more in-depth knowledge of the GIS development techniques relevant to their projects.

### Course Outcomes

S.No.	Description
CO1	Understand the basics of mapping and visualizing geographical information
CO2	Understand the important terms and concepts that govern mapping (projection, datum, ellipsoid, scale, coordinate systems)
CO3	Understand the use of Satellite remote sensing in mapping
CO4	Practical exposure to map making process in GIS softwares (digitizing geospatial information, handling multi-layer geospatial data, generating maps)

### Course outcome mapping with Programme Outcomes:

CO	PO1	PO2	PO3
CO1	2	1	3
CO2	3	3	3
CO3	2	3	3
CO4	3	3	3
Max.	3	3	3

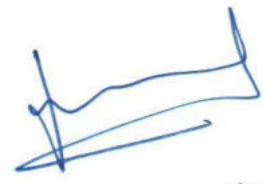
3 is High, 2 is Moderate, 1 is Low & - is Not Applicable

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### List of Tentative Practical

1. Basic programming concepts :
  - i) Introduction
  - ii) Data Types
  - iii) Operators
  - iv) Type conversion
  - v) Control and loops
2. C#: Introduction and C#
3. OOPS Programming
  - i) Basic of OOPS
  - ii) Inheritance
  - iii) Abstract class and interface
  - iv) Polymorphism
  - v) Overloading and Overriding
4. Introduction to Arc Objects
  - i) Add Ins
  - ii) Toolbar creation
  - iii) Understanding OMD
5. Accessing Maps and Layers
  - i) Introduction to maps and layers in Arc Objects
  - ii) Accessing Layers
  - iii) Working With Featurelayers
6. Interface Programming
  - i) Creating Interfaces
  - ii) Implementing Interfaces
7. Venturing into ArcCatalog



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## COURSE HANDOUT (ABRIDGED)

**Session:** 2021-2022

**Sub Session:** Semester I (Jul-Dec)

**Course Name:** Mobile GIS (GIS 611)

**L/T/P/C:** 2/0/2/3

### Course Description

This course introduces students to concepts in Mobile GIS technology, GPS theory, and the integration of GPS and GIS data. Students will learn how to use hand-held GPS units, hand held personal computers, and GPS software. Students would be able to plan a mobile project for use within an enterprise system and can choose appropriate data management and transaction models to support real-time field data collection. They will be able to create mobile map services that are optimized for use in the field and assess security needs and options for a mobile project. This will help in quickly configuring and deployment of a mobile project. Additionally, this will provide students a tool to synchronize data collected in the field with a geodatabase optimized for a mobile project. The course will emphasize the integration of geospatial technologies for field surveys.

### Course Outcomes

S.No.	Description
CO1	To learn how to use hand-held GPS units, hand held personal computers, and GPS software, concepts in Mobile GIS technology
CO2	To plan a mobile project for use within an enterprise system and can choose appropriate data management and transaction models to support real-time field data collection.
CO3	To create mobile map services that are optimized for use in the field and assess security needs and options for a mobile project
CO4	To provide students a tool to synchronize data collected in the field with a geo-database optimized for a mobile project

### Course outcome mapping with Programme Outcomes:

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

3 is High, 2 is Moderate, 1 is Low & - is Not Applicable

### List of Tentative Practical

  
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## COURSE HANDOUT (ABRIDGED)

**Session:** 2021-2022

**Sub Session:** Semester I (Jul-Dec)

**Course Name:** Geoinformatics for Environment (GIS 631)

**L/T/P/C:** 2/0/2/3

### Course Description

Geoinformatics is increasingly being used to solve complex environmental problems in domains such as management of natural resources, land use planning and management, nature conservation, and environmental monitoring, require reliable spatial information and methodologies. This course combines information and communication technology (ICT), Geographical Information Systems (GIS), remote sensing, GPS and mapping, environmental and social sciences such as land use planning, geography, etc. This course will provide the students with adequate knowledge about environmental issues and its management. Develop understanding about environmental hazards, their assessment and monitoring, Space Technology (Geoinformatics) for environmental conservation, planning and management.

### Course Outcomes

S.No.	Description
CO1	To solve complex environmental problems in domains such as management of natural resources, land use planning and management, nature conservation, and environmental monitoring, spatial information and methodologies.
CO2	To learn information and communication technology (ICT), Geographical Information Systems (GIS), remote sensing, GPS and mapping, environmental and social sciences such as land use planning, geography, etc.
CO3	To Develop understanding about environmental hazards, their assessment and monitoring, Space Technology (Geoinformatics) for environmental conservation, planning and management.

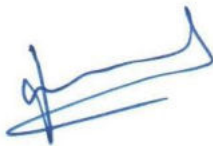
### Course outcome mapping with Programme Outcomes:

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	-	1	2	2	3	1	3	-	1	-	1	2
CO2	1	2	2	1	3	1	3	-	2	-	2	3
CO3	-	2	2	2	3	1	3	-	1	-	2	3
Max.	1	2	2	2	3	1	3	-	2	-	2	3

3 is High, 2 is Moderate, 1 is Low & - is Not Applicable

### List of Tentative Practical

Will be announced by the faculty

  
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## COURSE HANDOUT (ABRIDGED)

**Session:** 2021-2022

**Sub Session:** Semester I (Jul-Dec)

**Course Name:** Artificial Neural Network in GIS (GIS 641)

**L/T/P/C:** 3/0/2/4

### Course Description

This course is an introduction to Artificial Neural Networks to GIS students. It will focus on the computational fundamentals of artificial neural networks and their applications.

### Course Outcomes

S.No.	Description
CO1	Theoretical understanding of the mathematics in the models
CO2	Ability to apply the theory practically in the GIS domain
CO3	Deeper understanding of the concepts and ability to identify potential uses of ANN.

### Course outcome mapping with Programme Outcomes:

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	2	3	3	3	3	3	3	3	2	2	2	2
CO2	3	3	2	3	2	2	3	3	2	2	2	1
CO3	3	2	2	3	3	2	3	2	2	2	3	3
Max.	3	3	3	3	3	3	3	3	2	2	3	3

3 is High, 2 is Moderate, 1 is Low & - is Not Applicable

### List of Tentative Practical

- Tentative Practicals:
- 1.Linear Regression
  - 2.Artificial Neural Networks
  - 3.Gradient Descent Algorithm
  - 4.Nonlinear Activation Units
  - 5.Single-Layer Perceptions
  - 6.Least Mean Squares Algorithm.

  
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## COURSE HANDOUT (ABRIDGED)

**Session:** 2021-2022

**Sub Session:** Semester I (Jul-Dec)

**Course Name:** Organisational Behaviour (HRM 232)

**L/T/P/C:** 3/0/0/3

### Course Description

The course will provide an analytical perspective on the behaviour of individuals and groups inside organizations, and the relationship between important organizational characteristics such as structure and design and managerial behaviour. Students will be able to understand and appreciate individual, interpersonal, and group processes for increased effectiveness both within and outside of organizations, and the nature, functioning and design of organization as social collectivities. Students will also learn the key concepts and behavioural practices of Human Resources in organizations.

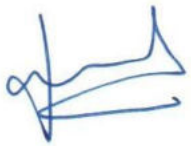
### Course Outcomes

S.No.	Description
CO1	1. To make IMBA aspirants understand how an organization works with reference to IT Companies.
CO2	2. To provide various dimensions of individual behaviour in different types of organisation designs and structures.
CO3	3. To develop self-awareness and awareness about others in the organization for effective management.
CO4	4. To explain the role and importance of groups and group dynamics
CO5	5. To give an overview with application-based approach to work in specific organisation culture
CO6	6. To discuss case studies to understand organisation change and related attitudinal issues for better work performance.
CO7	7. To teach HR functions and to utilise it in different behavioural approaches.

### Course outcome mapping with Programme Outcomes:

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	3	3	3	3	3	3	3	3	2	3	3	3
CO2	3	3	3	2	3	3	3	3	2	3	3	3
CO3	3	3	2	3	3	3	3	2	1	2	2	2
CO4	2	3	3	3	2	3	3	3	3	3	3	2
CO5	2	3	1	2	2	2	2	2	2	2	2	2
CO6	2	2	3	3	3	2	3	3	3	3	3	3
CO7	3	3	3	3	3	3	2	3	3	3	3	3
Max.	3	3	3	3	3	3	3	3	3	3	3	3

3 is High, 2 is Moderate, 1 is Low & - is Not Applicable

  
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## COURSE HANDOUT (ABRIDGED)

**Session:** 2021-2022

**Sub Session:** Semester II (Jan-Jun)

**Course Name:** Cross Cultural Management (HRM 242)

**L/T/P/C:** 2/0/0/2

### Course Description

This course focuses on business and management while providing an intellectual and experiential forum for developing the interpersonal-intercultural communication and interaction skills necessary for international managers. While learning to identify cultural aspects of verbal and nonverbal behaviour of persons from different cultures and themselves. While studying the concepts and principles of Cross-cultural management, Students can recognize the cultural differences that can cause difficulties in managing various situations. They can understand that challenging human element of business is just as important as the technical element of business to remain competitive, and it is the former rather than the latter. Despite such importance of being able to effectively manage cultural differences, many leadership and management concepts and prescribed practices taught in North American business schools are implicitly laden with Western cultural beliefs, values, and assumptions.

### Course Outcomes

S.No.	Description
CO1	1. Develop understanding on culture (CO1)
CO2	2. Identify the dimensions and determinants of culture (CO2)
CO3	3. Identify culture globally in different scenarios (CO3)
CO4	4. Understand cultural dimensions and dilemmas (CO4)
CO5	5. Understand various culture and styles of management (CO5)
CO6	6. Understand various culture and its organisation. (CO6)
CO7	7. Explore impact of globalization and internationalization on cultural practices (CO7)

### Course outcome mapping with Programme Outcomes:

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	3	2	2	2	2	2	2	2	2	2	2	2
CO2	2	3	3	3	3	3	3	3	3	3	3	3
CO3	3	3	3	3	3	3	3	3	3	3	3	3
CO4	2	2	2	2	2	2	2	2	2	2	3	3
CO5	3	3	2	3	2	3	2	3	3	3	2	2
CO6	3	2	3	2	2	3	1	1	2	2	2	2
CO7	2	2	3	3	3	3	3	1	2	3	2	3
Max.	3	3	3	3	3	3	3	3	3	3	3	3

3 is High, 2 is Moderate, 1 is Low & - is Not Applicable

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## COURSE HANDOUT (ABRIDGED)

**Session:** 2021-2022

**Sub Session:** Semester I (Jul-Dec)

**Course Name:** Human Resource Management (HRM 301)

**L/T/P/C:** 2/0/0/2

### Course Description

The objective of the course is to equip students with knowledge, skill and competencies to manage people along with capital, material, information and knowledge asset in the organization. The course has been designed keeping in mind not the specifically the need of HR Managers but all Managers- Fundamental assumption being that all Managers Finance, Market, approaching are accountable to their organization in terms of impact of their HRM practices and systems. The effectiveness of human resource management in organization depends largely on individual perception, assumption and belief about people. The course will provide students logic and rationale to make fundamental choice about their own assumption and belief in dealing with people.

### Course Outcomes

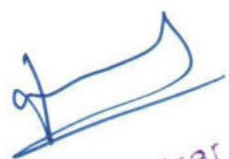
S.No.	Description
CO1	Define human resource management (HRM) and its significance for organizations
CO2	2. Identify the scope of HRM in contemporary organizations and define its context (CO2)
CO3	3. Identify tools to measure impact of HRM on an organization (CO3)
CO4	4. Understand the impact of diversity in the workplace, particularly gender diversity and sensitivity (CO4)
CO5	5. Understand the concept of job analysis and competency mapping, and be able to develop job descriptions and specifications (CO5)
CO6	6. Understand recruitment and selection function and its tools and techniques (CO6)
CO7	7. Understand the basic structure of compensation and benefits policies and systems, monetary and non-monetary rewards, variable pay, and performance-based pay (CO7)
CO8	8. Define training and development function, learn to design training programs and using training methodologies (CO8)
CO9	9. Understand performance management process (CO9)
CO10	10. Understand industrial relations, unionization, and collective bargaining process (CO10)
CO11	11. Understand the concept of organizational justice, discipline, grievances, and sanction process (CO11)
CO12	12. Identify contemporary issues in HRM, such as safety, health, EAP, and TQM (CO12)
CO13	13. Explore impact of globalization and internationalization on HR practices (CO13)

### Course outcome mapping with Programme Outcomes:

  
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CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	3	3	3	2	3	3	3	2	3	2	2	2
CO1 0	3	2	2	2	2	2	2	2	2	2	2	2
CO1 1	3	2	2	2	2	2	3	2	3	2	3	2
CO1 2	3	3	2	2	2	2	2	2	2	2	2	2
CO1 3	3	2	2	2	2	3	3	2	3	2	3	2
CO2	3	2	2	2	2	2	2	2	2	2	2	2
CO3	3	2	2	2	2	2	2	2	2	2	2	3
CO4	2	3	3	3	3	3	2	3	1	3	3	3
CO5	2	3	3	3	2	2	2	2	2	2	2	2
CO6	1	2	2	2	2	2	2	2	2	3	3	3
CO7	1	3	3	3	3	3	3	3	3	3	3	3
CO8	2	3	2	2	2	2	2	2	2	2	2	2
CO9	3	3	3	3	3	3	3	3	3	3	3	3
Max.	3	3	3	3	3	3	3	3	3	3	3	3

3 is High, 2 is Moderate, 1 is Low & - is Not Applicable

  
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## COURSE HANDOUT (ABRIDGED)

**Session:** 2021-2022

**Sub Session:** Semester II (Jan-Jun)

**Course Name:** Organization Development and Change Management (HRM 302)

**L/T/P/C:** 3/0/0/3

### Course Description

This course will enable students to introspect on the important change implications of the day-to-day happenings and practices of industry and business. The aim of the course is to stimulate discussion and debate using available theoretical frameworks.

This course equips students with the development and maintenance of changes and its impact on people and organisation. The course aims to educate students in the problems and with sufficient role of compliance along with discretionary organizational requirements in the matter. In addition to learning concepts, approaches, techniques and terms, students will examine the underlying reasons and forces shaping changes in, plans and policy.

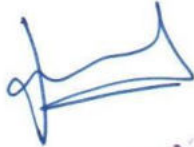
### Course Outcomes

S.No.	Description
CO1	Understand the key concepts related to Organisation development (CO1)
CO2	Understand the significance of organisation development and theories and its overall performance (CO2)
CO3	Understand the significance of change in organisation's overall performance (CO3)
CO4	Understanding the 'change management' and managerial effectiveness for organisation. (CO4)

### Course outcome mapping with Programme Outcomes:

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	3	3	3	3	3	3	3	3	3	3	3	3
CO2	3	3	3	3	2	2	2	2	2	2	2	3
CO3	2	2	3	2	2	2	2	1	3	3	2	3
CO4	2	3	3	1	2	2	2	3	2	2	2	2
Max.	3	3	3	3	3	3	3	3	3	3	3	3

3 is High, 2 is Moderate, 1 is Low & - is Not Applicable

  
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## COURSE HANDOUT (ABRIDGED)

**Session:** 2021-2022

**Sub Session:** Semester I (Jul-Dec)

**Course Name:** Team Building and Leadership (HRM 321)

**L/T/P/C:** 3/0/0/3

### Course Description

This course focuses on business and management while providing an intellectual and experiential forum for developing the Team building and Leadership skills.

This course provides students with the social science tools needed to solve organizational problems and influence the actions of individuals, groups and organizations. Here to prepare managers to understand how to best organize and motivate the human capital of the firm, manage social networks and alliances, and execute strategic change. In addition, to explore the challenge of personally managing the inevitable stresses and dangers of leadership.

### Course Outcomes

S.No.	Description
CO1	To apply leadership strategies for motivating people and changing organizations. (CO1)
CO2	To learn the skills toward political aspects of management. (CO2)
CO3	To identify the various sources of power in organizations and to thoughtfully consider both the positive and negative consequences of power. (CO3)
CO4	To assess personal values, beliefs, and ethical standards to enhance self-awareness in regard to personal leadership behaviours. (CO4)
CO5	To comprehend the role of Leaders in building effective organizations. (CO5)
CO6	To learn the importance of different leadership styles to suit different managerial situations. (CO6)
CO7	To examine the role of the leader's character and how his or her "dark side" undermines leadership credibility. (CO7)

### Course outcome mapping with Programme Outcomes:

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	2	3	3	3	3	3	3	3	3	3	3	3
CO2	3	3	3	3	2	2	2	2	2	2	3	3
CO3	3	2	2	2	2	2	2	2	3	3	2	3
CO4	3	2	3	3	3	3	2	3	3	3	3	3
CO5	3	2	3	3	3	3	2	3	2	3	3	3
CO6	3	2	2	3	3	3	3	3	2	3	3	3
CO7	3	2	3	3	2	2	3	3	2	3	3	3
Max.	3	3	3	3	3	3	3	3	3	3	3	3

3 is High, 2 is Moderate, 1 is Low & - is Not Applicable

  
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## COURSE HANDOUT (ABRIDGED)

**Session:** 2021-2022

**Sub Session:** Semester I (Jul-Dec)

**Course Name:** Remedial Math - I (MAT 011)

**LT/P/C:** 2/2/0/4

### Course Description

This pre-calculus course covers elements of Polynomial, Rational, Exponential, Logarithmic, Trigonometric functions, and their applications.

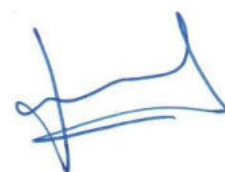
### Course Outcomes

S.No.	Description
CO1	Understand the basic concepts of functions and their graphs.
CO2	Understand linear and quadratic functions. Build linear and quadratic models from verbal descriptions and from data.
CO3	Find zeros of a polynomial function. Model and solve variation problems.
CO4	Understand the concepts of exponential and logarithmic functions. Model exponential growth and decay, logistic growth, and financial problems.
CO5	Understand trigonometry and inverse trigonometric functions. Apply the trigonometry in simple harmonic motion, damped motion and in combining waves.

### Course outcome mapping with Programme Outcomes:

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	3	3	2	2	2	2	1	1	2	1	2	3
CO2	3	3	2	2	2	2	1	1	2	1	2	3
CO3	3	3	2	2	2	2	1	1	2	1	2	3
CO4	3	3	2	2	2	2	1	1	2	1	2	3
CO5	3	3	2	2	2	2	1	1	2	1	2	3
Max.	3	3	2	2	2	2	1	1	2	1	2	3

3 is High, 2 is Moderate, 1 is Low & - is Not Applicable



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## COURSE HANDOUT (ABRIDGED)

**Session:** 2021-2022

**Sub Session:** Semester II (Jan-Jun)

**Course Name:** Remedial Math - II (MAT 012)

**L/T/P/C:** 2/2/0/4

### Course Description

This pre-calculus course covers elements of Coordinate Geometry, Vectors, Matrix Algebra, Sequences, Probability, and their applications.

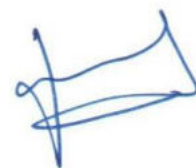
### Course Outcomes

S.No.	Description
CO1	Plot the points in the polar coordinate system and graph the polar equations. Also, find the vectors cross product and dot product.
CO2	Sketch and understand the graphs of conic sections. Also, graph the plane curves described by parametric equations.
CO3	Solve systems of linear and nonlinear equations. Also, graph and solve systems of linear and nonlinear inequalities.
CO4	Apply the concepts of sequence, series, principle of mathematical induction, binomial theorem to applied problems. Also, distinguish between permutation problems and combination problems.
CO5	Find the measures of central tendency, measures of dispersion and correlation for the given data.
CO6	Solve application problems described by vectors, linear systems, conic sections, sequences and series, permutations and combinations, probability and statistics.

### Course outcome mapping with Programme Outcomes:

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	3	2	1	1	1	1	1	3	1	1	1	3
CO2	3	2	1	1	1	1	1	3	1	1	1	3
CO3	3	2	1	1	1	1	1	3	1	1	1	3
CO4	3	2	1	1	1	1	1	3	1	1	1	3
CO5	3	2	1	1	1	1	1	3	1	1	1	3
CO6	3	3	2	2	2	2	1	3	2	2	2	3
Max.	3	3	2	2	2	2	1	3	2	2	2	3

3 is High, 2 is Moderate, 1 is Low & - is Not Applicable



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## COURSE HANDOUT (ABRIDGED)

**Session:** 2021-2022

**Sub Session:** Semester II (Jan-Jun)

**Course Name:** Remedial Math - III (MAT 022)

**L/T/P/C:** 2/2/0/4

### Course Description

This univariate calculus course introduces the concept of Limits, Continuity, Differentiation, Integration, and their applications.

### Course Outcomes

S.No.	Description
CO1	Understand the concepts of limit and continuity, rate of change and tangents to curves. Also, find asymptotes of graphs.
CO2	Understand the significance of derivative at a point and be familiar with the rules of differentiation.
CO3	Use derivatives to find extreme values of function.
CO4	Understand the basic integration formulas and solve problems using integration techniques.
CO5	Use integrals to solve physical problems involving the work done by a force, the fluid force against a planar wall, and the location of the object's center of mass.
CO6	Differentiate and integrate the transcendental functions.

### Course outcome mapping with Programme Outcomes:

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	3	3	3	3	3	3	3	1	3	3	2	3
CO2	3	3	3	3	3	3	3	1	3	3	2	3
CO3	3	3	3	3	3	3	3	1	3	3	2	3
CO4	3	3	3	3	3	3	3	1	3	3	2	3
CO5	3	3	3	3	3	3	3	1	3	3	2	3
CO6	3	3	3	3	3	3	3	1	3	3	2	3
Max.	3	3	3	3	3	3	3	1	3	3	2	3

3 is High, 2 is Moderate, 1 is Low & - is Not Applicable

  
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## COURSE HANDOUT (ABRIDGED)

**Session:** 2021-2022

**Sub Session:** Semester II (Jan-Jun)

**Course Name:** Algebra & Differential Equations (MAT 101)

**LT/P/C:** 3/1/0/4

### Course Description

The objective of the course is to give the students a basic knowledge of linear algebra and differential equations and provide them with techniques available to solve differential equations. These concepts seem to have lots of applications in computer science engineering, electronics and communication engineering, among other branches of mathematics and engineering.

### Course Outcomes

S.No.	Description
CO1	Classify differential equations by order and linearity. Also, solve first order linear differential equations by different methods.
CO2	Find solutions of higher order linear differential equations with constant coefficients.
CO3	Use Laplace transforms to solve differential equations.
CO4	Understand vector space and inner product space.
CO5	Apply the concepts of matrices in solving system of linear equations and finding Eigen values and Eigen vectors.
CO6	Solve application problems described by first order differential equations and linear second order differential equations. Also, solve non-homogeneous linear differential equations with discontinuous forcing functions using the method of Laplace Transforms. Explain the Gram-Schmidt orthogonalization process.

### Course outcome mapping with Programme Outcomes:

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	3	2	1	1	1	2	1	-	2	1	1	1
CO2	3	2	1	1	1	2	1	-	2	1	1	1
CO3	3	2	1	1	1	2	1	-	2	1	1	1
CO4	3	2	1	1	1	2	1	-	3	1	1	1
CO5	3	2	2	1	1	2	1	-	3	1	1	1
CO6	3	2	2	1	1	2	1	-	3	1	1	1
Max.	3	2	2	1	1	2	1	-	3	1	1	1

3 is High, 2 is Moderate, 1 is Low & - is Not Applicable

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## COURSE HANDOUT (ABRIDGED)

**Session:** 2021-2022

**Sub Session:** Semester I (Jul-Dec)

**Course Name:** Business Statistics (MAT 121)

**LT/P/C:** 3/0/0/3

### Course Description

Statistics is the branch of mathematics which has wide variety of applications in almost every field. It also lays a foundation to management studies. The course aims to provide the basic quantitative and analytical tools necessary for decision-making and to develop students' diagnostic and analytical skills through suitable logical problems. The course also aims to develop their ability to analyses, measure and judge quantities and to provide a probabilistic base for all functional areas of management. The focus is on understanding the relevant statistical technique applicable to a given situation and use of software like Excel to arrive at solutions and interpret the same.

### Course Outcomes

S.No.	Description
CO1	Organize and analysis of quantitative data and think critically with respect to quantitative information characterized by the center, spread, and skewness of data.
CO2	Express quantitatively the degree and direction of association between two linearly related variables and fit a regression model to the data as well as investigating the explained portion.
CO3	Develop the concept probability and probability distribution and hypothesis testing.
CO4	Process, visualize and analysis the data statistically using Excel

### Course outcome mapping with Programme Outcomes:

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

3 is High, 2 is Moderate, 1 is Low & - is Not Applicable

  
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## COURSE HANDOUT (ABRIDGED)

**Session:** 2021-2022

**Sub Session:** Semester II (Jan-Jun)

**Course Name:** Business Statistics II (MAT 202)

**L/T/P/C:** 3/0/0/3

### Course Description

Statistics is the branch of mathematics which has wide variety of applications in almost every field. It also lays a foundation to other applied courses like Optimization techniques, Reliability, Quality control, Stochastic process, Data analysis and Data mining etc.

The course aims to provide the basic quantitative and analytical tools necessary for decision-making and to develop students' diagnostic and analytical skills through suitable logical problems. The course also aims to develop their ability to analyses, measure and judge quantities and to provide a probabilistic base for all functional areas of management. The focus is on statistical tools.

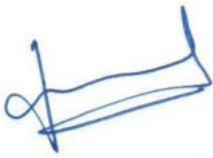
### Course Outcomes

S.No.	Description
CO1	Explore the techniques of Parametric and Non-Parametric Methods and their applications.
CO2	Understand the techniques of sampling and related concept
CO3	Understand time series analysis and forecasting
CO4	Understand Index number and their applications
CO5	Use statistical software for data analysis

### Course outcome mapping with Programme Outcomes:

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

3 is High, 2 is Moderate, 1 is Low & - is Not Applicable

  
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## COURSE HANDOUT (ABRIDGED)

**Session:** 2021-2022

**Sub Session:** Semester I (Jul-Dec)

**Course Name:** Probability and Random Process (MAT 221)

**L/T/P/C:** 3/1/0/4

### Course Description

The basic objective of this course is to give an elementary introduction to the theory of probability and random processes and their application for students in engineering.

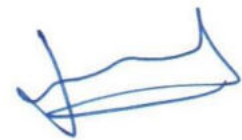
### Course Outcomes

S.No.	Description
CO1	Understand the basic concepts of probability, Bayes rule, and its applications.
CO2	Understand discrete and continuous distributions and develop ideas about various special distributions.
CO3	Understand the concept of random variables and their expectations and moments. Develop ideas on various properties of the functions of random variables.
CO4	Understand the concept of the central limit and laws of large numbers.
CO5	Understand random processes and their applications. Develop the ability to model simple random processes.

### Course outcome mapping with Programme Outcomes:

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	3	3	3	2	2	3	2	1	2	2	2	3
CO2	3	3	3	2	2	3	2	1	2	2	2	3
CO3	3	3	3	2	2	3	2	1	2	2	2	3
CO4	3	3	3	2	2	3	2	1	2	2	2	3
CO5	3	3	3	2	2	3	2	1	2	2	2	3
Max.	3	3	3	2	2	3	2	1	2	2	2	3

3 is High, 2 is Moderate, 1 is Low & - is Not Applicable



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## COURSE HANDOUT (ABRIDGED)

**Session:** 2021-2022

**Sub Session:** Semester I (Jul-Dec)

**Course Name:** Mathematical Foundation of Cyber Security  
(MAT 241)

**L/T/P/C:** 3/1/0/4

### Course Description

The course covers the mathematical foundations that are most relevant for Cyber Security studies. It highlights the basics of number theory like, GCD, Divisibility, Prime number etc. This course includes algebraic structure for Groups, Discrete logarithms, and Classification. Probability theory is important to understand the concept of probability and conditional probability. Statistics and regression are useful for analyzing large cyber data. All mathematical concepts are highly important for the mathematical foundation and calculation of Cyber Security.

### Course Outcomes

S.No.	Description
CO1	Learn basic mathematics required for mastering the subject
CO2	Appreciate the relevance of the technique in the subject
CO3	Learn to tackle cyber security issues from the mathematical point of view.

### Course outcome mapping with Programme Outcomes:

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	3	3	2	2	3	3	3	3	3	3	3	2
CO2	2	2	2	2	2	1	2	2	2	3	2	2
CO3	3	3	3	2	3	2	3	3	2	2	2	2
Max.	3	3	3	2	3	3	3	3	3	3	3	2

3 is High, 2 is Moderate, 1 is Low & - is Not Applicable

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## COURSE HANDOUT (ABRIDGED)

**Session:** 2021-2022

**Sub Session:** Semester I (Jul-Dec)

**Course Name:** Management of Risk (MFIN 005)

**L/T/P/C:** 2/0/0/2

### Course Description

The course aims to develop understanding of Management of Risk in businesses which involves the identification, assessment, and prioritization of risks followed by coordinated and economical application of resources to minimize, monitor, and control the probability and/or impact of unfortunate events. The course will help students understand different types of risks (Forex risk, interest rate risk, equity risk, credit risk, operational risk etc). The course will cover-- Identification of different forms of risk, Measuring volatility in market prices, Measure Value-at-Risk and its implications, Statistically measure risk & analyze applications, Application of VaR in managing risks & margining, Risk Management issues in investments, Lessons from some financial disasters. The course will familiarize the students with the process of risk management that consists of several steps which are as follows: identification of risk in a selected domain of interest; Planning the remainder of the process; Mapping out the social scope of risk management, the identity and objectives of stakeholders & the basis upon which risks will be evaluated, constraints; Defining a framework for the activity and an agenda for identification; Developing an analysis of risks involved in the process; Mitigation or Solution of risks using available technological, human and organizational resources.

### Course Outcomes

S.No.	Description
CO1	Understand the concept of risk, types of risk and its measurement
CO2	Understand the risk management framework and the concept of strategic risk management.
CO3	To understand the measurement of Return and Risk. Beta factor, CAPM, Asset pricing model and risk return analysis.
CO4	Understand portfolio management and evaluate portfolio performance with the help of Sharpe, Treynor and Jensens index.
CO5	Understand various types of derivative instruments

### Course outcome mapping with Programme Outcomes:

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	2	2	3	3	2	1	2	1	2	3	1	3
CO2	2	3	2	2	3	1	2	2	1	3	2	2
CO3	3	2	2	2	2	1	1	1	2	3	2	3
CO4	2	3	1	1	3	2	1	1	2	3	3	2
CO5	2	2	2	2	2	3	1	2	2	3	2	3
Max.	3	3	3	3	3	3	2	2	2	3	3	3

3 is High, 2 is Moderate, 1 is Low & - is Not Applicable

  
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## COURSE HANDOUT (ABRIDGED)

**Session:** 2021-2022

**Sub Session:** Semester I (Jul-Dec)

**Course Name:** Financial Instruments and Markets (MFIN 006)

**LT/P/C:** 2/0/0/2

### Course Description

The objective of the course is to provide a comprehensive working knowledge on a broad range of financial markets and their inherent instruments, including Equities, Bonds (asset-backed and mortgage-backed securities), Derivatives (equity and fixed income), & alternative investments. The course explores the basic features of each instrument introduced, explains their risk characteristics, and examines the markets in which they trade. Although the course covers a wide range of instruments, stronger emphasis is placed on fixed income based instruments with all their intricacies including pricing, term structure of interest rate, convertibles, bonds with embedded options, credit risk analysis, and fixed income portfolio management. In the process students will get a feel of various risk management strategies using Option, Futures and other interest rate derivatives. The course will construct several Excel based techniques to analyze bond valuation, term structure, portfolio statistics and risk mapping

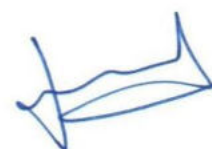
### Course Outcomes

S.No.	Description
CO1	To understand various concepts of the Financial Markets.
CO2	• To demonstrate the ability to organize, analyze and draw appropriate conclusions from financial information using numerical and financial data.
CO3	• To explain the basic functions, structure, type and nature of the financial markets and related instruments.
CO4	• To explain the features, operations and trading mechanism of Financial Markets
CO5	• To examine the contribution of Financial market in economic development of a country.
CO6	• To identify regulatory issues and challenges before financial markets.

### Course outcome mapping with Programme Outcomes:

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	2	3	3	3	3	3	3	3	2	2	2	2
CO2	2	2	2	3	2	3	2	2	2	2	1	1
CO3	2	2	-	2	2	1	3	1	2	2	2	1
CO4	1	1	3	2	2	1	1	1	1	1	2	1
CO5	3	1	2	1	2	1	2	1	1	2	2	1
CO6	2	2	-	1	2	1	2	1	2	2	1	1
Max.	3	3	3	3	3	3	3	3	2	2	2	2

3 is High, 2 is Moderate, 1 is Low & - is Not Applicable



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## COURSE HANDOUT (ABRIDGED)

**Session:** 2021-2022

**Sub Session:** Semester II (Jan-Jun)

**Course Name:** Business Organisations and Management  
(MGT 101)

**L/T/P/C:** 2/0/0/2

### Course Description

This course will provide an overview of the world of business, in particular at the various types of organizations in terms of their constitution and ownership. The course will also cover the legal and regulatory environment in which organizations work and the impact of the government on business. The course will also discuss the general organisation theory, the fundamental principles of management and the behaviour of groups and individuals within organizational context.

### Course Outcomes

S.No.	Description
CO1	Understand as what are the key constituents of a typical business organization and how it works?
CO2	Understand as how a business organization is structured, formed and do transactions in and out of country
CO3	Understand how business organization can finance its operations?
CO4	Understand basic functions of management – planning, organizing, leading, controlling etc.

### Course outcome mapping with Programme Outcomes:

CO	PO1	PO2	PO3	PO4	PO5
CO1	3	2	3	3	2
CO2	3	2	3	2	2
CO3	2	1	2	2	1
CO4	1	1	1	2	1
Max.	3	2	3	3	2

3 is High, 2 is Moderate, 1 is Low & - is Not Applicable

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## COURSE HANDOUT (ABRIDGED)

**Session:** 2021-2022

**Sub Session:** Semester I (Jul-Dec)

**Course Name:** Contemporary Business Issues (MGT 111)

**L/T/P/C:** 2/0/0/2

### Course Description

This course will provide an overview of the world of business, in particular at the various types of organizations in terms of their constitution and ownership. The course will also cover the legal and regulatory environment in which organizations work and the impact of the government on business. The course will also discuss the general organisation theory, the fundamental principles of management and the behaviour of groups and individuals within organizational context.

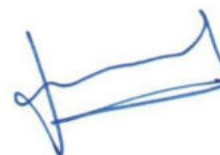
### Course Outcomes

S.No.	Description
CO1	Demonstrate an understanding of contemporary issues in the business environment
CO2	Demonstrate an understanding of contemporary issues in the major functions of business / management
CO3	Apply skills (research, analytical, argumentation, critical thinking, and judgements) within current debates on contemporary issues affecting business
CO4	Critically analyze contemporary business issues from the perspective of a range of different stakeholder and social groups.

### Course outcome mapping with Programme Outcomes:

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	3	1	3	2	1	2	2	1	2	1	2	1
CO2	3	3	3	2	2	2	3	2	2	1	2	3
CO3	3	3	1	2	2	2	3	2	2	1	1	3
CO4	2	3	3	2	2	1	2	2	2	1	3	1
Max.	3	3	3	2	2	2	3	2	2	1	3	3

3 is High, 2 is Moderate, 1 is Low & - is Not Applicable



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## COURSE HANDOUT (ABRIDGED)

**Session:** 2021-2022

**Sub Session:** Semester I (Jul-Dec)

**Course Name:** Office Productivity Tools (MGT 121)

**L/T/P/C:** 2/1/0/3

### Course Description

Business productivity depends on how well you and your team are trained on the tools used on a daily basis, tools that are constantly being updated. This course will take students through a comprehensive understanding of the most popular word processing, presentation and collaborative tools in the market. The course will help in developing the ability of the students to use technology to generate better reports, make professional presentations and work collaboratively through digital platforms.

### Course Outcomes

S.No.	Description
CO1	Design effective powerpoint presentation using the available tools in the software
CO2	Learning to present using powerpoint presentation tools
CO3	Learn to draft error free documents in a popular text editor and create table of content or using right fonts and indents and layout
CO4	Learning the use of media in documents and how to use them effectively
CO5	Learn to use track changes, notes, comments and referencing
CO6	Learn using online tools like video conferencing tools and collaboration tools etc

### Course outcome mapping with Programme Outcomes:

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	3	3	1	2	3	2	2	3	3	1	2	3
CO2	3	3	2	2	3	2	3	2	3	1	2	3
CO3	3	3	2	2	3	2	2	2	2	2	2	3
CO4	3	2	1	1	3	3	3	3	2	2	1	3
CO5	3	2	2	2	2	3	3	3	2	2	1	3
CO6	3	3	3	3	3	2	2	3	2	1	3	3
Max.	3	3	3	3	3	3	3	3	3	2	3	3

3 is High, 2 is Moderate, 1 is Low & - is Not Applicable

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## COURSE HANDOUT (ABRIDGED)

**Session:** 2021-2022

**Sub Session:** Semester II (Jan-Jun)

**Course Name:** Business Environment (MGT 122)

**L/T/P/C:** 3/0/0/3

### Course Description

The course aims at imparting knowledge about the various social, political, legal, economic and technological factors which influence the business environment. The course systematically explores the external environment in which businesses operate – legal & regulatory, macroeconomic, cultural, political, technological and natural. Additionally, the course will examine the critical opportunities and threats that arise from an analysis of external business conditions. Students will apply scenario planning to a selected industry and synthesize trends in the external environment in the presence of risk and uncertainty.

### Course Outcomes

S.No.	Description
CO1	Explain the basic concepts of business environment
CO2	Understand influence of society on business
CO3	Understand influence of politics on business
CO4	Understand influence of Technology on business
CO5	Understand influence of economy on business
CO6	Understand influence of legal aspects on business
CO7	Analyse the various business environmental concepts and chalk plans for a business
CO8	Learn the impact of globalization on today's businesses

### Course outcome mapping with Programme Outcomes:

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	2	3	3	3	3	3	3	3	3	3	3	3
CO2	3	3	3	3	3	3	3	3	3	3	3	3
CO3	3	3	3	3	3	3	3	3	2	3	1	2
CO4	2	2	2	3	2	3	2	2	3	2	2	3
CO5	2	3	3	2	2	1	2	1	2	2	2	2
CO6	2	2	2	2	2	2	2	2	2	2	2	2
CO7	3	3	3	2	3	3	3	2	3	3	3	3
CO8	2	3	3	3	3	3	3	3	3	2	3	3
Max.	3	3	3	3	3	3	3	3	3	3	3	3

3 is High, 2 is Moderate, 1 is Low & - is Not Applicable

  
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## COURSE HANDOUT (ABRIDGED)

**Session:** 2021-2022

**Sub Session:** Semester II (Jan-Jun)

**Course Name:** Business Ethics and Values in Management  
(MGT 232)

**L/T/P/C:** 3/0/0/3

### Course Description

This course will enable students to introspect on the important ethical implications of the day-to-day happenings and practices of industry and business. The aim of the course is to stimulate discussion and debate using available theoretical frameworks. The course will sensitise students to the ethical dilemmas and fundamental human values in improving managerial effectiveness. Using real life situations, the course will try to identify the variables in ethically complex business situations through an understanding of the more subtle criteria for making sound decisions.

Topics to be covered include Introduction to the concepts in Business Ethics and Human Values, Ethical theories; Moral Development; Managing ethics - Individual and situational influences; Making decisions in business ethics: Situational influences; Group Ethics; Ethical Dilemmas in Management; Ethics in Information Technology and Systems Usage; Employees and business ethics; Corporate Ethics and Company Philosophies, Economic Justice and Business Ethics, Distributive Justice and India, Global Social Issues-- Environmental Ethics Ethical Attitudes of Indian Managers; Law of karma; Whistle Blowing; Sci-Tech, Law, HRM and Ethics; Corporate Social Responsibility: Applications; Ethics and Corporate Governance, Human values and managerial effectiveness.

### Course Outcomes

S.No.	Description
CO1	Understand the key concepts related to Indian Ethos, Business Ethics and ethical dilemmas
CO2	Understand the significance of ethical orientation of an organization in its overall performance
CO3	Understand the significance of Ethos and Ethics in organisation's overall performance
CO4	Understand the role of human values in managerial effectiveness.
CO5	Understand the key concepts of corporate governance and their applications in Global arena

### Course outcome mapping with Programme Outcomes:

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	2	2	2	2	3	3	3	3	3	3	3	3
CO2	3	3	3	3	3	3	2	3	3	3	3	3
CO3	2	3	2	2	2	3	1	2	2	1	3	2
CO4	2	3	2	2	3	2	3	3	2	3	3	3
CO5	3	3	2	3	2	2	2	2	2	2	2	3
Max.	3	3	3	3	3	3	3	3	3	3	3	3

3 is High, 2 is Moderate, 1 is Low & - is Not Applicable

  
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## COURSE HANDOUT (ABRIDGED)

**Session:** 2021-2022

**Sub Session:** Semester I (Jul-Dec)

**Course Name:** International Business Management (MGT 242)

**L/T/P/C:** 3/0/0/3

### Course Description

This course attempts to give glimpse of international business to students. Students will learn about trade relations, international finance, trade theories and legal and labor agreements. Develop understanding of globalization, the way it operates, and its impact on the progress of nations, individuals, and firms. This course provide an overview of political, economic, and cultural differences among nations in the world and how firms are dealing with these differences in doing International Business. Students will know different types of Multi-Lateral Agencies like the WTO, IMF, World Bank etc, and how do they impact development of nations, individuals, and international businesses of firms in this course. Student will comprehend different operational aspects of International Business like Human Resource, Financials, Supply Chain etc.

### Course Outcomes

S.No.	Description
CO1	Develop understanding of globalization, the way it operates, and its impact on the progress of nations, individuals, and firms.
CO2	Acquaint pupil about political, economic, and cultural differences among nations in the world and how firms are dealing with these differences in doing International Business.
CO3	Acquire knowledge about functioning of different types of Multi Lateral Agencies like the WTO, IMF, World Bank etc, and how do they impact development of nations, individuals, and international businesses of firms.
CO4	Learn different theories propagated by economists in international trade to understand economic rationale behind any international business among nations of the world.
CO5	Develop understanding of International Monetary System and how it has evolved in several centuries in aiding International Business.
CO6	Acquaint pupil with different strategies adopted by firms in International Business while entering foreign nations or expanding their businesses.
CO7	Develop understanding of different operational aspects of International Business like Human Resource, Financials, Supply Chain etc.
CO8	Learn basic understanding of exports and imports of goods, services, labor and capital.

### Course outcome mapping with Programme Outcomes:

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	2	2	3	3	2	1	2	1	2	3	1	3
CO2	2	3	2	3	3	1	2	2	1	3	2	2
CO3	3	2	2	3	2	1	1	1	2	3	2	3
CO4	2	3	1	2	3	2	2	1	3	3	3	2
CO5	2	2	2	3	2	3	2	3	3	3	2	3
CO6	2	2	2	3	2	3	2	3	3	3	2	3
CO7	2	2	2	3	2	3	2	3	3	3	2	3
CO8	2	2	2	3	2	3	2	3	3	3	2	3
Max.	3	3	3	3	3	3	2	3	3	3	3	3

3 is High, 2 is Moderate, 1 is Low & - is Not Applicable

  
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## COURSE HANDOUT (ABRIDGED)

**Session:** 2021-2022

**Sub Session:** Semester I (Jul-Dec)

**Course Name:** Entrepreneurship & Startup ecosystems in India (MGT 251)

**L/T/P/C:** 3/1/0/4

### Course Description

The Business Environment in India has undergone a paradigm shift since the adoption of LPG. Indian Inc. catapulted itself to the role of 'Change Agent'. It is catalyst of a Knowledge-driven Market-centric economy. Competition breeds Innovation. Our economic policies encourage First generation Entrepreneurs – be it Micro, Small, Medium besides traditional Large Enterprises. The traditional form of business models like Family-run businesses are also success flag-post ventures in highly competitive global market ecosystem. Yet, there is a Knowledge-Divide. Our traditional theory based concepts are not effectively motivating young students to commercially exploit their Knowledge resource. This course will fill the void by sensitizing the students of the churning of business environment. The course will imbibe the attitudes of Entrepreneurship in budding students and hone their skill sets to Establish, Expand or Diversify and also explore merging concepts of growth of their own business.

### Course Outcomes

S.No.	Description
CO1	The students acquire necessary knowledge and skills required for organizing and carrying out entrepreneurial activities.
CO2	To develop the ability of analysing and understanding Indian Startup business situations in which entrepreneurs act.
CO3	To master the knowledge necessary to plan entrepreneurial activities.
CO4	The students will develop the ability of analysing various aspects of entrepreneurship – especially of understanding and taking over the risk, and the specificities as well as the pattern of entrepreneurship.
CO5	To contribute to their development of entrepreneurial and managerial potential.

### Course outcome mapping with Programme Outcomes:

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

3 is High, 2 is Moderate, 1 is Low & - is Not Applicable

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## COURSE HANDOUT (ABRIDGED)

**Session:** 2021-2022

**Sub Session:** Semester II (Jan-Jun)

**Course Name:** Innovation & Entrepreneurship (MGT 311)

**L/T/P/C:** 3/0/0/3

### Course Description

Project in Innovation & Entrepreneurship is a critical course in advancing your problem solving and applied skills. The course offers an opportunity to develop knowledge, skills, and attitude necessary to successfully commercialize new products and services. The focus is on advancing your knowledge of how to craft and improve key enterprise choices and outcomes. Sustaining enterprises in an environment of accelerated change is also a critical element of this course. This starts with the identification and framing of a real-world innovation project and problem drawn from your own environment / experiences. You will be challenged to plan how you will successfully implement this project. The course is structured on both a macro organizational level and micro project level to allow you to integrate contemporary lessons from successful enterprises into your practical innovation design and implementation project. Throughout the course, you will be asked to reflect on how the learning material applies to your own business idea to help you build a business plan.

### Course Outcomes

S.No.	Description
CO1	Demonstrate understanding of key concepts underpinning entrepreneurship and its application in the recognition and exploitation of product/ service/ process opportunities
CO2	Assess the commercial viability of new technologies and innovative business models
CO3	Plan, organize, and execute a project or new venture with the goal of bringing new products and service to the market
CO4	Critique a plan for implementing entrepreneurial activities in a globalized and competitive environment being mindful of the social, ethical and cultural issues.
CO5	Effectively present and communicate opportunities to both a technical- and a business-oriented audience

### Course outcome mapping with Programme Outcomes:

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

3 is High, 2 is Moderate, 1 is Low & - is Not Applicable

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## COURSE HANDOUT (ABRIDGED)

**Session:** 2021-2022

**Sub Session:** Semester II (Jan-Jun)

**Course Name:** Project Management (MGT 312)

**L/T/P/C:** 3/0/0/3

### Course Description

Course drives the Students on understanding about the Strategic Planning for Project Proposals by conducting Project requirement analysis, thereby enabling them to analyze the cost benefits, risk analysis and followed by proper planning for the Project Implementation. Project Management introduces project management from the standpoint of a manager who must organize, plan, implement, and control tasks to achieve an organizations schedule, budget, and performance objectives. By completing this course, it will enable the students to experience as a Project Manager role that actually helps their career.

### Course Outcomes

S.No.	Description
CO1	Understand project characteristics and various stages of a project.
CO2	Understand the conceptual clarity about project organization and feasibility analyses- Market, Technical, Financial and Economic
CO3	Analyze the learning and understand techniques for Project planning, scheduling and Execution Control.
CO4	Apply the risk management plan and analyze the role of stakeholders.

### Course outcome mapping with Programme Outcomes:

CO	PO1	PO2	PO3	PO4	PO5
CO1	3	2	3	3	3
CO2	3	2	2	3	2
CO3	3	3	2	3	3
CO4	3	2	1	3	2
Max.	3	3	3	3	3

3 is High, 2 is Moderate, 1 is Low & - is Not Applicable

  
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## COURSE HANDOUT (ABRIDGED)

**Session:** 2021-2022

**Sub Session:** Semester I (Jul-Dec)

**Course Name:** Production & Operations Management (MGT 321)

**L/T/P/C:** 3/0/0/3

### Course Description

The main aim of the course is to provide an overview of concepts involved in production, operations and supply chain management. These concepts include operation strategy, process design, forecasting, quality management, inventory management, scheduling and supply chain management. Emphasis will be on application on these concepts to actual business situations. The course focuses on the core conversion processes of the organization where value addition takes place for the customer, thereby providing a systematic means of studying and analysing organizational processes. The course also focuses on the different stages of the supply chain and the associated interactions, helping develop managerial insight in different contexts. The course aims to: impart a frame of reference for operations and supply chain management; impart knowledge of the various functions involved; impart knowledge of the relations with its environment; impart knowledge of the management issues.

Taking a process view, the course will examine a variety of industrial applications. The emphasis will be on improving efficiency of processes and also developing a unifying theme for production and operation related issues. The course will also focus on inventory theory and its application in supply chain management. Overall the course will take an analytical and detailed approach using models for decision-making and problem-solving.

### Course Outcomes

S.No.	Description
CO1	CO1. Ability to understand and analyze the Design of the Operation System, and Operation and Control of the System.
CO2	CO2. Ability to understand concepts, tools, and techniques involved in core operational capabilities, and apply them to a broad range of industries, both manufacturing and non-manufacturing.
CO3	CO3. Ability to deal with practical problems in production and operations by application of various economical and mathematical tools.
CO4	CO4. Ability to comprehend and account for the effect that uncertainty has on decision-making, as well as the interplay between strategic objectives and operational capabilities.
CO5	CO5. Ability to apply sales and operations planning, MRP and lean manufacturing concepts in different industries, both manufacturing and non-manufacturing.
CO6	CO6. Ability to understand major logistics functions and activities and also to differentiate between logistics and supply chain management.
CO7	CO7. Ability to apply and analyze logistics and purchasing concepts in the context of global supply chains.
CO8	CO8. Ability to apply quality management tools.
CO9	CO9. Ability to understand the contemporary challenges and issues in operations of global organizations.
CO10	CO10. Skill in application of concepts and tools for process improvement.
CO11	CO11. Ability to apply appropriate software, and interpret and use the output for problem solving and decision making.

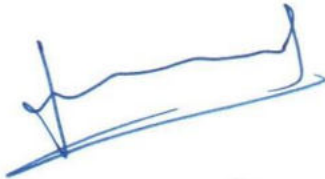
### Course outcome mapping with Programme Outcomes:

  
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CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	3	1	3	2	3	3	1	3	2	3	3	2
CO1 0	3	3	-	3	3	-	3	3	3	3	1	2
CO1 1	3	2	-	1	3	-	3	3	2	1	-	-
CO2	3	3	3	2	3	1	3	3	3	2	3	2
CO3	3	2	3	-	3	-	3	2	3	2	2	1
CO4	3	2	2	1	2	2	2	2	2	3	2	-
CO5	3	1	2	2	2	-	2	1	2	2	1	-
CO6	3	-	3	2	2	-	-	-	-	2	1	2
CO7	3	-	3	1	1	-	-	-	-	2	3	-
CO8	3	3	3	3	3	2	3	3	2	1	1	-
CO9	3	-	1	1	1	-	1	-	-	2	3	1
Max.	3	3	3	3	3	3	3	3	3	3	3	2

3 is High, 2 is Moderate, 1 is Low & - is Not Applicable

  
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## COURSE HANDOUT (ABRIDGED)

**Session:** 2021-2022

**Sub Session:** Semester II (Jan-Jun)

**Course Name:** Capstone Project I (MGT 322)

**L/T/P/C:** 2/0/0/2

### Course Description

There will be a single project based on all the terms, in which students learnt how to apply concepts, techniques and tools of business analytics and data science to identify a business problem, formulate the problem statement, understand the variables and the constraints, select the most appropriate analytical approach and tools & techniques, collect, collate, clean and analyze data, derive correct insights and reach an optimum solution. This course deals with real-life application of advanced analytics topics of statistics.

### Course Outcomes

S.No.	Description
CO1	Ability to understand business requirement and choosing a sample data to initiate a POC.
CO2	Ability to use enterprise-level data sources and work with them by using statistical software.
CO3	Ability to identify problem variables and task constraints in corresponding business settings.
CO4	Ability to determine and use the appropriate software system to implement solutions.
CO5	Ability to understand white papers and research projects to effectively present the business problem, methodology, process, and an innovative solution.
CO6	Ability to state the assumptions, evaluate the pros and cons for the possible alternatives.
CO7	Ability to reach at optimum data driven solution for the particular business scenario.
CO8	Ability to integrate business analysis and technical solutions by other team members.
CO9	Ability to organize and write the content of the project in a coherent and logical way

### Course outcome mapping with Programme Outcomes:

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	3	-	3	-	3	-	3	-	3	-	-	3
CO2	3	-	3	-	3	-	3	-	3	-	-	3
CO3	3	-	3	-	3	-	3	-	3	-	-	3
CO4	3	-	2	-	3	-	1	-	3	-	-	3
CO5	2	-	3	-	1	-	1	-	3	-	-	3
CO6	2	-	2	-	1	-	2	-	3	-	-	3
CO7	3	-	2	-	2	-	2	-	3	-	-	3
CO8	2	-	2	-	2	-	2	-	3	-	-	3
CO9	3	-	2	-	3	-	3	-	3	-	-	3
Max.	3	-	3	-	3	-	3	-	3	-	-	3

3 is High, 2 is Moderate, 1 is Low & - is Not Applicable

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## COURSE HANDOUT (ABRIDGED)

**Session:** 2021-2022

**Sub Session:** Semester II (Jan-Jun)

**Course Name:** Research Methods (MGT 341)

**L/T/P/C:** 3/0/0/3

### Course Description

This course will provide an overview of research methods that are usually employed in management research. The course will introduce the learner to the philosophy, basic concepts and techniques (both qualitative and quantitative) that form the core of management research. The course will delve into theory building, scientific method, research design, framing of research question, research alternatives, sampling, concepts of measurement, development of attitude scales, and their analysis and interpretation, basics of multivariate analysis and statistical inference. Overall, the course will help the learner develop a strong conceptual foundation for the research process. This course is intended to be an introductory gateway to research that the learner will conduct during their future research and dissertation work in Marketing, Finance, Organizational Behavior, HRM, Strategy, Systems, Operations and other areas of management. The course comprises several readings from books and journal as well as several research activities during which learners will be required to design empirical study, collect data and test the hypotheses with extensive use of statistical software.

### Course Outcomes

S.No.	Description
CO1	Identify the process of research, problem selection, and develop research questions
CO2	Understand the concept and meaning of research design.
CO3	Understand the measurement concepts, attitude scales and methods of data collection.
CO4	Understands the different techniques of sampling and data processing.
CO5	Understand the art of interpretation and report writing

### Course outcome mapping with Programme Outcomes:

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

3 is High, 2 is Moderate, 1 is Low & - is Not Applicable

  
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## COURSE HANDOUT (ABRIDGED)

**Session:** 2021-2022

**Sub Session:** Semester II (Jan-Jun)

**Course Name:** Business Laws & Applications (MGT 351)

**L/T/P/C:** 2/0/0/2

### Course Description

This course familiarises the students with the legal environment in which business operates in India and internationally. The course will provide practical legal knowledge of general business law issues including a basic understanding of how the politico-legal processes and legal infrastructure (contracts, intellectual property, anti-trust, anti-profiteering, bankruptcy etc.) affect business strategy and decision making. The course also discusses the technology and intellectual property dimensions in a global perspective (including patent, copyright, and trademark law) as well as laws relating to trade secrets, unfair competition, and consumer protection. Though the conceptual focus will be on Indian legal system, a conscious effort will be made to familiarise students with the challenges posed by diverse international legal regimes.

### Course Outcomes

S.No.	Description
CO1	Understand the legal system in India, Regulatory business environment and how it applies and impacts managerial capabilities in view of business. Also understand the legal process and the legal thought process.
CO2	Gain an overview different laws like contract law, property law and company law, their application and process.
CO3	Gain an overview of investment, insurance related law, IPR related laws, cyber laws GST Laws, negotiable instrument act, consumer protection act their application and process.
CO4	Understand the Regulatory and supervisory framework (rules, regulations and guidelines) related to FEMA, RBI, SEBI, SARFAESI Act and other acts.
CO5	Capacity Building for taking Informed Decision Making in Business transactions based on different laws.

### Course outcome mapping with Programme Outcomes:

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	2	1	2	2	2	2	3	3	2	2	2	2
CO2	2	1	2	2	2	2	3	3	2	2	2	2
CO3	2	1	2	2	2	2	3	3	2	2	2	2
CO4	2	1	2	2	2	2	3	3	2	2	2	2
CO5	2	1	1	3	3	3	3	3	3	3	3	2
Max.	2	1	2	3	3	3	3	3	3	3	3	2

3 is High, 2 is Moderate, 1 is Low & - is Not Applicable

  
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## COURSE HANDOUT (ABRIDGED)

**Session:** 2021-2022

**Sub Session:** Semester II (Jan-Jun)

**Course Name:** Business Policy, Planning & Strategy (MGT 361)

**L/T/P/C:** 2/0/0/2

### Course Description

This course focuses on how to establish a vision for the organization and strategically manage its future. Since this would encompass all functional areas the student will have an opportunity to utilize skills gained in other MBA courses in exploring the strategic management process in this integrative course. Students will gain skills in analyzing an organizations situation identifying appropriate strategies and designing and implementing strategic plans.

### Course Outcomes

S.No.	Description
CO1	Students will be able to describe major theories background work concepts and research output in the field of strategic management
CO2	Students will demonstrate a clear understanding of the concepts tools techniques used by executives in developing and executing strategies and will appreciate its integrative and interdisciplinary nature
CO3	Students will be able to demonstrate effective application of concepts tools techniques to practical situations for diagnosing and solving organisational problems
CO4	Students will be able to demonstrate capability of making their own decisions in dynamic business landscape
CO5	Students will be able to develop their capacity to think and execute strategically

### Course outcome mapping with Programme Outcomes:

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	3	2	3	2	3	3	3	2	3	2	2	3
CO2	3	3	2	3	2	2	2	3	2	3	2	2
CO3	2	1	3	2	1	2	3	1	1	1	3	2
CO4	2	2	1	3	2	3	1	3	3	3	1	3
CO5	2	3	2	1	3	1	2	2	2	2	3	1
Max.	3	3	3	3	3	3	3	3	3	3	3	3

3 is High, 2 is Moderate, 1 is Low & - is Not Applicable

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## COURSE HANDOUT (ABRIDGED)

**Session:** 2021-2022

**Sub Session:** Semester I (Jul-Dec)

**Course Name:** Capstone Project II (MGT 441)

**L/T/P/C:** 2/0/0/2

### Course Description

There will be a single project based on all the terms, in which students learnt how to apply concepts, techniques and tools of business analytics and data science to identify a business problem, formulate the problem statement, understand the variables and the constraints, select the most appropriate analytical approach and tools & techniques, collect, collate, clean and analyze data, derive correct insights and reach an optimum solution. This course deals with real-life application of advanced analytics topics of statistics.

### Course Outcomes

S.No.	Description
CO1	Ability to understand business requirement and choosing a sample data to initiate a POC.
CO2	Ability to use enterprise-level data sources and work with them by using statistical software.
CO3	Ability to identify problem variables and task constraints in corresponding business settings.
CO4	Ability to understand white papers and research projects to effectively present the business problem, methodology, process, and an innovative solution.
CO5	Ability to state the assumptions, evaluate the pros and cons for the possible alternatives.
CO6	Ability to reach at optimum data driven solution for the particular business scenario.
CO7	Ability to organize and write the content of the project in a coherent and logical way

### Course outcome mapping with Programme Outcomes:

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	2	2	3	3	2	3	1	3	2	3	3	3
CO2	2	3	2	2	2	3	1	2	3	3	2	3
CO3	-	2	2	2	2	2	2	2	3	2	1	2
CO4	1	3	2	2	2	2	2	2	2	2	1	1
CO5	2	2	1	1	1	2	3	2	2	3	1	1
CO6	2	1	1	1	1	1	3	2	1	1	1	2
CO7	1	1	1	1	1	1	1	1	2	1	1	2
Max.	2	3	3	3	2	3	3	3	3	3	3	3

3 is High, 2 is Moderate, 1 is Low & - is Not Applicable

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## COURSE HANDOUT (ABRIDGED)

**Session:** 2021-2022

**Sub Session:** Semester I (Jul-Dec)

**Course Name:** Technology Management (MGT 582)

**L/T/P/C:** 3/0/0/3

### Course Description

The course aims to develop basic understanding of technology and the characteristics of technology; why and how business organisations increasingly used technology- based strategies to gain competitive advantage; how technology impacts the organisation structure; how organisations 'manage' technology and technology development and what are the tools or techniques of management technology. At the end of the course, students will be able to perceive the ever- increasing role of technology in businesses and will have the required strategic understanding of how the organisations must manage technology to stay competitive.

### Course Outcomes

S.No.	Description
CO1	Communicate the major concepts in the functional areas of accounting, marketing, finance, information technology, and management.
CO2	Describe the legal, social, ethical, and economic environments of business in a global context.
CO3	Solve organization problems, individually and/or in teams, using quantitative, qualitative, and technology-enhanced approaches.
CO4	Demonstrate professional communication and behavior.

### Course outcome mapping with Programme Outcomes:

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

3 is High, 2 is Moderate, 1 is Low & - is Not Applicable

  
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## COURSE HANDOUT (ABRIDGED)

**Session:** 2021-2022

**Sub Session:** Semester I (Jul-Dec)

**Course Name:** Marketing Management I (MKT 202)

**L/T/P/C:** 3/0/0/3

### Course Description

The course aims to develop the students' ability to take a holistic view of different marketing decisions, i.e., product and brand, pricing, promotions and distribution (placing) and understand how they are interlinked. The course will also enable the student to understand how marketing decisions need to be continuously adapted to changes in the micro and macro environments in which the businesses operate. The course will provide insights into the step-by-step processes involved in the development of marketing plan, ensuring the successful future positioning and launch of new products/services in the marketplace. The course will provide real world perspective on marketing topics related to running a business (strategic issues, consumer retention, positioning, etc.). The course helps students study marketing as a rigorous discipline that uses logical frameworks for optimization of marketing decisions.

### Course Outcomes

S.No.	Description
CO1	Understand the basic Marketing concepts and the core marketing theme of identifying needs of customers and delivering benefits profitably keeping in mind the larger societal implications
CO2	Understand how STP work in real marketing situations
CO3	Understand how marketing organizations anticipate, manage and take advantage of the inconsistencies in the customer decision process
CO4	Understand the tactical and strategic aspects of marketing evidenced through 7 P's framework [Product, Promotion, Place, Price, Process, People and Physical evidence]
CO5	Understand the strategic aspect in marketing particularly strategic marketing
CO6	Develop the ability to measure and evaluate the attractiveness of different markets and market segments
CO7	Develop an understanding the various tradeoffs involved in the product development process
CO8	Develop an insight into design and management of distribution channel
CO9	Develop insight into the complexities involved in pricing decisions and how these decisions are taken.
CO10	Develop understanding of how promotional campaigns are run
CO11	Understand the value of relationship marketing
CO12	Appreciate sustainable marketing, societal marketing and business ethics in Marketing
CO13	Develop presentation skill, information search and analysis skill, resource management skill and decision-making skill

### Course outcome mapping with Programme Outcomes:

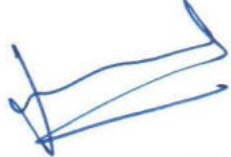
A handwritten signature in blue ink, appearing to be 'Neeinrana', written over a blue rectangular stamp.

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CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	3	1	1	1	1	1	2	2	2	1	1	3
CO1 0	2	2	2	1	1	1	2	2	1	1	1	3
CO1 1	3	2	2	1	2	2	2	1	1	1	1	3
CO1 2	2	1	2	1	3	3	2	2	2	1	2	1
CO1 3	-	3	3	3	2	1	3	3	3	3	2	3
CO2	3	2	2	1	3	1	3	2	2	1	2	2
CO3	3	2	1	2	3	1	2	2	2	3	1	2
CO4	2	2	1	2	3	1	3	3	2	2	1	2
CO5	3	2	1	1	3	1	3	3	2	2	3	2
CO6	3	2	2	2	2	1	3	3	2	3	3	2
CO7	3	2	2	2	3	1	3	2	2	3	3	2
CO8	3	2	2	2	3	1	3	2	2	3	3	2
CO9	3	2	2	2	3	1	3	1	2	3	3	2
Max.	3	3	3	3	3	3	3	3	3	3	3	3

3 is High, 2 is Moderate, 1 is Low & - is Not Applicable

  
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## COURSE HANDOUT (ABRIDGED)

**Session:** 2021-2022

**Sub Session:** Semester II (Jan-Jun)

**Course Name:** Marketing Management II (MKT 212)

**L/T/P/C:** 3/0/0/3

### Course Description

The course aims at nurturing marketing skills among the students. It will broaden the learners' horizons in understanding the marketing practices and also enhance their analytical and problem solving skills for real world marketing problems. By the end of this course, the learners shall be able to understand the underlying marketing concepts, marketing practices of corporate world, problem faced by marketers in dynamic business environment and marketing tactics to deal with such issues through discussion on marketing concepts, corporate world marketing practices and case studies.

### Course Outcomes

S.No.	Description
CO1	Understand the tactical and strategic aspects of marketing evidenced through 7P framework
CO2	Develop an insight into design and management of distribution channel
CO3	Develop understanding of how IMC is being managed
CO4	Develop understanding of brand management
CO5	Understand the value of relationship marketing
CO6	Understand the complexities and challenges involved in international marketing
CO7	Appreciate sustainable marketing, societal marketing and business ethics in Market
CO8	Develop presentation skill, information search and analysis skill, resource management skill and decision-making skill

### Course outcome mapping with Programme Outcomes:

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	3	2	1	1	3	1	2	2	1	3	2	2
CO2	3	2	1	1	3	1	2	2	1	3	2	2
CO3	3	2	2	2	3	2	3	2	3	3	3	3
CO4	3	2	2	2	3	3	2	2	1	1	2	2
CO5	3	2	2	2	2	3	2	2	2	1	1	3
CO6	3	1	2	2	2	2	3	1	2	2	2	1
CO7	2	3	2	2	3	3	2	1	2	2	3	2
CO8	2	3	2	3	3	3	3	3	3	2	2	3
Max.	3	3	2	3	3	3	3	3	3	3	3	3

3 is High, 2 is Moderate, 1 is Low & - is Not Applicable

  
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## COURSE HANDOUT (ABRIDGED)

**Session:** 2021-2022

**Sub Session:** Semester I (Jul-Dec)

**Course Name:** Sales & Distribution Management (MKT 311)

**L/T/P/C:** 3/0/0/3

### Course Description

As digital technology continues to open-up new distribution channels, customer demands and sales strategies are rapidly evolving. With multichannel networks becoming the norm, leaders must design a go-to-market strategy that sells the right products at the right time through the right combination of channels. Sales & Distribution Management is a comprehensive course focusing on optimization of sales outcomes by developing and managing a high-performance multichannel network and sales force. The course takes both a strategic and a tactical perspective. The course discusses factors influencing the human dynamics in managing sales and distribution systems; key opportunities and challenges that sales managers face in their day-to-day work; role of sales & distribution management in the broader corporate environment.

### Course Outcomes

S.No.	Description
CO1	Demonstrate understanding of role and responsibilities of "sales managers"
CO2	Apply models and frameworks for managing and enhancing the productivity and performance of sales and distribution systems
CO3	Analyze various issues and concerns related with designing and implementing effective sales strategy
CO4	Analyze various issues and concerns related with designing and implementing effective distribution strategy
CO5	Critically evaluate the sales and distribution performance and salesperson's performance

### Course outcome mapping with Programme Outcomes:

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

3 is High, 2 is Moderate, 1 is Low & - is Not Applicable

  
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## COURSE HANDOUT (ABRIDGED)

**Session:** 2021-2022

**Sub Session:** Semester II (Jan-Jun)

**Course Name:** Marketing Research (MKT 321)

**L/T/P/C:** 3/0/0/3

### Course Description

This course will provide an overview of research methods used in marketing. The course will introduce the learner to the basic concepts and techniques (both qualitative and quantitative) that form the core of marketing research. The course will delve into theory building, scientific method, research design, framing of research questions, sampling, concepts of measurement, development of attitude scales, and their analysis and interpretation, basics of multivariate analysis and statistical inference. The course will help the learner develop a strong conceptual foundation for marketing research.

### Course Outcomes

S.No.	Description
CO1	Understanding the marketing research processes
CO2	Understanding different research methods
CO3	The students would be able to apply research methods
CO4	Ability to analyse and interpret qualitative and quantitative data
CO5	Conduct and analyse a research project
CO6	Design a questionnaire and collect data from web-based platforms.

### Course outcome mapping with Programme Outcomes:

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	3	2	3	2	3	3	3	2	2	2	1	3
CO2	3	2	3	3	3	3	3	3	2	2	1	3
CO3	2	2	3	2	3	3	3	2	2	1	2	2
CO4	3	3	3	2	2	3	3	2	2	1	2	2
CO5	2	3	1	-	3	3	3	3	3	1	2	1
CO6	2	3	1	-	2	2	2	3	2	1	2	2
Max.	3	3	3	3	3	3	3	3	3	2	2	3

3 is High, 2 is Moderate, 1 is Low & - is Not Applicable

  
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## COURSE HANDOUT (ABRIDGED)

**Session:** 2021-2022

**Sub Session:** Semester II (Jan-Jun)

**Course Name:** Introduction to Digital & Social Media Marketing (MKT 322)

**L/T/P/C:** 3/0/0/3

### Course Description

Today, companies must connect with customers and other businesses through digital channels and adjust their marketing mix to succeed. Research indicates that marketing budget for digital marketing & social media marketing are increasing dramatically. These digital & social media marketing campaigns are becoming a pivotal part of effective marketing plans. The course familiarize students with an understanding of how the digital marketing works and develop the critical insights necessary to succeed in digital & social media marketing. This course explores the digital & social media marketing landscape and equip them with necessary skills to effectively use various digital marketing technologies & social media platforms. Students will acquire knowledge and skills through online readings, asynchronous discussions with other students and their faculty, interactions with online tutorials, and online and hands-on simulations.

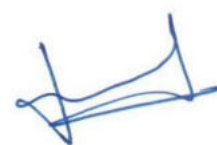
### Course Outcomes

S.No.	Description
CO1	Demonstrate the ability to recognize the ongoing trends in global e-commerce markets and technology given the dynamic and rapidly changing digital landscape
CO2	Demonstrate advanced practical skills in common digital marketing tools such as SEO, PPC etc.
CO3	Demonstrate in-depth knowledge of digital analytics to analyze various issues and concerns related with designing and implementing effective digital marketing strategy for meeting business objectives.
CO4	Demonstrate understanding of the social media landscape, tools and technologies
CO5	Design social media programs that directly support business and marketing goals

### Course outcome mapping with Programme Outcomes:

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	3	2	3	2	3	1	2	3	3	3	3	3
CO2	3	3	3	2	3	1	3	3	3	3	3	3
CO3	3	3	3	2	3	1	3	3	3	3	3	3
CO4	3	2	3	2	3	1	2	3	3	3	3	3
CO5	3	3	3	2	3	1	3	3	3	3	3	3
Max.	3	3	3	2	3	1	3	3	3	3	3	3

3 is High, 2 is Moderate, 1 is Low & - is Not Applicable



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## COURSE HANDOUT (ABRIDGED)

**Session:** 2021-2022

**Sub Session:** Semester I (Jul-Dec)

**Course Name:** Services Marketing (MKT 401)

**L/T/P/C:** 3/0/0/3

### Course Description

This course is meant to prepare students pursuing marketing careers in the services industries and would also be valuable to nonmarketing students desiring to grasp the main ideas of services marketing and how they may be used to create competitive advantage for firms. The course strengthens students ability to utilize marketing techniques to generate, promote, and deliver client value in the service economy by improving their grasp of diverse areas of services marketing. The textbook will be utilized to comprehend the fundamental concepts, and hands on exercises, case studies, and conversations will be used to provide experiential learning. Case studies from diverse sectors will be used to demonstrate concepts.

### Course Outcomes

S.No.	Description
CO1	Develop a grasp of the marketing issues faced by service firms as well as the similarities and distinctions between them and those faced by manufacturing businesses
CO2	Learn how to utilize the Gaps Model of Service Quality in service businesses
CO3	Develop vital knowledge of the four Ps and three additional Ps of the services marketing mix and how they relate to service quality management
CO4	Recognize the importance of technology in service marketing
CO5	Develop critical thinking, analysis and communication skills from the management point of view through case studies, discussions, written assignments

### Course outcome mapping with Programme Outcomes:

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	3	2	2	1	3	2	2	2	1	1	3	2
CO2	3	3	2	2	3	2	3	2	2	1	3	2
CO3	3	2	2	2	3	2	2	2	2	1	2	2
CO4	3	1	2	2	3	2	2	2	2	1	2	3
CO5	2	3	3	3	3	2	3	3	2	2	3	3
Max.	3	3	3	3	3	2	3	3	2	2	3	3

3 is High, 2 is Moderate, 1 is Low & - is Not Applicable

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## COURSE HANDOUT (ABRIDGED)

**Session:** 2021-2022

**Sub Session:** Semester I (Jul-Dec)

**Course Name:** Consumer Behaviour for Digital Marketers  
(MKT 411)

**L/T/P/C:** 3/0/0/3

### Course Description

Understanding the consumer behaviour is critical for digital age marketers to design and implement better marketing strategies for products services & ideas. This course borrows perspective from various fields such as psychology, sociology, anthropology, and economics. This has given rise to the need for a sophisticated marketing professional with a strong grasp on consumer behaviour issues. This course aims to develop critical understandings of consumer behaviour that will hold relevance both inside and outside the domain of marketing practice. It focuses upon understanding consumer decision-making processes and the various factors that influence these processes. This course discusses the basic consumer behaviour frameworks, theories, tools, and procedures. Students will learn to apply psychological, social, and cultural concepts to marketing decision making. The course broadly covers five aspects – the inner workings in the mind of a consumer that deals with consumer psychology and learning; the different situational factors that influence the consumer decision; the process by which a consumer makes a decision; the aggregate aftermath of consumer decisions; and finally, the key issues surrounding ethics and social responsibility. Student will also learn about ethical and social responsibility factors as they think through their marketing strategy.

### Course Outcomes

S.No.	Description
CO1	Demonstrate ability to explain and apply fundamental consumer behavior concepts to real-world decision-making problems pertaining to marketing strategy
CO2	Analyze various psychological factors, that influences consumer behaviour to build better marketing strategy
CO3	Analyze various socio-cultural factors, that influences consumer behaviour to build better marketing strategy
CO4	Analyze the consumer behavior on different stages of the consumer decision making process and suggest measures to influence those behaviors
CO5	Articulate key ethical and social responsibility concerns pertaining to a marketing strategy derived from the consideration of consumer behaviour

### Course outcome mapping with Programme Outcomes:

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	3	3	3	1	2	1	3	2	2	2	1	2
CO2	3	3	3	1	2	1	3	3	2	2	1	2
CO3	3	3	3	1	2	1	3	3	1	2	1	2
CO4	2	3	3	1	2	1	3	3	1	2	1	2
CO5	2	3	3	1	2	3	2	1	2	2	1	2
Max.	3	3	3	1	2	3	3	3	2	2	1	2

3 is High, 2 is Moderate, 1 is Low & - is Not Applicable

  
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## COURSE HANDOUT (ABRIDGED)

**Session:** 2021-2022

**Sub Session:** Semester I (Jul-Dec)

**Course Name:** Consumer Behaviour (MKT 512)

**L/T/P/C:** 3/0/0/3

### Course Description

The course aims to provide insights about buyer-behavior in a holistic manner (pre-purchase, purchase and post purchase). The course will aim to analyze buyer behavior using tools and techniques of consumer research to decipher buyer motivation and the impact of social and cultural variables on consumption decisions. The course will equip students with frameworks that can be used to analyse consumer behavior, design marketing strategies and to enhance the effectiveness of marketing programs.

### Course Outcomes

S.No.	Description
CO1	Explain and apply the key terms, definitions, and concepts used in the study of consumer behaviour.
CO2	Examine various psychological factors, that influences consumer behaviour
CO3	Examine various socio-cultural factors, that influences consumer behaviour
CO4	Apply understanding of consumer behaviour to influence different stages of the consumer decision making process
CO5	Articulate key ethical and social responsibility concerns pertaining to a marketing strategy derived from the consideration of consumer behaviour

### Course outcome mapping with Programme Outcomes:

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	3	3	3	1	2	1	3	2	2	2	1	2
CO2	3	3	3	1	2	1	3	3	2	2	1	2
CO3	3	3	3	1	2	1	3	3	1	2	1	2
CO4	2	3	3	1	2	1	3	3	1	2	1	2
CO5	2	3	3	1	2	3	2	1	2	2	1	2
Max.	3	3	3	1	2	3	3	3	2	2	1	2

3 is High, 2 is Moderate, 1 is Low & - is Not Applicable

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## COURSE HANDOUT (ABRIDGED)

**Session:** 2021-2022

**Sub Session:** Semester II (Jan-Jun)

**Course Name:** Integrated Marketing Communication (MKT 611)

**L/T/P/C:** 3/0/0/3

### Course Description

This course is designed to equip students with the competency of decision making in matters concerned with consumer/customer communications. This course breaks down the traditional advertising, public relations, and marketing silos by challenging practitioners to apply the optimum mix of media and message to motivate the target audience to act. The rise of the internet and Digital Marketing support the need to embrace integrated marketing communication as a *comprehensive approach to reach target audiences*. In this course, students will learn to use appropriate messages and communication channels based upon the demographics of target audiences, commensurate with the actual needs and business realities of marketing campaigns. Students will also learn and practice message and touch point integration with special attention to effectiveness and measurable results. The course will use a mix of pedagogical tools like projects, assignments/ exercises and case studies.

### Course Outcomes

S.No.	Description
CO1	To enable students to build a sound theoretical and practical understanding of the formulation of promotional strategy and the management of the marketing communication process
CO2	To develop an understanding of the economic and creative justifications for marketing communications
CO3	To be sensitive to ethical considerations in the formulation and the implementation of marketing communications strategy
CO4	Appreciate sustainable marketing, societal marketing and business ethics in marketing communication
CO5	Develop presentation skill, information search and analysis skill, resource management skill and decision-making skill.

### Course outcome mapping with Programme Outcomes:

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	3	3	1	1	3	1	2	2	2	1	2	1
CO2	3	3	2	1	3	1	3	2	3	1	1	2
CO3	2	2	2	3	3	3	3	1	2	2	3	2
CO4	3	3	2	2	2	2	2	2	2	1	2	2
CO5	3	3	2	3	3	2	3	3	3	1	2	3
Max.	3	3	2	3	3	3	3	3	3	2	3	3

3 is High, 2 is Moderate, 1 is Low & - is Not Applicable

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## COURSE HANDOUT (ABRIDGED)

**Session:** 2021-2022

**Sub Session:** Semester I (Jul-Dec)

**Course Name:** Marketing Analytics (MKT 623)

**L/T/P/C:** 3/0/0/3

### Course Description

This course will deal with data analytics techniques including prescriptive analytics and large-scale testing in solving key marketing problems in customer acquisition, development, and retention, and in providing a cohesive framework for studying consumer behavior. This course will discuss how analytics is being used not just about purchase decisions, but also about individual consumers pre- and post-purchase behavior. The course will also delve into the issue of how the expansion of retail stores, factory stores, and the Internet changed customer behavior. The focus will be on applying analytics to large consumer-level database and in learning how to target consumers individually and deriving customer insights.

### Course Outcomes

S.No.	Description
CO1	Understanding theoretical foundations of concepts
CO2	Choosing appropriate quantitative methods and understanding.
CO3	Applying Analytics to solve real world problems
CO4	Ability to identify business use cases for Marketing Analytics
CO5	Ability to apply and use tools to solve Marketing cases – Python, Excel etc.

### Course outcome mapping with Programme Outcomes:

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	1	2	2	2	3	3	3	2	3	3	3	2
CO2	1	2	2	2	2	2	2	2	2	3	3	2
CO3	1	2	2	2	2	2	2	2	2	3	3	2
CO4	1	2	2	2	3	3	3	2	3	3	3	2
CO5	1	2	2	2	2	2	2	2	2	3	3	2
Max.	1	2	2	2	3	3	3	2	3	3	3	2

3 is High, 2 is Moderate, 1 is Low & - is Not Applicable

A handwritten signature in blue ink is written over a purple circular stamp. The stamp contains the text 'REGISTERED' at the top, 'NIIT UNIVERSITY' in the middle, and 'MKT 623' at the bottom.



## COURSE HANDOUT (ABRIDGED)

**Session:** 2021-2022

**Sub Session:** Semester I (Jul-Dec)

**Course Name:** Community Connect (NU 111)

**L/T/P/C:** 0/0/2/1

### Course Description

Orientation to Field Visits: Each One Teach One; Importance of Education; Mentoring for Sensitivity & Curiosity; Understanding rural code of conduct; Sharing Technology education for access to learning

Accelerated Learning: Observing & selecting the mentee; Remedial teaching; developing lessons & tests for recapitulation; Getting to know children's world; School evaluation systems; alternative systems of learning; Teaching for Community Empowerment.

Measurement of Progress: in sensitivity; in degrees of curiosity; in aspirations; in learning styles; in mentoring styles; developing accelerated learning tests.

### Course Outcomes

S.No.	Description
CO1	• To develop sense of social responsibility amongst the students towards community participation, development, sensitization and education.
CO2	• To provide academic support / educational empowerment by way of one-to-one coaching / interactions in key subjects and issues relating to Community life.
CO3	• To get awareness about Community life and to sensitize community with respect to various issues.
CO4	• To develop competence required for sharing of responsibilities.
CO5	• To link the service activity to self-reflection, self-discovery and the acquisition and comprehension of values.

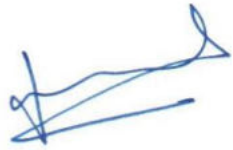
### Course outcome mapping with Programme Outcomes:

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	3	-	3	-	-	-	3	-	3	-	-	3
CO2	-	-	3	-	-	-	3	-	2	-	-	2
CO3	3	-	-	-	-	-	3	-	3	-	-	2
CO4	-	-	-	-	-	-	2	-	2	-	-	3
CO5	-	-	-	-	-	-	2	-	3	-	-	3
Max.	3	-	3	-	-	-	3	-	3	-	-	3

3 is High, 2 is Moderate, 1 is Low & - is Not Applicable

### List of Tentative Practical

Workshops  
Seminars  
Online Meetings  
Presentations  
Group Discussion

  
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## COURSE HANDOUT (ABRIDGED)

**Session:** 2021-2022

**Sub Session:** Semester II (Jan-Jun)

**Course Name:** Community Connect (NU 112)

**L/T/P/C:** 0/0/2/1

### Course Description

Orientation to Field Visits: Each One Teach One; Importance of Education; Mentoring for Sensitivity & Curiosity; Understanding rural code of conduct; Sharing Technology education for access to learning

Accelerated Learning: Observing & selecting the mentee; Remedial teaching; developing lessons & tests for recapitulation; Getting to know children's world; School evaluation systems; alternative systems of learning; Teaching for Community Empowerment.

Measurement of Progress: in sensitivity; in degrees of curiosity; in aspirations; in learning styles; in mentoring styles; developing accelerated learning tests.

### Course Outcomes

S.No.	Description
CO1	To develop sense of social responsibility amongst the students towards community participation, development, sensitization and education.
CO2	To provide academic support / educational empowerment by way of one-to-one coaching / interactions in key subjects and issues relating to Community life
CO3	To get awareness about Community life and to sensitize community with respect to various issues.
CO4	To develop competence required for sharing of responsibilities.
CO5	To link the service activity to self-reflection, self-discovery and the acquisition and comprehension of values.

### Course outcome mapping with Programme Outcomes:

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

3 is High, 2 is Moderate, 1 is Low & - is Not Applicable

### List of Tentative Practical

Online meeting based on the availability of human and technical resources

  
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## COURSE HANDOUT (ABRIDGED)

**Session:** 2021-2022

**Sub Session:** Semester II (Jan-Jun)

**Course Name:** R & D Project (NU 302)

**LT/P/C:** 1/0/6/4

### Course Description

The Research and Development (R & D) projects is a core course for all undergraduate 6th semester students. The purpose of this course is to train the students to perform research and to be familiar with the activities and methodologies generally followed during the research work. All Faculty of NU share their research problems and students select a problem according to his/her research interest. The students perform literature survey and find the research gaps and challenges in their respective selected problem and then narrow down to specific gap/challenge on which they want to pursue the research. Subsequently the students design a complete solution and implement the same in consultation with their faculty mentor. Students present these during two mid semester evaluations and submit brief report to explain these points. They give the presentation and show the demonstration during the final evaluation and submit the final report with plagiarism report. The activities during the research process imparts valuable learning objectives, like understanding the research process, develop critical thinking and problem-solving skills in addition to soft skills like communication skills, team-work skills etc. Outcome of the R & D projects as publications, conference paper, prototype, patent encourage the undergraduate students and faculty supervisors. Moreover, it has a positive impact on NU as well as society at large. This will be the base for Advanced R&D project in VII semester.

### Course Outcomes

S.No.	Description
CO1	Title of the project
CO2	To find the Research gaps and Challenges from the existing research works
CO3	Identify the particular area out of Research gaps and Challenges from the existing research works and explain the objectives to choose this area. Explain methodology with work flow and technology
CO4	Description of Tolls, hardware, open source software or third party software, system configuration which are required to complete the RandD project
CO5	Result and analysis with demonstration. Show the Outcome of the project, how it is going to be extended as Advanced RandD project.
CO6	Concluded the findings of the work done and identify the future scope of the project. The references should be given with all details like title of the research paper,

### Course outcome mapping with Programme Outcomes:

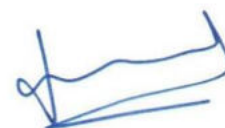
CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	3	3	3	3	3	3	3	3	3	2	3	3
CO2	3	3	3	3	3	3	3	3	3	2	2	3
CO3	3	3	3	3	3	3	3	3	3	3	3	3
CO4	3	3	3	3	3	3	3	3	3	3	3	3
CO5	3	3	3	3	3	3	3	3	3	3	3	3
CO6	3	3	2	2	2	1	2	3	2	3	2	2
Max.	3	3	3	3	3	3	3	3	3	3	3	3

3 is High, 2 is Moderate, 1 is Low & - is Not Applicable

  
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### List of Tentative Practical

Feature Selection & Classification for Multi-label Learning  
 Early diagnosis and Prediction of Alzheimer's Disease  
 Human Pose Estimation In Real-Time Videos  
 Object Detection and Recognition in Video  
 Attack Detection and prevention Schemes in Wireless Sensor Network / IoT  
 Tourist guided tour  
 Wireless Communication protocol and sensing system development for vehicular communication network.  
 Designing and prototyping a IoT-enabled Medicine Prescription System  
 Using Human Posture Detection for Yoga Posture Identification in Educable Adolescents  
 Self-Acquisition of Critical Skills using Mobile Apps as Tools for Adolescents with Learning Disabilities  
 Using Social Network Analysis to model Computer-Supported Collaborative Learning  
 Network monitoring tool  
 Fraud Detection  
 Use of block chain technology in Healthcare  
 Study of Malnutrition in Children  
 Information-centric networking(ICN)  
 Gateway selection for throughput optimization in multi-hop wireless networks  
 Design and development in portable Data Acquisition System (DAS) for recording and analysis of air pollutants  
 Coverage and Connectivity Issues in Wireless Sensor Networks  
 System for Monitoring the Loss of Attention in Automotive Drivers  
 Development of Requirements Engineering tool for IoT applications  
 Non-Invasive Tourist Guidance App for Monuments  
 Development of cellular based UAV security System  
 Development of Indoor and Outdoor Navigation System  
 V2G and Ride sharing services for Electric vehicles  
 System for Monitoring the Loss of Attention in Automotive Drivers  
 Study of Carbon Nano Tubes  
 Simulation study of Nanoscale MOSFETs for low power application  
 Discrete and Bounded Envy-Free Cake Cutting Protocol  
 Data Extraction from Graphs  
 Visualization of High Dimensional Data  
 Domain Decomposition  
 Artificial Intelligence in Games  
 Intelligent Analysis On Satellite Imagery  
 Digital Marketing Communication  
 Fog Computing based Node-to-Node Communication and Mobility Management Technique for Cellular Networks  
 Device-driven Communication Methodology and Mobility Management Scheme for 5G Networks  
 Exploration of heuristics approaches for examination scheduling.  
 Indexation of commodity derivatives in India  
 Identification of Carbohydrate Binding Modules (CBM) to study surface glycoprotein interaction  
 Computational approach to identify potential biomarker for the early detection of oral cancer  
  
 Virtual Screening, Molecular Docking & Simulation studies towards the discovery of HPV16/18-E7 natural inhibitors for Cancer  
 Developing antimicrobial nanocomposites as an efficient drug delivery system  
 Role of Probiotics in regulation of Host Immunity  
 Recognition of Facial Expression and Detection using python  
 Identification of Carbohydrate Binding Modules (CBM) to study surface glycoprotein interaction  
 Computational approach to identify potential biomarker for the early detection of oral cancer  
  
 Virtual Screening, Molecular Docking & Simulation studies towards the discovery of HPV16/18-E7 natural inhibitors for Cancer  
 Developing antimicrobial nanocomposites as an efficient drug delivery system  
 Role of Probiotics in regulation of Host Immunity



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## COURSE HANDOUT (ABRIDGED)

**Session:** 2021-2022

**Sub Session:** Semester I (Jul-Dec)

**Course Name:** Directed Independent Study (NU 400)

**L/T/P/C:** 1/0/0/4

### Course Description

This course covers cloud technology, services, and covers containers and container orchestration - the process of transforming the way the technology industry does. It covers some of the tools and buzzwords in association with these technologies, such as Docker and Kubernetes, and gives an understanding of what they mean. The second part of this course provides foundational security knowledge to recognize, compare, and contrast different types of cybersecurity vulnerabilities and threats and indicators associated with network attacks.

### Course Outcomes

S.No.	Description
CO1	Students will learn the fundamental ideas behind Cloud Computing or different threat actors, vectors, and intelligence sources
CO2	Cloud management techniques and cloud software deployment considerations or the security concerns associated with various types of vulnerabilities
CO3	Learn what containers are and how they work or the techniques used in penetration testing
CO4	Understand how to use containers in the real world to containerize an app or learn to implementing Secure Network Access Protocols

### Course outcome mapping with Programme Outcomes:

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

3 is High, 2 is Moderate, 1 is Low & - is Not Applicable

  
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## COURSE HANDOUT (ABRIDGED)

**Session:** 2021-2022

**Sub Session:** Semester I (Jul-Dec)

**Course Name:** Advanced R & D Project (NU 401)

**LT/P/C:** 1/0/6/4

### Course Description

Advanced R&D project is offered as an open elective in seventh semester to the fast learners and carry same credits as the other open electives. It will be based on the R&D project that students have done in 6th semester. The students who have shown promise during the R&D project during the sixth semester will get an opportunity to extend the work in the advanced R&D project. They will be working under the same faculty who had mentored him / her during the R&D project in VI semester. Some of the possible extensions may be, applying the same technique to different problems, fine tuning/improving the techniques to get the higher precision/accuracy, get to do more recent literature survey, devising instruments to collect data, data gathering & analysis etc. as per discussions with faculty mentor. Finally, students will write a comprehensive report/research article as guided by faculty mentor. Evaluation will be based on mid semester evaluation, end semester evaluation, mentor's evaluation and comprehensive report/research article. They give the presentation and show the demonstration during the final evaluation and submit the final report with plagiarism report.

### Course Outcomes

S.No.	Description
CO1	Select the domain/technology to define the next steps of research works
CO2	get to do more recent literature survey
CO3	applying the same technique to different problems, fine tuning/improving the techniques to get the higher precision/accuracy, devising instruments to collect data, data gathering and analysis etc.
CO4	Description of Tolls, hardware, open source software or third party software, system configuration which are required to complete the advanced R andD project
CO5	Result and analysis with demonstration. Show the Outcome of the project, how it is going to be extended as Advanced RandD project.
CO6	Concluded the findings of the work done and compare the results with existing works. The references should be given with all details like title of the research paper,

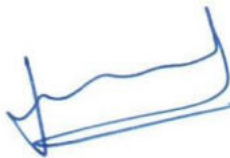
### Course outcome mapping with Programme Outcomes:

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	3	3	3	3	3	3	3	3	3	3	3	2
CO2	3	3	3	3	3	2	3	2	3	2	2	3
CO3	3	3	3	3	3	3	3	3	2	3	-	2
CO4	3	3	3	3	3	3	2	3	2	2	2	3
CO5	3	3	3	3	3	2	2	2	3	2	2	3
CO6	3	3	2	2	3	2	2	3	2	2	2	2
Max.	3	3	3	3	3	3	3	3	3	3	3	3

3 is High, 2 is Moderate, 1 is Low & - is Not Applicable

### List of Tentative Practical

Will work on the project as guided by mentor

  
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## COURSE HANDOUT (ABRIDGED)

**Session:** 2021-2022

**Sub Session:** Semester II (Jan-Jun)

**Course Name:** Industry Practice/ Project (NU 402)

**L/T/P/C:** 0/0/40/20

### Course Description

Industry Practice is a flagship course of 20 credits in the B Tech Programme of NIIT University. Every student of NIIT University has an opportunity to transfer learning from classroom to the workplace in industry in the final six-month semester of B Tech Programme. During Industry Practice, a student works on the real time project of an organization under direct mentoring by industry professional. This 6-month period makes the transition from student in a University to an employed professional in industry seamless or smooth for a student.

### Course Outcomes

S.No.	Description
CO1	Meet the rapidly changing needs and challenges of a professional workplace. Use the knowledge of mathematics, science, engineering (fundamentals/specialization) to solve the complex engineering problems.
CO2	Enable students to acquire learning by applying the knowledge and skills they possess, in unfamiliar, open-ended real life situations.
CO3	Give solutions for complicated engineering puzzles and design system segments or methods that match the defined requirements with proper consideration for public health and safety considering cultural, societal, and environmental.
CO4	Design, decide and implement relevant techniques, support, and state-of-the-art engineering and IT tools including forecast and modeling to complicated engineering exercises with knowledge of the limitations.

### Course outcome mapping with Programme Outcomes:

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	3	3	3	3	3	3	2	3	3	3	3	3
CO2	3	3	3	3	3	3	3	2	3	3	3	3
CO3	3	3	3	3	3	3	3	3	3	3	3	3
CO4	3	3	3	3	3	3	3	3	3	3	3	3
Max.	3	3	3	3	3	3	3	3	3	3	3	3

3 is High, 2 is Moderate, 1 is Low & - is Not Applicable

### List of Tentative Practical

Not applicable

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## COURSE HANDOUT (ABRIDGED)

**Session:** 2021-2022

**Sub Session:** Semester II (Jan-Jun)

**Course Name:** Contemporary Issues (NU 522)

**LT/P/C:** 2/0/0/2

### Course Description

1. In depth investigation of a chosen contemporary societal issue or problem of interdisciplinary nature and suggestion of a plausible solution should facilitate research culture.
2. As the chosen problem would invariably be interdisciplinary, students should develop an ability to analyze a problem from holistic perspective.
3. They should discover the interplay of subjectivity and objectivity, which exists in any problem solving.
4. This should give students an opportunity to widen their knowledge about contemporary issues facing global community and develop a global outlook and awareness.
5. The course methodology will require students to discuss in a group, give regular seminars and aim at publishing at least one article. This should help them hone oral and written communication skills. Not the least, students should develop a global outlook and awareness.

### Course Outcomes

S.No.	Description
CO1	In depth investigation of a chosen contemporary societal issue or problem of interdisciplinary nature and suggestion of a plausible solution should facilitate research culture.
CO2	As the chosen problem would invariably be interdisciplinary, students should develop an ability to analyze a problem from holistic perspective.
CO3	This should give students an opportunity to widen their knowledge about contemporary issues facing global community and develop a global outlook and awareness.
CO4	The course methodology will require students to discuss in a group, give regular seminars and aim at publishing at least one article. This should help them hone oral and written communication skills. Not the least, students should develop a global outlook and awareness.
CO5	They should discover the interplay of subjectivity and objectivity, which exists in any problem solving.

### Course outcome mapping with Programme Outcomes:

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	-	2	1	2	-	-	1	2	-	2	1	2
CO2	-	-	1	2	-	-	1	2	-	2	1	2
CO3	-	-	1	2	-	-	1	2	-	2	1	2
CO4	-	-	1	2	-	-	1	2	-	2	1	2
CO5	-	-	1	2	-	-	1	2	-	2	1	2
Max.	-	2	1	2	-	-	1	2	-	2	1	2

3 is High, 2 is Moderate, 1 is Low & - is Not Applicable

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## COURSE HANDOUT (ABRIDGED)

**Session:** 2021-2022

**Sub Session:** Semester I (Jul-Dec)

**Course Name:** Opto Electronics & Optical Communication (EC 311)

**L/T/P/C:** 3/0/2/4

### Course Description

Basics of optoelectronics, configuration of a fiber optic communication system, Fabrication of optical fibers, Fiber optic cables, Emergence of fiber optics as key technology. The nature of light, Basic optical laws and concepts, Modes, Optical fiber modes. Transmission Characteristics of optical fibers Attenuation, dispersion and Losses Optical sources and Detectors LEDs and ILDs, Photodetectors: PIN and APD WDM concepts, Introduction to optical amplification, optical multiplexing and switching, optical network concepts, introduction to non linear optics

Topics to be covered:

- S. No. Topic
1. Introduction
2. Ray Model
3. Wave model
4. Signal Degradations
5. Optical Sources
6. Photo Detectors
7. Noise and BER
8. Link Design
9. Optical Networks
10. Basic Principles of Satellite Communication
11. Satellite orbits
- 12 Satellite construction
13. Satellite link
14. Earth station
15. Space segment access and utilization
16. Application

### Course Outcomes

S.No.	Description
CO1	Understand the need of Optical communication and basics of Optoelectronics.
CO2	Understand the nature of light , structure of optical fiber and concept of waveguiding.
CO3	Understand the characteristics of Optical Fiber.
CO4	Understand the working of Optical sources and Detectors.
CO5	Understand the WDM concepts and will have introductory knowledge of optical networks.

### Course outcome mapping with Programme Outcomes:

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

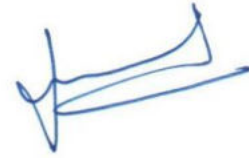


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3 is High, 2 is Moderate, 1 is Low &amp; - is Not Applicable

**List of Tentative Practical**

- Expt 01: Setting up of analog link.
- Expt 02: Setting up of Digital link.
- Expt 03: Intensity modulation using analog input signal.
- Expt 04: Intensity modulation using digital input signal.
- Expt 05: Frequency modulation.
- Expt 06: Pulse width modulation.
- Expt 07: Propagation loss in optical fibers.
- Expt 08: Bending losses in optical fibers.
- Expt 09: Optical Power measurement.
- Expt 10: Measurement of losses using optical power meter.
- Expt 11: Measurement of Numerical Aperture.
- Expt 12: Study of E-O converter system using optical power meter.
- Expt 13: Study of O-E converter system using optical power meter.
- Expt 14: To plot the characteristic of photodetector.
- Expt 15: Characteristics of fiber optic communication link.
- Expt 16: Splicing of optical fibers.



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## COURSE HANDOUT (ABRIDGED)

**Session:** 2021-2022

**Sub Session:** Semester II (Jan-Jun)

**Course Name:** Coding and Information Theory (EC 312)

**L/T/P/C:** 3/1/0/4

### Course Description

Topics to be covered:

1. Information Theory: Introduction, Uncertainty and Information, Average Mutual Information and Entropy, Information measures for continuous random variables.
2. Source Coding: Source Coding theorem, Huffman Coding, Shannon Fano Coding, Arithmetic coding, L-Z Algorithm, Introduction to Image compression.
3. Channel Capacity and Coding: Introduction, Channel models, Channel Capacity, Channel Coding, Information Capacity Theorem.
4. Error Control Coding: Introduction, Equivalent codes, Parity Check Matrix, Linear Block codes, Perfect codes, Hamming Codes. Low density parity check codes, Optimal Linear codes, MDS codes, Bounds on minimum distance. Cyclic codes.
5. Cryptography: Introduction, Encryption Techniques, Symmetric Cryptography, Data encryption standards, International Data Encryption Algorithm, RC Ciphers, Asymmetric Algorithm, Quantum Cryptography, Biometric Encryption.

### Course Outcomes

S.No.	Description
CO1	Information Theory: Introduction, Uncertainty and Information, Average Mutual Information and Entropy, Information measures for continuous random variables.
CO2	Source Coding: Source Coding theorem, Huffman Coding, Shannon Fano Coding, Arithmetic coding, L-Z Algorithm, Introduction to Image compression.
CO3	Channel Capacity and Coding: Introduction, Channel models, Channel Capacity, Channel Coding, Information Capacity Theorem.
CO4	Error Control Coding: Introduction, Equivalent codes, Parity Check Matrix, Linear Block codes, Perfect codes, Hamming Codes. Low density parity check codes, Optimal Linear codes, MDS codes, Bounds on minimum distance, Cyclic codes.
CO5	Cryptography: Introduction, Encryption Techniques, Symmetric Cryptography, Data encryption standards, International Data Encryption Algorithm, RC Ciphers, Asymmetric Algorithm, Quantum Cryptography, Biometric Encryption.

### Course outcome mapping with Programme Outcomes:

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

3 is High, 2 is Moderate, 1 is Low & - is Not Applicable

  
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## COURSE HANDOUT (ABRIDGED)

**Session:** 2021-2022

**Sub Session:** Semester II (Jan-Jun)

**Course Name:** Internship (NUCS 601)

**L/T/P/C:** 1/0/0/12

### Course Description

Internship is a flagship course of 12 credits in M Tech Program. Internship program has an opportunity to transfer learning from classroom to the workplace in industry. During Internship, students will work on the live project and show their capabilities related to the technologies and tools which they learnt in the classroom along with subject expertise. This 6-month period makes the transition from Cybersecurity learner to Cybersecurity Professional in industry.

### Course Outcomes

S.No.	Description
CO1	Meet the rapidly changing needs and challenges of a professional workplace. Use the knowledge of Cyber Security Specialization to solve the complex industry problems.
CO2	Enable students to acquire learning by applying the knowledge and skills they possess, in unfamiliar, open-ended real life situations.
CO3	Give solutions for complicated problems and design system segments or methods that match the defined requirements with proper consideration for public health and safety considering cultural, societal, and environmental.
CO4	Design, decide and implement relevant techniques, support, and state-of-the-art engineering and IT tools to complicated engineering exercises with knowledge of the limitations.

### Course outcome mapping with Programme Outcomes:

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	3	3	3	3	3	3	2	3	3	3	3	3
CO2	3	3	3	3	3	3	3	2	3	3	3	3
CO3	3	3	3	3	3	3	3	3	3	3	3	3
CO4	3	3	3	3	3	3	3	3	3	3	3	3
Max.	3	3	3	3	3	3	3	3	3	3	3	3

3 is High, 2 is Moderate, 1 is Low & - is Not Applicable

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## COURSE HANDOUT (ABRIDGED)

**Session:** 2021-2022

**Sub Session:** Semester I (Jul-Dec)

**Course Name:** Marketing Analytics (MKT 623)

**L/T/P/C:** 3/0/0/3

### Course Description

This course will deal with data analytics techniques including prescriptive analytics and large-scale testing in solving key marketing problems in customer acquisition, development, and retention, and in providing a cohesive framework for studying consumer behavior. This course will discuss how analytics is being used not just about purchase decisions, but also about individual consumers pre- and post-purchase behavior. The course will also delve into the issue of how the expansion of retail stores, factory stores, and the Internet changed customer behavior. The focus will be on applying analytics to large consumer-level database and in learning how to target consumers individually and deriving customer insights.

### Course Outcomes

S.No.	Description
CO1	Understanding theoretical foundations of concepts
CO2	Choosing appropriate quantitative methods and understanding.
CO3	Applying Analytics to solve real world problems
CO4	Ability to identify business use cases for Marketing Analytics
CO5	Ability to apply and use tools to solve Marketing cases – Python, Excel etc.

### Course outcome mapping with Programme Outcomes:

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	1	2	2	2	3	3	3	2	3	3	3	2
CO2	1	2	2	2	2	2	2	2	2	3	3	2
CO3	1	2	2	2	2	2	2	2	2	3	3	2
CO4	1	2	2	2	3	3	3	2	3	3	3	2
CO5	1	2	2	2	2	2	2	2	2	3	3	2
Max.	1	2	2	2	3	3	3	2	3	3	3	2

3 is High, 2 is Moderate, 1 is Low & - is Not Applicable

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## COURSE HANDOUT (ABRIDGED)

**Session:** 2021-2022

**Sub Session:** Semester I (Jul-Dec)

**Course Name:** Community Connect (NU 111)

**L/T/P/C:** 0/0/2/1

### Course Description

Orientation to Field Visits: Each One Teach One; Importance of Education; Mentoring for Sensitivity & Curiosity; Understanding rural code of conduct; Sharing Technology education for access to learning

Accelerated Learning: Observing & selecting the mentee; Remedial teaching; developing lessons & tests for recapitulation; Getting to know children's world; School evaluation systems; alternative systems of learning; Teaching for Community Empowerment.

Measurement of Progress: in sensitivity; in degrees of curiosity; in aspirations; in learning styles; in mentoring styles; developing accelerated learning tests.

### Course Outcomes

S.No.	Description
CO1	• To develop sense of social responsibility amongst the students towards community participation, development, sensitization and education.
CO2	• To provide academic support / educational empowerment by way of one-to-one coaching / interactions in key subjects and issues relating to Community life.
CO3	• To get awareness about Community life and to sensitize community with respect to various issues.
CO4	• To develop competence required for sharing of responsibilities.
CO5	• To link the service activity to self-reflection, self-discovery and the acquisition and comprehension of values.

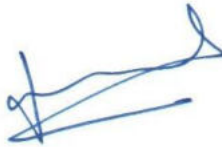
### Course outcome mapping with Programme Outcomes:

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	3	-	3	-	-	-	3	-	3	-	-	3
CO2	-	-	3	-	-	-	3	-	2	-	-	2
CO3	3	-	-	-	-	-	3	-	3	-	-	2
CO4	-	-	-	-	-	-	2	-	2	-	-	3
CO5	-	-	-	-	-	-	2	-	3	-	-	3
Max.	3	-	3	-	-	-	3	-	3	-	-	3

3 is High, 2 is Moderate, 1 is Low & - is Not Applicable

### List of Tentative Practical

Workshops  
Seminars  
Online Meetings  
Presentations  
Group Discussion

  
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## COURSE HANDOUT (ABRIDGED)

**Session:** 2021-2022

**Sub Session:** Semester II (Jan-Jun)

**Course Name:** Community Connect (NU 112)

**L/T/P/C:** 0/0/2/1

### Course Description

Orientation to Field Visits: Each One Teach One; Importance of Education; Mentoring for Sensitivity & Curiosity; Understanding rural code of conduct; Sharing Technology education for access to learning

Accelerated Learning: Observing & selecting the mentee; Remedial teaching; developing lessons & tests for recapitulation; Getting to know children's world; School evaluation systems; alternative systems of learning; Teaching for Community Empowerment.

Measurement of Progress: in sensitivity; in degrees of curiosity; in aspirations; in learning styles; in mentoring styles; developing accelerated learning tests.

### Course Outcomes

S.No.	Description
CO1	To develop sense of social responsibility amongst the students towards community participation, development, sensitization and education.
CO2	To provide academic support / educational empowerment by way of one-to-one coaching / interactions in key subjects and issues relating to Community life
CO3	To get awareness about Community life and to sensitize community with respect to various issues.
CO4	To develop competence required for sharing of responsibilities.
CO5	To link the service activity to self-reflection, self-discovery and the acquisition and comprehension of values.

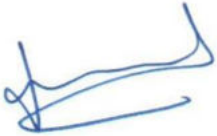
### Course outcome mapping with Programme Outcomes:

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

3 is High, 2 is Moderate, 1 is Low & - is Not Applicable

### List of Tentative Practical

Online meeting based on the availability of human and technical resources

  
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## COURSE HANDOUT (ABRIDGED)

**Session:** 2021-2022

**Sub Session:** Semester II (Jan-Jun)

**Course Name:** R & D Project (NU 302)

**L/T/P/C:** 1/0/6/4

### Course Description

The Research and Development (R & D) projects is a core course for all undergraduate 6th semester students. The purpose of this course is to train the students to perform research and to be familiar with the activities and methodologies generally followed during the research work. All Faculty of NU share their research problems and students select a problem according to his/her research interest. The students perform literature survey and find the research gaps and challenges in their respective selected problem and then narrow down to specific gap/challenge on which they want to pursue the research. Subsequently the students design a complete solution and implement the same in consultation with their faculty mentor. Students present these during two mid semester evaluations and submit brief report to explain these points. They give the presentation and show the demonstration during the final evaluation and submit the final report with plagiarism report. The activities during the research process imparts valuable learning objectives, like understanding the research process, develop critical thinking and problem-solving skills in addition to soft skills like communication skills, team-work skills etc. Outcome of the R & D projects as publications, conference paper, prototype, patent encourage the undergraduate students and faculty supervisors. Moreover, it has a positive impact on NU as well as society at large. This will be the base for Advanced R&D project in VII semester.

### Course Outcomes

S.No.	Description
CO1	Title of the project
CO2	To find the Research gaps and Challenges from the existing research works
CO3	Identify the particular area out of Research gaps and Challenges from the existing research works and explain the objectives to choose this area. Explain methodology with work flow and technology
CO4	Description of Tolls, hardware, open source software or third party software, system configuration which are required to complete the RandD project
CO5	Result and analysis with demonstration. Show the Outcome of the project, how it is going to be extended as Advanced RandD project.
CO6	Concluded the findings of the work done and identify the future scope of the project. The references should be given with all details like title of the research paper,

### Course outcome mapping with Programme Outcomes:

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	3	3	3	3	3	3	3	3	3	2	3	3
CO2	3	3	3	3	3	3	3	3	3	2	2	3
CO3	3	3	3	3	3	3	3	3	3	3	3	3
CO4	3	3	3	3	3	3	3	3	3	3	3	3
CO5	3	3	3	3	3	3	3	3	3	3	3	3
CO6	3	3	2	2	2	1	2	3	2	3	2	2
Max.	3	3	3	3	3	3	3	3	3	3	3	3

3 is High, 2 is Moderate, 1 is Low & - is Not Applicable

  
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### List of Tentative Practical

Feature Selection & Classification for Multi-label Learning  
 Early diagnosis and Prediction of Alzheimer's Disease  
 Human Pose Estimation In Real-Time Videos  
 Object Detection and Recognition in Video  
 Attack Detection and prevention Schemes in Wireless Sensor Network / IoT  
 Tourist guided tour  
 Wireless Communication protocol and sensing system development for vehicular communication network.  
 Designing and prototyping a IoT-enabled Medicine Prescription System  
 Using Human Posture Detection for Yoga Posture Identification in Educable Adolescents  
 Self-Acquisition of Critical Skills using Mobile Apps as Tools for Adolescents with Learning Disabilities  
 Using Social Network Analysis to model Computer-Supported Collaborative Learning  
 Network monitoring tool  
 Fraud Detection  
 Use of block chain technology in Healthcare  
 Study of Malnutrition in Children  
 Information-centric networking(ICN)  
 Gateway selection for throughput optimization in multi-hop wireless networks  
 Design and development in portable Data Acquisition System (DAS) for recording and analysis of air pollutants  
 Coverage and Connectivity Issues in Wireless Sensor Networks  
 System for Monitoring the Loss of Attention in Automotive Drivers  
 Development of Requirements Engineering tool for IoT applications  
 Non-Invasive Tourist Guidance App for Monuments  
 Development of cellular based UAV security System  
 Development of Indoor and Outdoor Navigation System  
 V2G and Ride sharing services for Electric vehicles  
 System for Monitoring the Loss of Attention in Automotive Drivers  
 Study of Carbon Nano Tubes  
 Simulation study of Nanoscale MOSFETs for low power application  
 Discrete and Bounded Envy-Free Cake Cutting Protocol  
 Data Extraction from Graphs  
 Visualization of High Dimensional Data  
 Domain Decomposition  
 Artificial Intelligence in Games  
 Intelligent Analysis On Satellite Imagery  
 Digital Marketing Communication  
 Fog Computing based Node-to-Node Communication and Mobility Management Technique for Cellular Networks  
 Device-driven Communication Methodology and Mobility Management Scheme for 5G Networks  
 Exploration of heuristics approaches for examination scheduling.  
 Indexation of commodity derivatives in Identification of Carbohydrate Binding Modules (CBM) to study surface glycoprotein interaction  
 Computational approach to identify potential biomarker for the early detection of oral cancer  
  
 Virtual Screening, Molecular Docking & Simulation studies towards the discovery of HPV16/18-E7 natural inhibitors for Cancer  
 Developing antimicrobial nanocomposites as an efficient drug delivery system  
 Role of Probiotics in regulation of Host Immunity  
 Recognition of Facial Expression and Detection using python  
 Identification of Carbohydrate Binding Modules (CBM) to study surface glycoprotein interaction  
 Computational approach to identify potential biomarker for the early detection of oral cancer  
  
 Virtual Screening, Molecular Docking & Simulation studies towards the discovery of HPV16/18-E7 natural inhibitors for Cancer  
 Developing antimicrobial nanocomposites as an efficient drug delivery system  
 Role of Probiotics in regulation of Host Immunity

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## COURSE HANDOUT (ABRIDGED)

**Session:** 2021-2022

**Sub Session:** Semester I (Jul-Dec)

**Course Name:** Directed Independent Study (NU 400)

**L/T/P/C:** 1/0/0/4

### Course Description

This course covers cloud technology, services, and covers containers and container orchestration - the process of transforming the way the technology industry does. It covers some of the tools and buzzwords in association with these technologies, such as Docker and Kubernetes, and gives an understanding of what they mean. The second part of this course provides foundational security knowledge to recognize, compare, and contrast different types of cybersecurity vulnerabilities and threats and indicators associated with network attacks.

### Course Outcomes

S.No.	Description
CO1	Students will learn the fundamental ideas behind Cloud Computing or different threat actors, vectors, and intelligence sources
CO2	Cloud management techniques and cloud software deployment considerations or the security concerns associated with various types of vulnerabilities
CO3	Learn what containers are and how they work or the techniques used in penetration testing
CO4	Understand how to use containers in the real world to containerize an app or learn to implementing Secure Network Access Protocols

### Course outcome mapping with Programme Outcomes:

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

3 is High, 2 is Moderate, 1 is Low & - is Not Applicable

  
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## COURSE HANDOUT (ABRIDGED)

**Session:** 2021-2022

**Sub Session:** Semester I (Jul-Dec)

**Course Name:** Advanced R & D Project (NU 401)

**L/T/P/C:** 1/0/6/4

### Course Description

Advanced R&D project is offered as an open elective in seventh semester to the fast learners and carry same credits as the other open electives. It will be based on the R&D project that students have done in 6th semester. The students who have shown promise during the R&D project during the sixth semester will get an opportunity to extend the work in the advanced R&D project. They will be working under the same faculty who had mentored him / her during the R&D project in VI semester. Some of the possible extensions may be, applying the same technique to different problems, fine tuning/improving the techniques to get the higher precision/accuracy, get to do more recent literature survey, devising instruments to collect data, data gathering & analysis etc. as per discussions with faculty mentor. Finally, students will write a comprehensive report/research article as guided by faculty mentor. Evaluation will be based on mid semester evaluation, end semester evaluation, mentor's evaluation and comprehensive report/research article. They give the presentation and show the demonstration during the final evaluation and submit the final report with plagiarism report.

### Course Outcomes

S.No.	Description
CO1	Select the domain/technology to define the next steps of research works
CO2	get to do more recent literature survey
CO3	applying the same technique to different problems, fine tuning/improving the techniques to get the higher precision/accuracy, devising instruments to collect data, data gathering and analysis etc.
CO4	Description of Tolls, hardware, open source software or third party software, system configuration which are required to complete the advanced R andD project
CO5	Result and analysis with demonstration. Show the Outcome of the project, how it is going to be extended as Advanced RandD project.
CO6	Concluded the findings of the work done and compare the results with existing works. The references should be given with all details like title of the research paper,

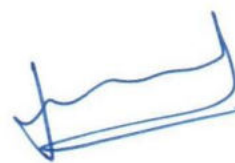
### Course outcome mapping with Programme Outcomes:

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	3	3	3	3	3	3	3	3	3	3	3	2
CO2	3	3	3	3	3	2	3	2	3	2	2	3
CO3	3	3	3	3	3	3	3	3	2	3	-	2
CO4	3	3	3	3	3	3	2	3	2	2	2	3
CO5	3	3	3	3	3	2	2	2	3	2	2	3
CO6	3	3	2	2	3	2	2	3	2	2	2	2
Max.	3	3	3	3	3	3	3	3	3	3	3	3

3 is High, 2 is Moderate, 1 is Low & - is Not Applicable

### List of Tentative Practical

Will work on the project as guided by mentor

  
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## COURSE HANDOUT (ABRIDGED)

**Session:** 2021-2022

**Sub Session:** Semester II (Jan-Jun)

**Course Name:** Industry Practice/ Project (NU 402)

**L/T/P/C:** 0/0/40/20

### Course Description

Industry Practice is a flagship course of 20 credits in the B Tech Programme of NIIT University. Every student of NIIT University has an opportunity to transfer learning from classroom to the workplace in industry in the final six-month semester of B Tech Programme. During Industry Practice, a student works on the real time project of an organization under direct mentoring by industry professional. This 6-month period makes the transition from student in a University to an employed professional in industry seamless or smooth for a student.

### Course Outcomes

S.No.	Description
CO1	Meet the rapidly changing needs and challenges of a professional workplace. Use the knowledge of mathematics, science, engineering (fundamentals/specialization) to solve the complex engineering problems.
CO2	Enable students to acquire learning by applying the knowledge and skills they possess, in unfamiliar, open-ended real life situations.
CO3	Give solutions for complicated engineering puzzles and design system segments or methods that match the defined requirements with proper consideration for public health and safety considering cultural, societal, and environmental.
CO4	Design, decide and implement relevant techniques, support, and state-of-the-art engineering and IT tools including forecast and modeling to complicated engineering exercises with knowledge of the limitations.

### Course outcome mapping with Programme Outcomes:

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	3	3	3	3	3	3	2	3	3	3	3	3
CO2	3	3	3	3	3	3	3	2	3	3	3	3
CO3	3	3	3	3	3	3	3	3	3	3	3	3
CO4	3	3	3	3	3	3	3	3	3	3	3	3
Max.	3	3	3	3	3	3	3	3	3	3	3	3

3 is High, 2 is Moderate, 1 is Low & - is Not Applicable

### List of Tentative Practical

Not applicable

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## COURSE HANDOUT (ABRIDGED)

**Session:** 2021-2022

**Sub Session:** Semester II (Jan-Jun)

**Course Name:** Contemporary Issues (NU 522)

**L/T/P/C:** 2/0/0/2

### Course Description

1. In depth investigation of a chosen contemporary societal issue or problem of interdisciplinary nature and suggestion of a plausible solution should facilitate research culture.
2. As the chosen problem would invariably be interdisciplinary, students should develop an ability to analyze a problem from holistic perspective.
3. They should discover the interplay of subjectivity and objectivity, which exists in any problem solving.
4. This should give students an opportunity to widen their knowledge about contemporary issues facing global community and develop a global outlook and awareness.
5. The course methodology will require students to discuss in a group, give regular seminars and aim at publishing at least one article. This should help them hone oral and written communication skills. Not the least, students should develop a global outlook and awareness.

### Course Outcomes

S.No.	Description
CO1	In depth investigation of a chosen contemporary societal issue or problem of interdisciplinary nature and suggestion of a plausible solution should facilitate research culture.
CO2	As the chosen problem would invariably be interdisciplinary, students should develop an ability to analyze a problem from holistic perspective.
CO3	This should give students an opportunity to widen their knowledge about contemporary issues facing global community and develop a global outlook and awareness.
CO4	The course methodology will require students to discuss in a group, give regular seminars and aim at publishing at least one article. This should help them hone oral and written communication skills. Not the least, students should develop a global outlook and awareness.
CO5	They should discover the interplay of subjectivity and objectivity, which exists in any problem solving.

### Course outcome mapping with Programme Outcomes:

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	-	2	1	2	-	-	1	2	-	2	1	2
CO2	-	-	1	2	-	-	1	2	-	2	1	2
CO3	-	-	1	2	-	-	1	2	-	2	1	2
CO4	-	-	1	2	-	-	1	2	-	2	1	2
CO5	-	-	1	2	-	-	1	2	-	2	1	2
Max.	-	2	1	2	-	-	1	2	-	2	1	2

3 is High, 2 is Moderate, 1 is Low & - is Not Applicable

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## COURSE HANDOUT (ABRIDGED)

**Session:** 2021-2022

**Sub Session:** Semester I (Jul-Dec)

**Course Name:** Opto Electronics & Optical Communication (EC 311)

**L/T/P/C:** 3/0/2/4

### Course Description

Basics of optoelectronics, configuration of a fiber optic communication system, Fabrication of optical fibers, Fiber optic cables, Emergence of fiber optics as key technology. The nature of light, Basic optical laws and concepts, Modes, Optical fiber modes. Transmission Characteristics of optical fibers Attenuation, dispersion and Losses Optical sources and Detectors LEDs and ILDs, Photodetectors: PIN and APD WDM concepts, Introduction to optical amplification, optical multiplexing and switching, optical network concepts, introduction to non linear optics

Topics to be covered:

- S. No. Topic
1. Introduction
2. Ray Model
3. Wave model
4. Signal Degradations
5. Optical Sources
6. Photo Detectors
7. Noise and BER
8. Link Design
9. Optical Networks
10. Basic Principles of Satellite Communication
11. Satellite orbits
12. Satellite construction
13. Satellite link
14. Earth station
15. Space segment access and utilization
16. Application

### Course Outcomes

S.No.	Description
CO1	Understand the need of Optical communication and basics of Optoelectronics.
CO2	Understand the nature of light , structure of optical fiber and concept of waveguiding.
CO3	Understand the characteristics of Optical Fiber.
CO4	Understand the working of Optical sources and Detectors.
CO5	Understand the WDM concepts and will have introductory knowledge of optical networks.

### Course outcome mapping with Programme Outcomes:

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



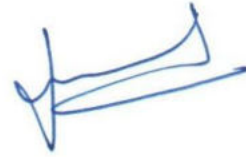
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3 is High, 2 is Moderate, 1 is Low & - is Not Applicable

### List of Tentative Practical

- Expt 01: Setting up of analog link.
- Expt 02: Setting up of Digital link.
- Expt 03: Intensity modulation using analog input signal.
- Expt 04: Intensity modulation using digital input signal.
- Expt 05: Frequency modulation.
- Expt 06: Pulse width modulation.
- Expt 07: Propagation loss in optical fibers.
- Expt 08: Bending losses in optical fibers.
- Expt 09: Optical Power measurement.
- Expt 10: Measurement of losses using optical power meter.
- Expt 11: Measurement of Numerical Aperture.
- Expt 12: Study of E-O converter system using optical power meter.
- Expt 13: Study of O-E converter system using optical power meter.
- Expt 14: To plot the characteristic of photodetector.
- Expt 15: Characteristics of fiber optic communication link.
- Expt 16: Splicing of optical fibers.



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## COURSE HANDOUT (ABRIDGED)

**Session:** 2021-2022

**Sub Session:** Semester II (Jan-Jun)

**Course Name:** Coding and Information Theory (EC 312)

**L/T/P/C:** 3/1/0/4

### Course Description

Topics to be covered:

1. Information Theory: Introduction, Uncertainty and Information, Average Mutual Information and Entropy, Information measures for continuous random variables.
2. Source Coding: Source Coding theorem, Huffman Coding, Shannon Fano Coding, Arithmetic coding, L-Z Algorithm, Introduction to Image compression.
3. Channel Capacity and Coding: Introduction, Channel models, Channel Capacity, Channel Coding, Information Capacity Theorem.
4. Error Control Coding: Introduction, Equivalent codes, Parity Check Matrix, Linear Block codes, Perfect codes, Hamming Codes. Low density parity check codes, Optimal Linear codes, MDS codes, Bounds on minimum distance. Cyclic codes.
5. Cryptography: Introduction, Encryption Techniques, Symmetric Cryptography, Data encryption standards, International Data Encryption Algorithm, RC Ciphers, Asymmetric Algorithm, Quantum Cryptography, Biometric Encryption.

### Course Outcomes

S.No.	Description
CO1	Information Theory: Introduction, Uncertainty and Information, Average Mutual Information and Entropy, Information measures for continuous random variables.
CO2	Source Coding: Source Coding theorem, Huffman Coding, Shannon Fano Coding, Arithmetic coding, L-Z Algorithm, Introduction to Image compression.
CO3	Channel Capacity and Coding: Introduction, Channel models, Channel Capacity, Channel Coding, Information Capacity Theorem.
CO4	Error Control Coding: Introduction, Equivalent codes, Parity Check Matrix, Linear Block codes, Perfect codes, Hamming Codes. Low density parity check codes, Optimal Linear codes, MDS codes, Bounds on minimum distance, Cyclic codes.
CO5	Cryptography: Introduction, Encryption Techniques, Symmetric Cryptography, Data encryption standards, International Data Encryption Algorithm, RC Ciphers, Asymmetric Algorithm, Quantum Cryptography, Biometric Encryption.

### Course outcome mapping with Programme Outcomes:

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

3 is High, 2 is Moderate, 1 is Low & - is Not Applicable

  
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## COURSE HANDOUT (ABRIDGED)

**Session:** 2021-2022

**Sub Session:** Semester II (Jan-Jun)

**Course Name:** Satellite Communication (EC 411)

**L/T/P/C:** 3/0/2/4

### Course Description

Kepler's laws, Geostationary and non-geostationary orbits, Orbit perturbations Signal impairment: rain attenuation, atmospheric losses, ionospheric effects, Polarization, Antennas, Power supply, Altitude control, Station keeping, Thermal control, Transponders, Receive-only TV antennas, Transmit-receive earth stations, Equivalent isotropic radiated power (EIRP), Transmission losses, Receiver noise, Carrier-to-noise ratio, Link power budget equations, Intermodulation, Inter-satellite links, TDMA, FDMA, and CDMA techniques, ATM over satellite links, TCP/IP over satellite links.

### Course Outcomes

S.No.	Description
CO1	Understand the need of Satellite communication and basic mechanism behind Satellite Communication.
CO2	Understand radio wave propagation and its various implications.
CO3	Understand the space segment of satellite communication in detail.
CO4	Understand the earth segment of satellite communication in detail.
CO5	Understand different aspects of Space links.
CO6	Understand various Satellite Access strategies.

### Course outcome mapping with Programme Outcomes:

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	3	3	2	3	2	2	3	1	1	1	-	3
CO2	3	2	3	2	2	2	3	1	1	1	-	3
CO3	3	2	2	3	2	3	3	1	1	1	-	3
CO4	3	3	3	3	2	3	2	1	1	1	-	3
CO5	3	3	3	2	2	3	2	1	1	1	1	3
CO6	3	3	3	3	2	2	3	1	1	1	-	3
Max.	3	3	3	3	2	3	3	1	1	1	1	3

3 is High, 2 is Moderate, 1 is Low & - is Not Applicable

### List of Tentative Practical

- Expt 01: Establishing a Direct Communication Link between Uplink Transmitter and Downlink Receiver using Tone Signal.
- Expt 02: Setting up an Active Satellite Link and demonstrate Link Fail Operations.
- Expt 03: Establishing an Audio Satellite Link between Transmitter and Receiver.
- Expt 04: Communicating 'Voice' Signal through Satellite Link.
- Expt 05: Changing different combinations of Uplink and Downlink Frequencies and to check the Communication Link
- Expt 06: Transmitting & receiving three separate Signals (Audio, Video, Tone) simultaneously through satellite link
- Expt 07: Transmitting & receiving Function Generator Waveforms through Satellite Link
- Expt 08: Transmitting and receiving PC data through satellite link
- Expt 09: Study the delay between Uplink Transmitter and Downlink Receiver during data transmission
- Expt 10: To send tele-command and receive intensity of light from satellite.
- Expt 11: To send tele-command and receive Temperature from satellite.
- Expt 12: To calculate the carrier to noise ratio for a satellite link.
- Expt 13: To calculate signal to noise ratio for a satellite link.

  
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## COURSE HANDOUT (ABRIDGED)

**Session:** 2021-2022

**Sub Session:** Semester I (Jul-Dec)

**Course Name:** Capstone Project I (EC 461)

**LT/P/C:** 1/0/6/4

### Course Description

Capstone project at VII semester in BTech ECE program will provide an opportunity for the students to integrate the knowledge gathered during the course of Engineering and apply in designing an application-oriented product. Students under this course will design the product in Communication, VLSI, Embedded Systems, IOT, Robotics and other relevant areas. The designed product is expected to have software as well as hardware implementation. The project will involve many phases which includes identification of the problem statement, defining the problem, research to find out its feasibility, conceptualization of the project which leads to the development of the final product.

### Course Outcomes

S.No.	Description
CO1	Learn to apply knowledge - Students should know the method of finding the problem and model it according where they can apply their knowledge.
CO2	Concept Design - After knowing the problem, students should know the approach to proceed for the solution. Students should apply appropriate model to get it solved.
CO3	Development and Integration- This is to make them understandable about the various development stages involved step by step and also integrating various software and hardware to create an effective system modelling.
CO4	Testing and Validation Skill. Students should know the method of calibrating various instrument and devices for accurate result so as to achieve a quality testing and validation result out of the system.
CO5	Gather expertise in the domain of the project

### Course outcome mapping with Programme Outcomes:

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

3 is High, 2 is Moderate, 1 is Low & - is Not Applicable

### List of Tentative Practical

No Practicals in this course.

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## COURSE HANDOUT (ABRIDGED)

**Session:** 2021-2022

**Sub Session:** Semester I (Jul-Dec)

**Course Name:** Business Economics I (ECON 111)

**L/T/P/C:** 3/0/0/3

### Course Description

The goal of this course is to equip the student with the methodology of decision making using the concepts of microeconomics. Starting out with an exposition of the theory of decision making by households and firms, the participants will learn to comprehend the working of the markets, the determination of prices and the techniques of decision making that the players in the market can adopt to ensure that sound decisions are made. This course is designed to acquaint the student with the theoretical underpinnings of decision making in alternative market conditions, after considering the preferences of the consumers.

### Course Outcomes

S.No.	Description
CO1	Understand the importance of economics in managerial decision-making process
CO2	Understand the process of optimal decision making of a consumer given its resources
CO3	Learn optimal decision making in production of goods and services
CO4	Learn types of market and their optimal decision-making process
CO5	Learn types of market and their optimal decision-making process
CO6	Create understanding of input market like labour and capital and its pricing methodologies
CO7	Studying the process of different price control and reason behind market failures like asymmetrical information, moral hazards etc.

### Course outcome mapping with Programme Outcomes:

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	3	2	2	-	1	1	1	1	-	1	1	-
CO2	3	2	2	-	1	1	1	1	-	1	1	-
CO3	3	2	2	-	1	1	1	1	-	1	1	-
CO4	3	2	2	-	1	1	1	1	-	1	1	-
CO5	3	2	2	-	1	1	1	1	-	1	1	-
CO6	3	2	2	-	1	1	1	1	-	1	1	-
CO7	3	2	2	-	1	1	1	1	-	1	1	-
Max.	3	2	2	-	1	1	1	1	-	1	1	-

3 is High, 2 is Moderate, 1 is Low & - is Not Applicable

  
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## COURSE HANDOUT (ABRIDGED)

**Session:** 2021-2022

**Sub Session:** Semester II (Jan-Jun)

**Course Name:** Business Economics II (ECON 112)

**LT/P/C:** 3/0/0/3

### Course Description

This course exposes students to an overview of an exchange based economy and draws out the relationship between crucial macroeconomic variables like the level of income, employment, prices, investment, money supply, trade and foreign exchange etc. The design of government policy measures in regulating the economy will be discussed. Specific problems like inflation, growth and the control of business cycles will be addressed with respect to the Indian Economy. The purpose is to provide the student with a fundamental knowledge of the macro economy on the basis of which, policy decisions can be analysed and business can be made.

### Course Outcomes

S.No.	Description
CO1	Get Acquainted with difference between Microeconomics and Macroeconomics
CO2	Develop understanding of the functioning of an economy especially in context of Indian Economy and its data structure.
CO3	Develop understanding of Households as well as firms decision making criteria and its impact over Macroeconomic Performances
CO4	Create deep understanding of economics of a government of a nation -sources and application of funds
CO5	Develop understanding of science of money - supply and demand
CO6	Acquire understanding of structure of Trade Accounts of a country with foreign nations - BoP
CO7	Get awareness about the foreign exchange regimes and its valuation determinants
CO8	Get proficiency over science of Economics of Growth
CO9	Accomplish understanding Economic Cycles/Disturbances

### Course outcome mapping with Programme Outcomes:

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	3	-	1	-	-	-	-	-	-	-	-	-
CO2	3	-	1	-	-	-	-	-	-	-	-	-
CO3	3	1	1	-	-	-	-	-	-	-	1	-
CO4	3	-	1	-	1	-	1	-	-	-	1	-
CO5	3	-	1	-	1	-	-	-	-	-	1	-
CO6	3	-	1	-	-	-	-	-	-	-	3	-
CO7	3	-	1	-	-	-	-	-	-	-	1	-
CO8	3	1	1	-	-	-	1	-	-	-	1	-
CO9	3	1	1	-	-	-	-	-	-	-	1	-
Max.	3	1	1	-	1	-	1	-	-	-	3	-

3 is High, 2 is Moderate, 1 is Low & - is Not Applicable

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## COURSE HANDOUT (ABRIDGED)

**Session:** 2021-2022

**Sub Session:** Semester I (Jul-Dec)

**Course Name:** Digital Logic & Circuit (EL 101)

**L/T/P/C:** 3/0/3/4

### Course Description

The Digital Logic & Circuits Course introduces the fundamentals of logic gates, Boolean algebra, Karnaugh maps, etc. It also introduces Combinational & Sequential circuit components such as adders, subtractors, multiplexers, encoders, decoders, flip-flops, latches, registers and their application in designing various combinational & sequential digital circuits.

The course module will include the following topics: Digital Processing of Information, Number Systems and Arithmetic, Combinational Logic, logic operations – AND, OR, NOT, Boolean algebra; Boolean functions, De Morgan's theorems, Karnaugh map representations of Boolean functions; Minimisation of Boolean functions, Multiplexer-based realisation of K-maps, Combinational circuit design using multiplexers and gates. Latches and Flip-flops, Ripple counters, Sequence generator using flip-flops, State Diagram, Synchronous counters, Shift Registers, Ring and MLS counters, State Machine: Mealy and Moore Machine, Arithmetic and Control Unit Designing,

### Course Outcomes

S.No.	Description
CO1	Understand the need of Digital Systems and applications, various number systems, logic gates, Boolean algebra
CO2	Design and utilize combinational and sequential components such as adders, multiplexers, decoders, counters and registers.
CO3	Explain how gates and components are used in the design of an Arithmetic Logic Unit
CO4	Demonstrate knowledge of the nomenclature in the area of memory devices: ROM, PROM, PLD, FPGAs, etc. and state machine
CO5	Compare various simulators available for design digital circuits and use Logicsim to construct and verify digital circuit operations

### Course outcome mapping with Programme Outcomes:

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

3 is High, 2 is Moderate, 1 is Low & - is Not Applicable

### List of Tentative Practical

- Expt01 - Digital Test Kit and Logic Gates design
- Expt02 - Adders design
- Expt03 - Subtractor
- Expt04 - Programmable ALU design
- Expt05 - Binary Encoder & Decoder and Code converter (Binary to Gray) design
- Expt06 - BCD to 7-Segment Decoder design
- Expt07 - Latches & Flip-flops design
- Expt08 - Flip-flops & Ripple Counters design
- Expt09 - Synchronous Counters design
- Expt10 - Serial-Parallel Multiplier design

  
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## COURSE HANDOUT (ABRIDGED)

**Session:** 2021-2022

**Sub Session:** Semester II (Jan-Jun)

**Course Name:** Physics (PHY 101)

**L/T/P/C:** 3/0/3/4

### Course Description

This is a comprehensive course in Physics that deals with quantum mechanics, Semiconductor Physics, Magnetism, Dielectrics and LASER. In order to allow the students to get exposed to experimental methods, the course also has a laboratory component. This helps the students to integrate theoretical knowledge and concepts with practical experience. Students will also learn operation of scientific equipment, collection of data and their analysis.

### Course Outcomes

S.No.	Description
CO1	Explain the concepts of wave/particle dual nature and quantum mechanical behavior of microscopic systems. In addition, students will be skilled in critical thinking and analytical reasoning as applied to scientific problems.
CO2	Demonstrate an understanding of conduction in semiconductor materials and various applications of p-n junction diodes. Additionally, students will develop scientific problem-solving skills, including organization of given information, quantitative solutions, interpreting results.
CO3	Develop an understanding of atomic origin of magnetism, types and various applications.
CO4	Understand the dielectric behavior of materials and basics of ferroelectricity and piezoelectricity. In this way it will assist the students to develop the understanding of mathematical description of these principles that can be used to develop devices, structures, and technologies that are useful for mankind.
CO5	Explain the principle of laser light generation as well as construction and applications of solid state and gas lasers
CO6	Develop a hands-on experience by performing lab experiments based on the concepts of interference, diffraction, ultrasonic diffraction, coupled pendulum, magnetic susceptibility and others

### Course outcome mapping with Programme Outcomes:

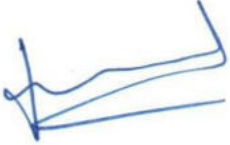
CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	3	3	3	2	2	1	1	2	3	3	2	1
CO2	3	3	3	2	2	2	2	2	3	3	2	1
CO3	2	3	3	3	3	2	3	3	3	3	2	3
CO4	2	2	2	2	3	3	3	3	2	2	2	3
CO5	1	2	2	2	2	3	2	2	2	2	3	2
CO6	1	1	2	1	1	2	3	2	1	2	3	2
Max.	3	3	3	3	3	3	3	3	3	3	3	3

3 is High, 2 is Moderate, 1 is Low & - is Not Applicable



### List of Tentative Practical

1. (a) To study the diffraction pattern obtained by a single and double slit.  
(b) To find width of the single slit.  
(c) To find slit width of the single slit separation in the double slit system.
2. To determine the wavelengths of different lines observed in spectrum of mercury light.
3. To determine the radius of curvature of a plano-convex lens using newton's rings.
4. (a) To determine normal mode frequencies of a system consisting of two pendulums coupled together by a string under tension.  
(b) To determine the time required for exchange of energy between the two pendulums.
5. (a) To study the formation of standing waves on a stretched string.  
(b) To determine the frequency of an electrically driven tuning fork.
6. To measure charge to mass ratio ( $e/m$ ) of an electron using Thomson's bar magnet method.
7. Study of Hall Effect.
8. (a) To find the induced EMF as a function of velocity of the magnet passing through the coil.  
(b) To find the charge delivered to a capacitor because of electromagnetic induction.
9. To find the speed of sound waves in kerosene by using ultrasonic diffraction method.
10. To find the amount of rotation for a solution of sugar in water and deduce its specific rotation.
11. To determine refractive indices of glass plates by measuring their Brewster's angles.
12. (a) To study the variation of current in a series LCR circuit  
(b) To study the variation of current in a parallel LCR circuit  
(c) To find the inductance  $L$  of the given inductor by each of the above four methods and calculate the average value of  $L$ .
13. To determine the magnetic susceptibility of a solid material.



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## COURSE HANDOUT (ABRIDGED)

**Session:** 2021-2022

**Sub Session:** Semester II (Jan-Jun)

**Course Name:** Fundamentals of Psychology (PSY 301)

**L/T/P/C:** 2/1/0/3

### Course Description

The course intends to develop an understanding of the growing discipline of psychology and to enable students in developing skills and competencies needed to meet the challenges of the real world. Understanding data about human behaviour is an important and valuable skill in today's society. Corporates, institutions all use continuous stream of big data to describe and predict human behaviour. Whether studying Cyber security, Artificial intelligence, Internet of Things or any other specialization, it becomes extremely helpful to understand human behaviour and what humans think and act. The syllabus is created keeping in mind the dynamic nature of humans, society and workplace and to inculcate the required competencies in the students to understand and respond to the same efficiently and effectively.

### Course Outcomes

S.No.	Description
CO1	To develop a knowledge base of human behavior across the broad areas of psychology including cognition (thought, memory, perception), learning, personality and social and environmental influences.
CO2	Critically assess information related to the study of behavior and mental processes, and use the critical assessment in forming conclusions and arguments.
CO3	Students will demonstrate acquisition of both factual knowledge and the ability to conceptualize and apply this knowledge to their own behavior, to ways of interacting with others, and to their roles in society.
CO4	To understand the importance of group dynamics and leadership and the importance of effective communication in an organization.

### Course outcome mapping with Programme Outcomes:

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

3 is High, 2 is Moderate, 1 is Low & - is Not Applicable

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## COURSE HANDOUT (ABRIDGED)

**Session:** 2021-2022

**Sub Session:** Semester II (Jan-Jun)

**Course Name:** Security Analysis & Portfolio Management  
(RSK 601)

**L/T/P/C:** 3/0/0/3

### Course Description

This course is designed to teach the fundamentals of investments along with the analysis and strategies as an investor. The course familiarizes the students to understand how market works and how securities are traded. The course discusses the risk return tradeoff of an individual investor, it also persists how investment in securities market is evaluated based on Fundamental and Technical analysis. It also discusses application of Modern Portfolio Theory, analysis of active and passive investment strategies, and measurement of portfolio performance.

### Course Outcomes

S.No.	Description
CO1	Understand how financial markets work and how securities are traded.
CO2	Construct optimal portfolios and illustrate the theory and empirical applications of asset pricing models.
CO3	Explain macro and industry analysis, equity valuation, financial statement analysis and technical analysis.
CO4	Analyze bond prices and yields of fixed-income portfolios.
CO5	Analyze and evaluate portfolio performance.

### Course outcome mapping with Programme Outcomes:

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	3	3	3	3	3	3	3	2	2	2	1	1
CO2	3	2	1	2	3	1	2	3	2	1	2	2
CO3	3	2	3	2	3	3	3	1	2	3	2	3
CO4	2	2	2	3	3	3	2	1	2	3	2	3
CO5	2	3	2	3	3	3	2	3	3	1	3	1
Max.	3	3	3	3	3	3	3	3	3	3	3	3

3 is High, 2 is Moderate, 1 is Low & - is Not Applicable

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## COURSE HANDOUT (ABRIDGED)

**Session:** 2021-2022

**Sub Session:** Semester I (Jul-Dec)

**Course Name:** Communication Skills (TA 102)

**L/T/P/C:** 2/0/2/3

### Course Description

Communication plays a crucial role in the management of an organization. Without proper communication, no organization can function properly. No matter which medium one communicates in, speaking and listening both should take place. This course aims to hone the communication and professional skills of the young graduates making them ready for professional environment. The course has been designed to have an appropriate blend of theory and practical sessions so that the students gain a sound knowledge of communication theoretical skills and understand ways of applying these skills in future.

### Course Outcomes

S.No.	Description
CO1	Understand and apply knowledge of human communication and language processes as they occur across various contexts, e.g., interpersonal, intrapersonal, small group, organizational, media, gender, family, intercultural communication, technologically mediated communication, etc. from multiple perspectives.
CO2	Speak extemporaneously on a given topic as well as participate effectively in group discussions
CO3	Comprehend relatively sophisticated written texts, such as- <ul style="list-style-type: none"> <li>• Magazine articles</li> <li>• Short stories</li> <li>• Personal and socio-political essays</li> <li>• Technical information on websites</li> </ul>
CO4	Students will be able to write: <ul style="list-style-type: none"> <li>• Unified and coherent paragraphs</li> <li>• Clear and logical arrangement of ideas</li> <li>• Syntactical variation, using simple, compound and complex sentences</li> <li>• Accurate punctuation</li> </ul>

### Course outcome mapping with Programme Outcomes:

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

3 is High, 2 is Moderate, 1 is Low & - is Not Applicable

### List of Tentative Practical

- P1. Write about 'I' and read it aloud in the class (Creative Introduction)
- P2. Talk about your 3 Strengths and 3 Weaknesses
- P3. Listening Skill Activity
- P4. Role Play
- P5. Group Discussion
- P6. Presentation Skills

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## COURSE HANDOUT (ABRIDGED)

**Session:** 2021-2022

**Sub Session:** Semester I (Jul-Dec)

**Course Name:** Fundamentals of Computer Programming (TA  
111)

**L/T/P/C:** 2/0/4/4

### Course Description

This is an introductory course on Programming Fundamentals. Its aim is to introduce basic concepts of Programming using high level language like Python. Students will solve problems by developing simple algorithms and then implement them using a Python programming language. The Lab component complements the theory by practicing the concept using Python. Through this course students will learn Object Oriented Programming concepts and how to use Object Oriented Python. Through this course students will become expert to use unique features of Python Language along with Python standard libraries and modules and packages.

### Course Outcomes

S.No.	Description
CO1	To acquire programming skills in core Python
CO2	To acquire data structure and data file handling and data management skills in Python
CO3	To acquire Object Oriented Skills in Python
CO4	To develop the skill of designing applications using comprehensive libraries in Python
CO5	To develop the ability to write applications in Python for specialized domain areas

### Course outcome mapping with Programme Outcomes:

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	3	3	3	3	3	3	2	3	3	2	2	3
CO2	3	3	3	3	3	3	2	3	3	2	2	3
CO3	3	3	3	3	3	3	2	3	3	2	2	3
CO4	3	3	3	3	3	3	2	3	3	2	2	3
CO5	3	3	3	3	3	3	2	3	3	2	2	3
Max.	3	3	3	3	3	3	2	3	3	2	2	3

3 is High, 2 is Moderate, 1 is Low & - is Not Applicable

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**List of Tentative Practical**

- 01 Installation
- 02 Type conversion, Operators, Expressions, Syntax Errors, Runtime Errors, Semantic Errors
- 03 Control Statements: if, elif, else, nested if else
- 04 Loops: For, While, nested loops, Break, Continue, Pass
- 04 Functions: Parameters and Arguments, Return Values, Required Arguments, Keyword Arguments, Variable-length Arguments, Default Arguments, lambda function, Recursive Functions
- 05 Lists and Tuple
- 06 Dictionaries
- 07 Set
- 08 Input-Output and File handling
- 09 String Manipulation
- 10 Object Oriented Programming
- 11 Python Library for Data Visualization : Matplotlib and Seaborn
- 12 Python Libraries: NumPy and Random
- 13 Python Library for Data Analysis : Pandas
- 14 Python Library for Mathematical Computation : SciPy
- 15 Python Application development : Programming best practices



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## COURSE HANDOUT (ABRIDGED)

**Session:** 2021-2022

**Sub Session:** Semester II (Jan-Jun)

**Course Name:** Communication Proficiency & Professional Skills I (TA 112)

**LT/P/C:** 2/0/0/2

### Course Description

This course covers the finer aspects of communication whereby practical or applied aspects of Interpersonal Communication, Soft Skills and Etiquette, and Business Writing are emphasized. The course intends to emphasize on enhancing the personal skills to communicate effectively and cordially. It is an attempt to weave seamlessly academics with the industry requirements.

### Course Outcomes

S.No.	Description
CO1	Be well-versed in English with professional vocabulary, as well as be prepared for the competitive Verbal Tests
CO2	To apply the learnt written communication aspects effectively through various types of letter, notice, agenda, minutes and reports
CO3	To comprehend and face professional world with self-confidence, positive attitude, team spirit, analytical skills and leadership skill
CO4	To express knowledge, ideas and analytical insights effectively through oratory skills to the professional audience

### Course outcome mapping with Programme Outcomes:

CO	PO1	PO2	PO3	PO4	PO5
CO1	1	1	2	3	3
CO2	2	3	2	3	3
CO3	3	3	3	3	3
CO4	3	3	3	2	2
Max.	3	3	3	3	3

3 is High, 2 is Moderate, 1 is Low & - is Not Applicable

A handwritten signature in blue ink is written over a purple stamp. The stamp contains the text 'Registrar NIIT UNIVERSITY' and 'Nagpur' below it.



## COURSE HANDOUT (ABRIDGED)

**Session:** 2021-2022

**Sub Session:** Semester I (Jul-Dec)

**Course Name:** Signals and Systems (EL 211)

**LT/P/C:** 3/1/0/4

### Course Description

Classification of Signals and Systems – Continuous-time and Discrete-time signals, Common signals, Various system representation techniques: differential, difference and state-space representations. System Analysis Techniques – Fourier series, Time-domain vs. Frequency-domain methods, Fourier, Laplace and Z- transforms Discrete Fourier transform. Linear Time-invariant Systems – Input/output description, Impulse response, Convolution, System functions, Frequency response, Bode plots, Pole-zero plots. Filters – Ideal filter characteristics, Approximation methods, FIR and IIR systems, Analog and Digital filters. Random Signals ? Random variables and random process, Linear systems and random signals

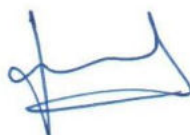
### Course Outcomes

S.No.	Description
CO1	This course introduces students to mathematical descriptions of signals and systems, and mathematical tools for analyzing and designing systems that can operate on signals to achieve a desired effect.
CO2	This will encourage understanding of students regarding properties of system for analysis of the system in practical use.
CO3	Students will learn various mathematical tools and technique such as convolution process, fourier series, fourier transform and laplace transform. Students will also get an understanding of ideal filtering, amplitude modulation and sampling of the signal.
CO4	Students will develop basic problem-solving skills and become familiar with formulating a mathematical problem from a general problem statement.

### Course outcome mapping with Programme Outcomes:

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	3	3	3	3	2	3	3	1	2	2	3	3
CO2	3	3	3	3	2	3	2	2	3	3	3	2
CO3	3	2	3	3	3	3	2	3	3	3	2	1
CO4	3	2	3	2	3	3	3	3	3	3	2	3
Max.	3	3	3	3	3	3	3	3	3	3	3	3

3 is High, 2 is Moderate, 1 is Low & - is Not Applicable

  
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## COURSE HANDOUT (ABRIDGED)

**Session:** 2021-2022

**Sub Session:** Semester II (Jan-Jun)

**Course Name:** Linear Integrated Circuits and Instrumentation  
(EL 212)

**L/T/P/C:** 3/1/0/4

### Course Description

This course introduces the fundamentals of Operational amplifier (OPAMP), Timer ICs and Instrumentation which includes circuit design of amplifier, oscillator, filter designing. In this course student come to know Timer ICs and their application in Multivibrator and Schmitt trigger circuit design. In this course Phase locked loop and its application is discussed. Instrumentation basics also introduced which gives an opportunity for student to learn various instruments, their testing and calibration.

### Course Outcomes

S.No.	Description
CO1	Understand the basic of Operational Amplifier (OPAMP).
CO2	: Learn the application of OPAMP.
CO3	Understand the design of Linear IC, Oscillator, Active Filter Design.
CO4	: Understand the design of 555 timer application as Astable and Monostable Multivibrator, Rectifier.
CO5	Understand the basic concept of Phase Locked Loop, Communication System.
CO6	Understand the concept of Instrumentation.

### Course outcome mapping with Programme Outcomes:

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	3	3	2	2	3	1	2	3	2	3	1	3
CO2	3	3	2	2	3	1	2	3	2	3	1	3
CO3	3	2	2	2	2	1	2	2	2	3	1	3
CO4	3	2	2	2	2	1	1	2	2	3	1	3
CO5	3	3	2	2	3	1	1	3	2	3	-	3
CO6	3	3	2	3	3	1	2	2	3	3	-	3
Max.	3	3	2	3	3	1	2	3	3	3	1	3

3 is High, 2 is Moderate, 1 is Low & - is Not Applicable

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## COURSE HANDOUT (ABRIDGED)

**Session:** 2021-2022

**Sub Session:** Semester I (Jul-Dec)

**Course Name:** Microprocessor & Microcontroller (EL 202)

**L/T/P/C:** 3/0/2/4

### Course Description

This course introduces 8-bit Microprocessors and Microcontrollers to the students of Electronics & Communications at an undergraduate level. The course aims to achieve twin objectives of creating a sound foundation in microprocessors and microcontrollers and keeping the content relevant to contemporary industry. Therefore, the hardware design, programming and the applications of some of the most popular 8-bit processors and controllers will be dealt with in-depth in this course along with troubleshooting techniques.

### Course Outcomes

S.No.	Description
CO1	Understanding the architecture and programming model of an 8-bit RISC Microcontroller
CO2	Understanding the architecture and programming model of an 8-bit CISC Microcontroller/Microprocessor
CO3	Understand Memory and I/O Expansion in the context of microprocessors and microcontrollers
CO4	Designing real-world systems using 8-bit microcontrollers/microprocessors
CO5	Testing and debugging microcontroller-based systems

### Course outcome mapping with Programme Outcomes:

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	3	3	2	2	3	3	2	2	2	3	1	3
CO2	3	3	2	2	3	3	2	2	2	3	1	3
CO3	3	3	3	2	3	2	2	2	2	2	1	1
CO4	3	3	3	3	2	3	3	2	2	3	3	3
CO5	3	3	3	3	3	3	2	3	3	3	2	3
Max.	3	3	3	3	3	3	3	3	3	3	3	3

3 is High, 2 is Moderate, 1 is Low & - is Not Applicable

### List of Tentative Practical

- Expt01 - Getting familiar with PIC16F development environment and tools (assembler, compiler, simulator and programmer).
- Exp02 - Using GPIO of PIC16F877a microcontroller.
- Exp03 - Analog data acquisition and display on LCD using PIC16F877a board.
- Exp04 - Data transmission and reception using asynchronous serial link on PIC16F877a board.
- Exp05 - Generate PWM Signal using PIC16F877a timers.
- Exp06 - Read the scanned keypad and display the key value on LCD provided on PIC16F877a board.
- Exp07 - Getting familiar with 89SXX development environment by writing and executing the GPIO application.
- Exp08 - Demonstrate the usage of DAA instruction of 89S52 and build a two-digit BCD counter using it.
- Exp09 - Write a 1s delay routine in 89S52 assembly language using interrupts.
- Exp10 - Demonstrate the usage of external data memory on 89S52 board.
- Exp11 - Increase the number of available I/O lines in 89S52.

  
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## COURSE HANDOUT (ABRIDGED)

**Session:** 2021-2022

**Sub Session:** Semester I (Jul-Dec)

**Course Name:** Analog Electronics (EL 112)

**LT/P/C:** 3/0/3/4

### Course Description

Having attained the basic knowledge of circuit fundamentals in Electrical Science subject, Analog Electronic Course at Third semester UG level introduces the fundamentals of basic semiconductor devices like diodes, transistors viz. Bipolar Junction transistors and Field effect transistors, their applications in analog domain like amplifiers. It also introduces operational amplifier and its negative feedbacks applications. It also introduces different types of oscillators, timers, multivibrator and voltage regulators.

Course Contents:

Transistors: Operating point, Hybrid model, DC model of transistor. CE, CB and CC configuration. AC & DC analysis and load line. Biasing & stabilization techniques. Thermal runaway, Thermal stability.

Small Signal Amplifiers at Low Frequency: Analysis of BJT multistage amplifier, DC and RC coupled amplifiers.

Understanding of multivibrator circuit. Timer circuit(IC 555), Op-amp, Voltage regulator etc.

### Course Outcomes

S.No.	Description
CO1	Understand the BJTs DC and AC analysis and small signal model
CO2	understanding of BJTs biasing, stabilization and Ebers Mole model
CO3	Understand the classification and analysis of voltage-series, voltage-shunt, current-series and current-shunt feedback amplifier.
CO4	Gain understanding of Hybrid pi model and frequency response of amplifier circuit
CO5	Analysis of feedback amplifier, their key specifications and applications. Study of Opamp with circuit designing
CO6	Designing of High frequency Amplifier and Power Amplifiers.
CO7	Understand and design Oscillator and Multivibrator

### Course outcome mapping with Programme Outcomes:

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	3	3	3	3	3	3	3	2	3	3	3	3
CO2	3	3	3	3	1	3	3	2	2	2	2	3
CO3	-	2	3	3	2	3	3	3	3	3	1	1
CO4	3	2	3	3	3	3	3	3	1	1	3	3
CO5	3	2	3	3	3	3	3	3	2	3	3	3
CO6	3	2	2	3	2	3	3	3	3	3	3	3
CO7	3	3	1	3	1	3	3	3	1	1	1	2
Max.	3	3	3	3	3	3	3	3	3	3	3	3

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### List of Tentative Practical

- Exp1. Design and simulation of CE amplifier circuit
- Exp2. Design and analysis of multistage amplifier circuit.
- Exp3. Simulation of class A amplifier circuit.
- Exp4. Design of comparator.
- Exp5. Design of feedback amplifier
- Exp6. Design of Astable multivibrator
- Exp7. Design of Monostable multivibrator
- Exp8. Study of Hartley Oscillator using LT simulator
- Exp9: Design and simulation of Schmitt Trigger

A project to be carried out individually or as a group as a subcomponent under the practical evaluation component.



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## COURSE HANDOUT (ABRIDGED)

**Session:** 2021-2022

**Sub Session:** Semester II (Jan-Jun)

**Course Name:** Fundamentals of Electronics (EL 111)

**L/T/P/C:** 3/1/0/4

### Course Description

This course is designed to help students gain an understanding of basics of DC and AC circuits and PN junction devices and thus equip them for courses on Analog and Digital Electronics.

### Course Outcomes

S.No.	Description
CO1	Use appropriate network analysis techniques to determine the current in or voltage across one or more branches of a given electrical circuit.
CO2	Analyze an RLC circuit with a step source.
CO3	Analyze an RLC circuit supplied with a sinusoidal source.
CO4	Understand the concept of reactance and impedance.
CO5	Understand the frequency response of RLC circuits.
CO6	Understand and draw phasor diagrams for simple AC circuits.
CO7	Compute the active and reactive power in an AC circuit and power factor
CO8	Understand the basic filter types.
CO9	Understand the construction, characteristics and major applications of junction diodes and bipolar junction transistors.

### Course outcome mapping with Programme Outcomes:

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	3	3	2	2	3	2	2	3	2	2	1	3
CO2	3	3	3	3	3	3	2	2	2	1	2	2
CO3	3	2	3	3	3	3	3	2	3	2	2	1
CO4	3	3	3	3	2	3	3	2	3	3	2	2
CO5	3	2	3	3	2	3	3	1	3	3	3	3
CO6	3	3	3	3	2	3	3	2	3	3	3	3
CO7	2	3	2	3	3	2	3	3	3	3	3	3
CO8	2	1	2	3	3	1	2	2	2	3	3	3
CO9	2	2	2	2	1	3	1	3	2	3	3	-
Max.	3	3	3	3	3	3	3	3	3	3	3	3

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## COURSE HANDOUT (ABRIDGED)

**Session:** 2021-2022

**Sub Session:** Semester I (Jul-Dec)

**Course Name:** AI in Cyber Security (CS 4251)

**L/T/P/C:** 3/0/2/4

### Course Description

This course gives an overview of AI concepts and how to apply them to solve problems in the area of Cybersecurity. This course also gives an overview of Cyber Threat Intelligence and future trends of AI in the field of Cybersecurity.

### Course Outcomes

S.No.	Description
CO1	Understand how AI can solve problems in Cybersecurity
CO2	Understand the applications of AI concepts in Cybersecurity
CO3	Understand the basic concepts of Cyber Threat Intelligence
CO4	Understand the important trends and how AI is the future of Cybersecurity

### Course outcome mapping with Programme Outcomes:

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	3	3	3	3	3	3	2	3	3	3	3	3
CO2	3	3	3	3	3	3	2	3	3	3	3	3
CO3	3	3	3	3	3	3	2	3	3	3	3	3
CO4	3	3	3	3	3	3	2	3	3	3	3	3
Max.	3	3	3	3	3	3	2	3	3	3	3	3

3 is High, 2 is Moderate, 1 is Low & - is Not Applicable

### List of Tentative Practical

Students will be required to make a project based on the concepts studied in theory classes. The project will be of 20 % marks. The detailed evaluation of the project will be done as follows:

- Project work 12% marks
- Presentation 5% marks
- Project report 3% marks

Students will have to give a presentation of their project which would be of 10 minutes showing the work done in the project and the output achieved. The dates for final presentation will be announced by Course-in-charge. However, the final presentation is expected to take place one week before comprehensive examination.

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## COURSE HANDOUT (ABRIDGED)

**Session:** 2021-2022

**Sub Session:** Semester I (Jul-Dec)

**Course Name:** Blockchain Security (CS 5112)

**L/T/P/C:** 3/1/0/4

### Course Description

The course starts with a review of hash functions, hash pointers and data structures leading to an introduction to block chain. Merkle trees, digital signatures and the idea of using public keys as identities are followed by a simple cryptocurrency as an example of blockchain. The utility of blockchain for decentralization is discussed with the idea of distributed consensus, incentives and proof of work. The mechanics of the most famous of block chain, the cryptocurrency Bitcoin, is discussed by covering its transactions, scripts, blocks and the Bitcoin network. Storing and using cryptocurrency, various aspects of the security of the block chain through cold storage, splitting and sharing keys etc. are discussed. Blockchain mining, anonymity and alternate mining puzzles are discussed. In the module of Ethereum and Smart Contracts, the Turing Complete Programming language used for Ethereum is distinguished from the stack based Bitcoin scripting language. The concepts of gas, incentives and security are covered in the discussion of the Ethereum Blockchain. The upcoming rollout of EIP-1559, a proposal to make Ethereum transactions more efficient by using a hybrid system of base fees and tips to more evenly incentivize miners in periods of high and low network congestion is discussed at the end of the course. The students will review at least nineteen research papers in the course including the white papers for Bitcoin and Ethereum, Transaction Fee Mechanism Design for the Ethereum Blockchain etc. in the first nine weeks and the last week. Towards the end of the course, the students will spend around five weeks on a project Smart Contracts using Remix, a Solidity IDE.

### Course Outcomes

S.No.	Description
CO1	Learning how a blockchain works and what makes it different from a traditional ledger.
CO2	Understanding how secure is a blockchain.
CO3	Learning about the level of anonymity of the users of a blockchain.
CO4	Mastering the basics of Solidity, a high-level language and use it to design a smart contract solution.
CO5	Appreciating Transaction Fee Mechanism Design for the Ethereum Blockchain in light of EIP-1559.

### Course outcome mapping with Programme Outcomes:

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	3	3	3	3	3	2	2	2	2	1	2	3
CO2	3	3	3	3	3	3	3	3	3	1	3	3
CO3	3	3	3	3	3	3	2	3	3	1	3	2
CO4	3	3	3	1	3	3	1	2	3	2	2	3
CO5	3	3	3	3	3	3	1	2	2	1	3	2
Max.	3	3	3	3	3	3	3	3	3	2	3	3

3 is High, 2 is Moderate, 1 is Low & - is Not Applicable

  
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## COURSE HANDOUT (ABRIDGED)

**Session:** 2021-2022

**Sub Session:** Semester I (Jul-Dec)

**Course Name:** Advanced Cyber Security Tools for IOT & Blockchain Security (CS 5122)

**L/T/P/C:** 0/0/4/4

### Course Description

Students will learn about the advanced tools of Cyber Security.

### Course Outcomes

S.No.	Description
CO1	Techniques Malware analysis in different environments, Automated malware analysis with tools.
CO2	Security testing of different kinds of cyber attacks.
CO3	Introduction of IOT and Blockchain related tools for cyber security.
CO4	Demonstration and lots of hands-on of the tools for the advanced cyber security.

### Course outcome mapping with Programme Outcomes:

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

3 is High, 2 is Moderate, 1 is Low & - is Not Applicable

### List of Tentative Practical

1. Understating of different Malware.
2. Practical of Malware.
3. Malware Analysis practical.
4. Malware Monitoring process.
5. Practical Security Testing
6. IoT Related Practical.
7. IoT Security Tool configuration.
8. Firewall, Antivirus Configurations.
9. Blockchain Tool Practical.
10. Wireshark and Nmap Practical.
11. Process Monitor Tools
12. EDR related Tool practical.
13. PowerShell
14. Microsoft ATP and ATA Practical

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## COURSE HANDOUT (ABRIDGED)

**Session:** 2021-2022

**Sub Session:** Semester I (Jul-Dec)

**Course Name:** Cyber Security Operations (CS 5132)

**L/T/P/C:** 3/0/2/4

### Course Description

Objective of this is to provide knowledge of the Security incident monitoring concept, Analysis the Cyber Defense Operations, Fundamentals of SIEM, EDR.

### Course Outcomes

S.No.	Description
CO1	Learn fundamental concepts about Cyber Security operations and SOC and these concepts apply to the cyber security defense. How to prepare the defense plan and be ready to respond to any incident.
CO2	Understand the tools, like SIEM and techniques to be deployed for Cyber Security operation. The deployment of tools which will have data analysis and correlation abilities. What techniques are used to automate tasks and provide meaningful correlated information which will help analyzing the security incident.
CO3	Evaluate impact on security incident through events and logs. Evaluate the events, logs, for seeing the impact of security incident. Develop ability to see the logs, find out what logs can provide which will help in incident response.
CO4	Analysis all events, incidents and build the complete picture to know what happened, why happened and what can happen and then take proactive steps
CO5	Apply knowledge to do incident triage and take actions to protect the IT infrastructure
CO6	Explore new and emerging concepts in SOAR and EDR

### Course outcome mapping with Programme Outcomes:

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	3	3	3	3	2	2	2	3	2	2	1	3
CO2	3	3	3	3	3	2	2	3	3	2	3	3
CO3	3	3	3	3	3	3	2	3	3	3	3	3
CO4	3	3	3	3	3	3	2	2	3	3	2	3
CO5	3	3	2	3	3	2	2	2	3	3	1	3
CO6	3	2	2	2	2	2	1	1	2	2	1	3
Max.	3	3	3	3	3	3	2	3	3	3	3	3

3 is High, 2 is Moderate, 1 is Low & - is Not Applicable

### List of Tentative Practical

1. Logs and events created on laptop
2. Type of Logs created on Linux OS
3. Type of logs and events created on Windows OS
4. Deployment of SIEM tool - Splunk free version.
5. Design, build and deploy use cases on SIEM tool
6. Investigate SOC automation to achieve SOAR.

  
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## COURSE HANDOUT (ABRIDGED)

**Session:** 2021-2022

**Sub Session:** Semester I (Jul-Dec)

**Course Name:** Vulnerability Assessment & Penetration Testing (CS 5142)

**L/T/P/C:** 3/0/2/4

### Course Description

In the field of computer science, hacking is explained as gaining unauthorized access of data in a system computer by exploiting the weak and soft areas of the security on that system. Ethical hacking is the art of identifying and securing potential threats to digital assets like websites, server, networks, operating system and more of an organization. An ethical hacker is an expert, who is employed by an IT firm or an organization to penetrate into the security in order to locate vulnerabilities and to resolve them and make the organization digitally impenetrable. In this Course in order to develop these skills, you will learn advanced techniques which are used by both black and white hats so that you can better understand methodologies.

### Course Outcomes

S.No.	Description
CO1	Understand Concept of Vulnerability Assessment, Malware, Software Security issues
CO2	Understand the concept of Penetration Testing and Various Methodologies
CO3	Interpreting Various law and Compliance to web Application Security, Risk Assessment
CO4	Apply Knowledge to find security vulnerability in Web Applications, Use hacking tools

### Course outcome mapping with Programme Outcomes:

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

3 is High, 2 is Moderate, 1 is Low & - is Not Applicable

### List of Tentative Practical

1. Setup VM LAB, Introduction to Kali and Pentesting Lab, Owasp Juice Shop
2. Reconnaissance and Footprinting
3. Scanning of Target Machine
4. Advance Scanning of Target Machine
5. Enumeration Of Target Machine
6. Vulnerability Assessment by Nessus ( Community Version)
7. Vulnerability Assessment by Nikto/Nexpose( Community Version)
8. Exploit generation through Metasploit Part-1
9. Exploit generation through Metasploit Part-2
10. Xss and Sql Injection Practical
11. Error Based SQL Injection
12. Android App Reverse Engineering- 2 Labs
13. Owasp Top 10 Vulnerability Exploitations( Continue till End of semester)

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## COURSE HANDOUT (ABRIDGED)

**Session:** 2021-2022

**Sub Session:** Semester I (Jul-Dec)

**Course Name:** AI and ML in Cyber Security (CS 5152)

**L/T/P/C:** 3/0/2/4

### Course Description

This course helps give an overview of the various technologies that make up AI, where they have come from, and what AI has evolved into today. In this course students will get an introduction of Cybersecurity and then learn how AI is being applied to the Cybersecurity. After finishing this course students will be able to use Cognitive Computing, Machine Learning, and Deep Learning, and know how they apply to the cybersecurity space. Also, they will understand the important trends in both fields and how AI is the future of cybersecurity.

### Course Outcomes

S.No.	Description
CO1	Understanding the role of AI in the field of Cybersecurity
CO2	How Cognitive Computing, Machine Learning, and Deep Learning play an important role in the area of Cybersecurity
CO3	Future trends of AI in Cybersecurity

### Course outcome mapping with Programme Outcomes:

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	3	3	3	3	3	3	2	3	3	3	3	3
CO2	3	3	3	3	3	3	2	3	3	3	3	3
CO3	3	3	3	3	3	3	2	3	3	3	3	3
Max.	3	3	3	3	3	3	2	3	3	3	3	3

3 is High, 2 is Moderate, 1 is Low & - is Not Applicable

### List of Tentative Practical

Students will be required to make a project based on the concepts studied in theory classes. Students will be required to work in a group on a project topic based on the concepts of the course.

A handwritten signature in blue ink, appearing to be 'Neemrana', written over a horizontal line.

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## COURSE HANDOUT (ABRIDGED)

**Session:** 2021-2022

**Sub Session:** Semester I (Jul-Dec)

**Course Name:** Advanced Cyber Security Tools for Cyber Defense Operations (CS 5182)

**L/T/P/C:** 0/0/4/4

### Course Description

In this course students will learn about the Threat Hunting & malware analysis, hands-on in different tools, Configuration and administration use of QRADAR, Uses of CALDERA and CyTrONE.

### Course Outcomes

S.No.	Description
CO1	Techniques Malware analysis in different environments, Automated malware analysis with tools.
CO2	Threat hunting lab architecture and toolsets and Threat Hunting using sample logs.
CO3	Overview, Configuration and Deployment of different kind of Cyber Defense Tools.
CO4	Demonstration and lots of hands-on of the tools.

### Course outcome mapping with Programme Outcomes:

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

3 is High, 2 is Moderate, 1 is Low & - is Not Applicable

### List of Tentative Practical

1. Understanding of different Malware.
2. Practical of Malware.
3. Malware Analysis practical.
4. Malware Monitoring process.
5. Practical Threat Hunting
6. Configuration of QRadar.
7. SIEM Tool configuration.
8. Firewall, Antivirus Configurations.
9. Caldera Tool Practical.
10. Practical of CyTrONE.
11. Wireshark and Nmap Practical.
12. Process Monitor Tools
13. EDR related Tool practical.
14. PowerShell
15. Microsoft ATP and ATA Practical

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## COURSE HANDOUT (ABRIDGED)

**Session:** 2021-2022

**Sub Session:** Semester I (Jul-Dec)

**Course Name:** IOT Security (CS 5192)

**L/T/P/C:** 3/0/2/4

### Course Description

In the first part of this course the students will be introduced to IOT technology, its architecture, building blocks, protocols and standards (existing and emerging). This will be supplemented by IoT case-studies. In the second part of this course they will learn about the vulnerabilities that exist in IoT and how these might be exploited. They will then learn what tools exist to spot these vulnerabilities and methods to plug them. Vulnerabilities and threats in the context of Industrial IoT (IIoT), medical IOT and home automation will also be discussed.

### Course Outcomes

S.No.	Description
CO1	Familiarization with IoT architecture and its physical and software building blocks. Introduction to systems-on-chip, wireless sensor nodes, sensors and actuators.
CO2	Understanding IoT specific protocols and standards such as MQTT and CoAP. Also learning the internals of protocols that support building IoT such as LoRaWAN, IPV6, BLE, etc.
CO3	Understanding the sources of risks and vulnerabilities, attack vectors, privacy concerns, Vulnerability analysis tools, hardware hacking and access management. Case studies.
CO4	A survey of existing and emerging IoT security standards
CO5	Case-studies from industrial, medical and home applications of IoT, with emphasis on potential vulnerabilities

### Course outcome mapping with Programme Outcomes:

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

3 is High, 2 is Moderate, 1 is Low & - is Not Applicable

### List of Tentative Practical

1. Programs for simulating sensor output and its digitization
2. MQTT/CoAP data packet generation carrying sensor data
3. Signature analysis
4. Firmware analysis (2-3 experiments)
5. IoT device and network simulation

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## COURSE HANDOUT (ABRIDGED)

**Session:** 2021-2022

**Sub Session:** Semester I (Jul-Dec)

**Course Name:** Threat intelligence (CS 5202)

**L/T/P/C:** 3/0/2/4

### Course Description

Cyber threat intelligence represents a force multiplier for organizations looking to update their response and detection programs to deal with increasingly sophisticated advanced persistent threats. Malware is an adversary's tool but the real threat is the human one and cyber threat intelligence focuses on countering those flexible and persistent human threats with empowered and trained human defenders. During a targeted attack an organization needs a top notch and cutting-edge threat hunting or incident response team armed with the threat intelligence necessary to understand how adversaries operate and to counter the threat.

### Course Outcomes

S.No.	Description
CO1	Understand the cybersecurity threats
CO2	Threat analysis.
CO3	Design threat intelligence models.

### Course outcome mapping with Programme Outcomes:

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	3	3	2	2	2	2	3	1	2	3	3	-
CO2	2	3	2	3	2	1	2	2	3	1	2	2
CO3	1	2	1	3	2	1	1	3	2	1	2	3
Max.	3	3	2	3	2	2	3	3	3	3	3	3

3 is High, 2 is Moderate, 1 is Low & - is Not Applicable

### List of Tentative Practical

- Expt01 – Understanding of threat data (collaborative Lab work)
- Expt02 – Static Analysis of threats
- Expt03 – Dynamic analysis of threats
- Expt04 – Malware analysis in controlled environment
- Expt05 – Analyzing non Pe malicious files
- Expt06 – Machine Learning tools
- Expt07 – Creating threat models
- Expt08 – Optimization of threat models
- Expt09 – Creating threats report

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## COURSE HANDOUT (ABRIDGED)

**Session:** 2021-2022

**Sub Session:** Semester II (Jan-Jun)

**Course Name:** Introduction to Data Driven Decisions (DS 202)

**L/T/P/C:** 3/0/0/3

### Course Description

This course focuses on why it is important to leverage data when contemplating organizational choices and supplies the tools at the core of data-driven decision making. The course explores how technology enables the collection and organization of exponential growth of data, understanding of enterprise data and how to analyze that data to gain powerful insights. The course covers collecting and analyzing data – data quality, database, data warehouse related technologies, communicating results to decision makers through business intelligence, business analytics, data visualization processes for driving improvement, statistical process control, metrics dashboards and translating data strategies, and the connection between data driven decisions and organizational performance.

### Course Outcomes

S.No.	Description
CO1	Have a high level of understanding of enterprise data, data quality and data management
CO2	Gather detail understanding of Enterprise Data Strategy
CO3	Gather clear understanding on data driven decision making for different Management levels
CO4	Acquire knowledge of data visualization and its business interpretation
CO5	Develop knowledge of statistical Modeling for predictive analytics

### Course outcome mapping with Programme Outcomes:

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

3 is High, 2 is Moderate, 1 is Low & - is Not Applicable

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## COURSE HANDOUT (ABRIDGED)

**Session:** 2021-2022

**Sub Session:** Semester I (Jul-Dec)

**Course Name:** Data Visualization (DS 211)

**L/T/P/C:** 2/0/4/4

### Course Description

This course covers the techniques and algorithms for creating effective visualizations with special emphasis given to interactive data visualization.

### Course Outcomes

S.No.	Description
CO1	Data preparation, data extraction and story telling through the design visualization
CO2	Visualising large graphs and networks
CO3	Spatial data and text visualisation
CO4	Algorithmic approach for dynamic and interactive visualisation
CO5	Providing basic idea about geometrical pattern, dimension etc of data and techniques for extracting the data features

### Course outcome mapping with Programme Outcomes:

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	3	3	3	3	3	1	3	1	3	3	3	3
CO2	2	3	3	3	3	2	2	2	3	3	3	3
CO3	3	3	3	3	3	1	2	1	2	3	3	3
CO4	3	3	2	3	3	1	1	3	3	3	3	3
CO5	3	3	3	3	3	2	3	2	3	3	2	3
Max.	3	3	3	3	3	2	3	3	3	3	3	3

3 is High, 2 is Moderate, 1 is Low & - is Not Applicable

### List of Tentative Practical

Tutorials and practical will be based on what taught in the lecture along with a combination of graphical interphase

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## COURSE HANDOUT (ABRIDGED)

**Session:** 2021-2022

**Sub Session:** Semester II (Jan-Jun)

**Course Name:** Statistical Methods for Data Science (DS 212)

**L/T/P/C:** 3/0/2/4

### Course Description

This course covers fundamental aspects of inferential statistics for data science students. The course will involve theoretical topics and some programming assignments. Topics covered include Probability Theory, Random Variables, Statistical Inference, Hypothesis Testing, Bayesian Inferences and Computational Methods. The course is an in-depth coverage on various Statistical Techniques to make the students conversant with the methods of Statistics used for data science. For Analysis R software is used. The students will continuously practice their newly acquired skills through R Studio. The class is expected to be interactive, and students are encouraged to participate in class discussions.

### Course Outcomes

S.No.	Description
CO1	Explain the concept of descriptive Statistics and data reduction.
CO2	Explain the concept of estimation of parameters and calculate the problems related to point and interval estimation
CO3	Explain the concept of Testing of Hypotheses and solve the problems of testing of Hypothesis.
CO4	Hypothesize various advanced statistical techniques for modelling and exploring practical situations.
CO5	Describe the role of the posterior distribution in Bayesian inference about a parameter
CO6	Understand how to apply computational methods to extract information
CO7	Retrieve, analyze, synthesize, and evaluate outputs produced from RStudio

### Course outcome mapping with Programme Outcomes:

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	2	2	3	1	1	3	2	1	1	3	3	3
CO2	2	3	2	2	2	3	2	2	1	3	2	2
CO3	3	2	2	2	2	3	1	1	2	1	2	3
CO4	2	3	2	3	3	3	-	1	3	1	3	2
CO5	2	2	2	3	2	3	-	1	3	1	2	3
CO6	3	2	2	3	3	2	-	2	2	1	2	2
CO7	2	1	3	1	3	1	2	1	1	3	-	2
Max.	3	3	3	3	3	3	2	2	3	3	3	3

3 is High, 2 is Moderate, 1 is Low & - is Not Applicable

### List of Tentative Practical

- P1. Exploration and analysis of toy datasets using R
- P2. Application of PCA on dataset using R
- P3. Application of Clustering on dataset using R
- P5. Point estimation and interval estimation using R
- P6. Testing of Hypothesis using R
- P7. Estimation of the CDF using R
- P8. Bootstrapping using R
- P9: Simulation using R

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## COURSE HANDOUT (ABRIDGED)

**Session:** 2021-2022

**Sub Session:** Semester II (Jan-Jun)

**Course Name:** Optimization for Data Science (DS 222)

**L/T/P/C:** 3/0/2/4

### Course Description

This course covers several optimisation techniques that are required for data science.

### Course Outcomes

S.No.	Description
CO1	Data optimisation technique using gradient descent, golden section method and first and second order line search algorithm
CO2	Data optimisation technique using penalty function, quadratic programming, saddle point and duality theory, Classical approach to optimization with equality and inequality constraints
CO3	Genetic algorithms, Differential evolution, particle swarm optimization.
CO4	Ant colony optimization, Simulated annealing.
CO5	Use of conjugate gradient, hyper gradient descent method, Newton method, secant method and Quasi Newton method for data optimisation.

### Course outcome mapping with Programme Outcomes:

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	3	3	3	3	3	1	3	1	3	3	3	3
CO2	2	3	3	3	3	2	3	2	2	3	3	3
CO3	3	3	3	3	3	3	1	3	1	3	3	3
CO4	3	3	3	3	3	3	2	3	1	3	3	3
CO5	3	3	3	3	3	2	3	3	3	3	3	3
Max.	3	3	3	3	3	3	3	3	3	3	3	3

3 is High, 2 is Moderate, 1 is Low & - is Not Applicable

### List of Tentative Practical

Tutorials and practical will be based on what taught in the lecture along with a combination of graphical interphase

  
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## COURSE HANDOUT (ABRIDGED)

**Session:** 2021-2022

**Sub Session:** Semester II (Jan-Jun)

**Course Name:** Data Science Using R (DS 302)

**LT/P/C:** 3/0/0/3

### Course Description

The field commonly known as Data Science lies at the intersection of mathematics, computer science, and domain expertise. Within the data science (DS) world, there are a multitude of areas of study, and exploration. This course will introduce the basics of R programming. Students will learn the R skills needed to answer essential questions and perform basic exploratory analysis. The course will cover R functions and data types, then tackle how to operate on data frames and when to use data sub-setting techniques. Students will learn how to apply general data sub-setting features like select and filter, and how to wrangle, analyze and visualize data. The course aim is to make the students conversant with the concept of Data Science and techniques to be used for data analytics including the construction of different statistical Models used for Data Analytics. The course is an in-depth coverage on various Statistical Techniques and goodness of fit tests used for data analytics. The module is practical oriented. For Analysis R software is used. The students will continuously practice their newly acquired skills through R Studio.

### Course Outcomes

S.No.	Description
CO1	Learn Data Science concepts using R and functioning of R
CO2	Understand Exploratory and Inferential Data Analytics
CO3	Learn to create and present various graphics using R
CO4	Fit a Statistical Model using R
CO5	Learn Classification Techniques using R

### Course outcome mapping with Programme Outcomes:

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

3 is High, 2 is Moderate, 1 is Low & - is Not Applicable

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## COURSE HANDOUT (ABRIDGED)

**Session:** 2021-2022

**Sub Session:** Semester II (Jan-Jun)

**Course Name:** Big Data Concepts (DS 402)

**L/T/P/C:** 2/0/4/4

### Course Description

The course covers techniques to build and maintain reliable and scalable systems capable of handling large amounts of data using Apache Hadoop, its extensions, libraries and related technologies

### Course Outcomes

S.No.	Description
CO1	Build map reduce programs to process big data
CO2	Build programs to use analytical and processing tools of Hadoop framework
CO3	Implement Data Pipeines
CO4	Design Dashboards for data visualization

### Course outcome mapping with Programme Outcomes:

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

3 is High, 2 is Moderate, 1 is Low & - is Not Applicable

### List of Tentative Practical

- P1. Programs to perform file read and write in HDFS
- P2. Programs for to implement different design patterns using map reduce algorithms.
- P3. Pig: Writing scripts for data processing
- P4. HBase: Querying data for data processing
- P5. Hive: Querying data for data processing
- P6. Flume: Programs for data ingestion using various sources, sinks and channels
- P7. Spark: Use RDD and Data frames to process data
- P8. Tableau: Designing and implementing dashboards

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## COURSE HANDOUT (ABRIDGED)

**Session:** 2021-2022

**Sub Session:** Semester II (Jan-Jun)

**Course Name:** Analog and Digital Communication (EC 202)

**L/T/P/C:** 3/0/3/4

### Course Description

Overview of communication system - Transmitters, Transmission channels & receivers, Concept of modulation, its needs.

Review of signal & system concept.

Linear & Non-linear Modulation: Amplitude modulation, Time domain representation of AM signal, transmission bandwidth for AM; Calculation of Transmitted power & sideband power & Efficiency. Demodulation of AM signals. Transmission and reception of Angle Modulation: Time and Frequency domain representations.

Generation of Pulse modulation: PWM, PPM generation.

Introduction to digital modulation technique ASK, FSK, PSK, BPSK, QPSK, QAM, generation method, mathematical representation & modelling. Interferences and fading on signal, various multiple access techniques: TDMA, FDMA etc.

### Course Outcomes

S.No.	Description
CO1	Understanding of basic communication principles and technologies relating to information transmission over wire and wireless communication channels and different channel models.
CO2	Examine challenges in various communication system due to different channel condition and apply appropriate techniques to address such issues achieving optimum performance
CO3	Choosing appropriate communication protocols and techniques for various application by understanding their comparative analysis, Merits and demerits. Case study to reach user expectation and benefit of society.

### Course outcome mapping with Programme Outcomes:

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	2	2	2	2	2	2	2	1	1	2	1	1
CO2	2	3	2	2	3	2	3	1	1	3	2	2
CO3	3	3	3	3	3	3	3	2	2	3	2	3
Max.	3	3	3	3	3	3	3	2	2	3	2	3

3 is High, 2 is Moderate, 1 is Low & - is Not Applicable

### List of Tentative Practical

- 1 Introduction to Signal Generation - I (Simulation)
- 2 Introduction to Signal analysis - II (Simulation)
- 3 Generation of various signal (Simulation).
- 4 Design and analysis of AM (using simulation & hardware). Measurement of Modulation Index.
- 5 Design and analysis of FM. (using hardware and simulation). Effect of MI.
- 6 Study of Sampling (three different sampling method) and duty cycle
- 7 Study of Pulse Code Modulation and Delta Modulation
- 8 Study of Carrier modulation Techniques. (ASK, PSK, FSK)
- 9 Study of Delta modulation and ADM.
- 10 Study of various Pulse Modulation (PWM, PPM)
- 11 Study of PRBS Generator and Source and Channel Coders.
- 12 Study and analysis of various Digital modulation technique (BPSK, DPSK, QPSK etc.)

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## COURSE HANDOUT (ABRIDGED)

**Session:** 2021-2022

**Sub Session:** Semester I (Jul-Dec)

**Course Name:** Antenna and Microwave Propagation (EC 301)

**L/T/P/C:** 3/0/2/4

### Course Description

Antennas and microwave propagation of radio signals are a fundamental aspect of communications as well as any other device that will radiate or receive electromagnetic waves over an air interface. The aim of the course is to make the student able to understand the theories, methods, physical mode of operation in the context of microwave, and the technical construction of the components that are used in wireless systems. Moreover, the course will introduce the microwave network theory and the use of scattering matrix, design criteria for waveguides, microwave components. Furthermore, different types of antennas and their characteristics will be studied, which will help the students to design antennas for different communication systems.

The emphasis of this course would be:

- To explain electromagnetic theory regarding waveguides and working of microwave components.
- To analyze microwave network by the use of scattering and transmission parameters.
- To explain the basics of ante

### Course Outcomes

S.No.	Description
CO1	CO1: Understand basics of Microwave origin and propagation
CO2	CO2: Understand the concept of Microwave Networks and its analysis
CO3	CO3: Understand the basics of Antenna
CO4	CO4: Understand the design aspects and Working of different types of Antenna
CO5	CO5: Understand the working of various Microwave active devices

### Course outcome mapping with Programme Outcomes:

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

3 is High, 2 is Moderate, 1 is Low & - is Not Applicable

### List of Tentative Practical

Practicals are based on the study of radiation patterns of different antenna and Microwave devices.

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## COURSE HANDOUT (ABRIDGED)

**Session:** 2021-2022

**Sub Session:** Semester II (Jan-Jun)

**Course Name:** Control Theory (EC 302)

**L/T/P/C:** 3/0/3/4

### Course Description

Control Theory is the study of the analysis and regulation of the output behaviors of dynamical systems subject to input signals. Control systems- Basics of feedback theory. Modelling of various types of systems - Electrical, Mechanical, Electromechanical, Mechatronic, Thermal, Pneumatic, Hydraulic, process industry related. Study of sensors, transducers, actuators. the course also helps in Time Domain Analysis – Transient response of first and second order systems. Steady state errors. Response with P, PI, PID controllers. Limitations of Time domain analysis.

Frequency Domain Analysis using Polar plots, frequency domain specifications, Bode plots, gain and phase margins. Correlation with time domain analysis, Minimum phase/Non – minimum phase systems.

Stability and Compensation techniques Concepts of absolute, asymptotic, conditional and marginal stability. Routh – Hurwitz and Nyquist stability criterion. Root locus technique and its application. Concepts of compensation. Lag/Lead/Lag – Lead networks for compensation. Compensation using P, PI, PID controllers

### Course Outcomes

S.No.	Description
CO1	Define and explain feedback and feed-forward control architecture and discuss the importance of performance, robustness and stability in control design
CO2	Interpret and apply block diagram representations of control systems and design PID controllers based on empirical tuning rules.
CO3	Compute gain and phase margins from Bode diagrams and Nyquist plots and understand their implications in terms of robust stability
CO4	Lead-Lag compensators based on frequency data for an open-loop linear system.

### Course outcome mapping with Programme Outcomes:

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	3	3	3	3	3	1	3	2	2	3	2	3
CO2	3	3	3	3	2	3	2	1	3	3	2	2
CO3	3	3	2	3	3	3	1	3	1	2	3	3
CO4	1	1	1	2	1	1	2	1	1	1	3	2
Max.	3	3	3	3	3	3	3	3	3	3	3	3

3 is High, 2 is Moderate, 1 is Low & - is Not Applicable

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### List of Tentative Practical

Expt01. Introduction to MATLAB for Control System.

Expt02. Study the features of Control System Simulator kit (CSS 2454 Kit).

To study and analyze the response of Low Pass Filter High Pass Filter & Band Pass Filter using R, L, C. (CSS 2454 Kit) Adders design.

Expt03. To observe the First Order, Second Order, Third Order control system for different values of the Damping Ratio at different values of resistance.

To observe the Type 0 control system Steady State Error (Ess) for Unit, Step, Square, Ramp and parabolic wave input.

To observe the Type 1 control system Steady State Error (Ess) for Unit, Step, Square, Ramp and parabolic wave input.  
To observe the Type 2 control system Steady State Error (Ess) for Unit, Step, Square, Ramp and parabolic wave input.

Expt04. To study and analyze the response of Integrator & Differentiator.

WAP to convert the transfer function to pole zero using MATLAB.

Expt05. To study and analyze the Step response of LRC circuits.

WAP to study the Impulse, Ramp and Step Response of the system using MATLAB.

Expt06. To study the Process and Time response of Second Order system with P, PI, PID control.

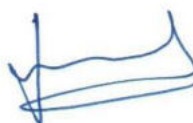
Expt07. To study and analyze the open loop response of Plant, Lag, Lead, Lag-Lead Compensator.

To study and analyze the open loop response of Plant with Compensator.

Expt08. To study and analyze Root- Locus plot of various transfer function in MATLAB.

Expt09. To study and analyze Bode- Plot of various transfer function in MATLAB.

Expt10. To study and analyze Nyquist-Plot of various transfer function in MATLAB



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## COURSE HANDOUT (ABRIDGED)

**Session:** 2021-2022

**Sub Session:** Semester II (Jan-Jun)

**Course Name:** Business and Management Accounting II  
(ACC 102)

**L/T/P/C:** 3/0/0/3

### Course Description

Accounting knowledge is very essential for managing the business. It provides tools and methodology for recording, summarising, analysing and planning on the basis of accounting information and transactions. Business enterprises prepare and use Financial Statements, Marginal Costing and CVP Analysis, Ratio Analysis, Budget and Budgetary Control, Inventory Management etc. for analysing profitability, business trends, cost control and decision making. All these information are used by the stakeholders of the companies.

This course intended to impart knowledge of Financial Statements, Financial Statement Analysis, Generally Accepted Accounting Principles, Annual Reports and Accounting for Partnership in detail. The course will also help acquaint the students with cost and management accounting mechanics, process and system, with an emphasis on how to use accounting information for decision making, performance evaluation and control. This course will also provide detail knowledge of Cost Sheet, Marginal Costing and CVP Analysis, Ratio Analysis, Budget and Budgetary Control, Inventory Management.

At the completion of course students will be able to apply their Accounting knowledge and skills to prepare and analyse Financial statements and able to use the Management Accounting concepts for decision making, performance evaluation and control.

### Course Outcomes

S.No.	Description
CO1	Understand and interpret how the informational content of corporate financial statements is useful and the way they are used by different parties
CO2	Understanding the accounting concepts and the methodology of preparing accounts
CO3	Understanding the application of Indian Accounting Standards and IFRSs
CO4	Analyse and interpret financial statements using comparative, common size analysis and trend analysis
CO5	Understand the Annual Reports and to interpret all the items shown in that
CO6	Understand the importance of CFS and why they are made.
CO7	Understand the different types of Auditors' reports while analysing the annual report of companies.
CO8	Understand the concepts of inventory valuation and its role in costing.
CO9	Understand the types of taxes and tax system of the country.

### Course outcome mapping with Programme Outcomes:

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CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	2	-	3	1	3	1	1	2	1	3	2	2
CO2	3	3	2	1	1	1	1	3	3	2	3	3
CO3	3	3	3	3	3	2	2	2	2	2	2	2
CO4	3	3	3	3	3	2	2	2	2	2	2	2
CO5	-	-	-	-	-	-	-	-	-	-	-	-
CO6	-	-	-	-	-	-	-	-	-	-	-	-
CO7	-	-	-	-	-	-	2	3	3	-	-	-
CO8	2	3	-	-	2	-	3	3	2	2	-	-
CO9	3	-	-	-	2	-	-	-	-	2	-	-
Max.	3	3	3	3	3	2	3	3	3	3	3	3

3 is High, 2 is Moderate, 1 is Low & - is Not Applicable

  
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## COURSE HANDOUT (ABRIDGED)

**Session:** 2021-2022

**Sub Session:** Semester I (Jul-Dec)

**Course Name:** Financial Analytics (BA 504)

**L/T/P/C:** 4/0/0/4

### Course Description

This course delves deep into financial analytics. This course provides a framework to understand and apply various tools and techniques required to answer some crucial financial questions. It develops an understanding how to use financial indicators, benchmarks and ratios to detect and prevent a possible fraud. This course enables the candidate to appreciate the use of analytics in Banking/Retail/Insurance to provide a meaningful business solution.

### Course Outcomes

S.No.	Description
CO1	Develop an understating of various fraud detection models
CO2	To be able to apply Fraud Detection Models and to find the possible manipulations
CO3	To understand the various VaR models and their applications
CO4	Understand Credit risk and its Modelling
CO5	Understanding the Bond Price Yield relationship and its application

### Course outcome mapping with Programme Outcomes:

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

3 is High, 2 is Moderate, 1 is Low & - is Not Applicable

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## COURSE HANDOUT (ABRIDGED)

**Session:** 2021-2022

**Sub Session:** Semester I (Jul-Dec)

**Course Name:** Machine Learning (BA 411)

**L/T/P/C:** 3/0/0/3

### Course Description

The course aims to provide a rigorous concepts underlying machine learning, like, what is learning? How can a machine learn? How do we quantify the resources needed to learn a given concept? Is learning always possible? , Can we know whether the learning process succeeded or failed?

The course also presents several key machine learning algorithms. Specific attention to algorithms appropriate for large scale learning is also covered, with the applications where data is plentiful and computation time becomes the bottleneck. Validations are taken with accuracy and computation time.

### Course Outcomes

S.No.	Description
CO1	Understand the fundamental process of Machine Learning, univariate, bivariate and multivariate data modelling, supervised and unsupervised learning
CO2	Understand how to use machine learning tools to analyze real-life business problems
CO3	Create data models and compare them through model diagnostics
CO4	Understand model selection and boosting of models

### Course outcome mapping with Programme Outcomes:

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	3	-	-	-	-	-	3	3	-	-	-	-
CO2	-	3	-	-	-	-	3	3	-	-	-	-
CO3	3	3	-	-	3	-	-	3	3	-	2	-
CO4	3	3	-	-	3	-	-	3	3	-	3	-
Max.	3	3	-	-	3	-	3	3	3	-	3	-

3 is High, 2 is Moderate, 1 is Low & - is Not Applicable

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## COURSE HANDOUT (ABRIDGED)

**Session:** 2021-2022

**Sub Session:** Semester I (Jul-Dec)

**Course Name:** Data Visualization (BA 512)

**L/T/P/C:** 3/0/0/3

### Course Description

This course will help students understand how data is visualized. This course will also help students acquire the expertise and the tools needed for presenting data-based evidence with impact, across images, graphics, and visualizations of big data and for conveying their ideas in ways that are convincing and catchy.

### Course Outcomes

S.No.	Description
CO1	Understand the basics of data visualization, visualization as a medium, and representation of the data.
CO2	Understand and learn exploration of data visually.
CO3	Understand and learn the process of data visualization using tools like Excel, Tableau and build visuals using programming language R, Python.
CO4	Understand and learn to use data calculations to enhance the visualization.
CO5	Understand and learn to use qualitative and quantitative data analysis and visualization useful for business.
CO6	Understand the process of creating dashboards using advance Excel and Tableau.
CO7	Understand the basic ingredients of storytelling.
CO8	Understand the different analytical/visualization tools for visualization.
CO9	Slicing and dicing data with Excel to help business understand the insights using visualization

### Course outcome mapping with Programme Outcomes:

CO	PO1	PO2	PO3	PO4	PO5
CO1	3	3	2	-	1
CO2	3	3	3	-	3
CO3	3	3	3	-	1
CO4	2	2	2	-	1
CO5	2	2	-	-	1
CO6	2	2	3	3	3
CO7	2	2	-	3	3
CO8	3	3	3	-	3
CO9	3	3	3	-	3
Max.	3	3	3	3	3

3 is High, 2 is Moderate, 1 is Low & - is Not Applicable

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## COURSE HANDOUT (ABRIDGED)

**Session:** 2021-2022

**Sub Session:** Semester II (Jan-Jun)

**Course Name:** Predictive Analytics (BA 522)

**L/T/P/C:** 3/0/0/3

### Course Description

This course covers the key concepts used for extracting stored data elements, understand what they imply, and transform their formats and derive new relationships among them to produce a dataset suitable for analytical modelling. The course aims to help students produce a fully processed data set compatible for building powerful predictive models that can be deployed to increase productivity and profitability. Students will also be able to use forecasting models for predicting future values of variables (such as future sales from past data) etc.

### Course Outcomes

S.No.	Description
CO1	Understand the fundamental process of business analytics, univariate, bivariate and multivariate data modelling, supervised and unsupervised learning
CO2	Understand data cleaning, preparation, and data visualization.
CO3	Develop predictive model based on neural networks, decision trees, logistic Regression and Bayesian network models to solve Business Problem using R.
CO4	Perform time series analysis using R
CO5	Learn classification techniques based on clustering, random forest, SVM and Association rules.

### Course outcome mapping with Programme Outcomes:

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

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## COURSE HANDOUT (ABRIDGED)

**Session:** 2021-2022

**Sub Session:** Semester I (Jul-Dec)

**Course Name:** Python & Bio Python (BI 431)

**L/T/P/C:** 3/0/2/4

### Course Description

#### IMPORTANCE OF PYTHON

The course gives an insight to the python programming language and the bioinformatics tools that this language provides. Course coverage would include a detailed introduction to the language and then will proceed to its applicability to Bioinformatics applications. Python focuses on the problem solving rather than lower level details. Python has been used in a lot of scientific applications, parallel programming, and benchmarking systems. Due to its versatility it has been a preferred language at NASA, Google etc.

Applicability to Bioinformatics:

Python has great applicability in Bioinformatics applications due to the availability of a rich and updated toolset for bioinformatics libraries making it a powerful platform superseding erstwhile BioPerl. The course holds great value and applicability for students of Computer Science, Biotech and Electronics streams.

### Course Outcomes

S.No.	Description
CO1	Python Programming Basics, syntax, constructs, datatypes and building logic using the constructs
CO2	Primitive and Non-Primitive Data types of Python such as Numbers, Strings, Lists, Dictionaries, Sets, Tuples and Files
CO3	Using python functions libraries and modules and defining our own functions and modules
CO4	Regular Expressions, advanced features such as Lambda, Map, Filter, Reduce etc
CO5	BioPython modules and working with Bioinformatic resources and databases on the Internet

### Course outcome mapping with Programme Outcomes:

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

3 is High, 2 is Moderate, 1 is Low & - is Not Applicable

### List of Tentative Practical

To be shared during course delivery

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## COURSE HANDOUT (ABRIDGED)

**Session:** 2021-2022

**Sub Session:** Semester I (Jul-Dec)

**Course Name:** Remedial Biology (BIO 001)

**L/T/P/C:** 3/0/2/4

### Course Description

This course will provide a comprehensive overview of microbial world, understanding fundamental structure differences in prokaryotic and eukaryotic cells. Structure of cell organelles, their function with cell cycle and cell division will be studied in details. Function of various biomolecules, their involvement in various biochemical pathways, mineral nutrients and their transport to the cell will be considered. Advances in biotechnology and its application to human welfare will be discussed.

### Course Outcomes

S.No.	Description
CO1	Understand hierarchy of biological world and able to compare various cells
CO2	Acquire basic knowledge of structure and functions of the cell, biomolecules, essential physiological and biochemical processes.
CO3	Explain genetics, gene interaction mechanism in plants and animals, inheritance pattern, and techniques to interpret the results.
CO4	Recombinant DNA technology and its applications in biotechnology.

### Course outcome mapping with Programme Outcomes:

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

3 is High, 2 is Moderate, 1 is Low & - is Not Applicable

### List of Tentative Practical

- P1. To study structure and working of a compound microscope; identify and study the morphology of plant cell, animal cell and prokaryote.
- P2. To make a temporary stained mount of
  - A) Onion peel and study, it under microscope- a plant cell
  - B) To make a temporary mount of cheek epithelial cells of man- Animal cell.
- P3. To prepare slides of bacteria and yeasts-microbial cells.
- P4. Hanging drop technique for demonstrating motility of bacteria.
- P5. To estimate the glucose concentration in a given sample
- P6. To estimate the protein concentration in a given sample by Biuret test.
- P7. Cell viability assay with trypan blue exclusion method.
- P8. To study the enzyme reaction – cellulase or amylase and effect of temperature and pH on enzymatic reaction.
- P9. To study of different stages of mitosis in onion root tip cells.
- P10. To study the effect of colchicine on mitosis in onion root tip cell.
- P11. To study various stages of meiosis.

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## COURSE HANDOUT (ABRIDGED)

**Session:** 2021-2022

**Sub Session:** Semester I (Jul-Dec)

**Course Name:** Biological Chemistry (BIO 201)

**L/T/P/C:** 3/0/3/4

### Course Description

This course in Biochemistry gives an insight about the application of chemistry in understanding the biological processes. Course coverage includes detailed concepts about biomolecules and their metabolism along with its application in interdisciplinary areas such as drug discovery, immunology and cell biology. Biochemistry will focus on laying the fundamentals about chemical structure, enzyme catalysed reactions and application of biomolecules including proteins, lipids, carbohydrates and nucleotides in life processes.

### Course Outcomes

S.No.	Description
CO1	Understand the molecular basis of life including biochemical properties of water.
CO2	Overview of the different major macromolecules and their biochemical properties.
CO3	Gain the knowledge of Enzyme Kinetics, Mechanism and their biochemical properties.
CO4	Understand bioenergetics and metabolism of biomolecules.

### Course outcome mapping with Programme Outcomes:

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

3 is High, 2 is Moderate, 1 is Low & - is Not Applicable

### List of Tentative Practical

- P1: Calibration of laboratory pipettes, and pH-meter
- P2: Preparation of buffers and molar solution.
- P3: Isoelectric precipitation of proteins
- P4: Qualitative analysis of amino acids
- P5: Titration curve of amino acids
- P6: Protein estimation
- P7: Glucose estimation
- P8: Spectrophotometric analysis of some in-organic chemicals
- P9: Protein conformation study
- P10: Acid hydrolysis of polysaccharides.
- P11: Influence of substrate concentration, temperature, pH and inhibitors on enzyme activity
- P12: Estimation of saponification value of fats and oils

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## COURSE HANDOUT (ABRIDGED)

**Session:** 2021-2022

**Sub Session:** Semester I (Jul-Dec)

**Course Name:** Molecular Biology (BIO 202)

**L/T/P/C:** 3/0/3/4

### Course Description

This course covers the detailed analysis of molecular mechanism of various stages of cell cycle and their regulation. This course is aimed to understand the basic concept of gene regulation at all levels, and the structure-function relationships of nucleic acids and proteins. In this course Biological systems will be studied at molecular level. Major emphasis will give to understand the concept of DNA damage, DNA repair, replication, genetic recombination, transcriptional and post-transcriptional processes. Molecular biology techniques and the logic of experimental design will be highlighted.

### Course Outcomes

S.No.	Description
CO1	The course aims to prepare students with basic knowledge of the structural and functional properties of cell and cell organelles.
CO2	Student will be able to understand the concept of Cell division and its regulation through cell cycle.
CO3	Learn the structure and function of DNA, RNA and the molecular processes (replication, transcription, translation etc.) that occur in and between cells.
CO4	Explain the concept of gene structure and function, gene regulation, gene expression, microbial genetics, mutation and DNA repair mechanism.
CO5	Student will able to execute a range of laboratory experiments such as DNA isolation, purification and manipulation by using standard conventional methods and molecular biology techniques.

### Course outcome mapping with Programme Outcomes:

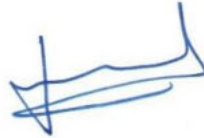
CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	2	2	2	1	2	-	-	-	-	-	-	-
CO2	2	3	2	2	2	-	-	-	1	-	-	1
CO3	2	3	2	3	2	2	-	-	2	3	-	2
CO4	2	2	2	2	1	2	-	-	2	3	-	2
CO5	2	2	2	3	3	2	2	1	3	3	2	3
Max.	2	3	2	3	3	2	2	1	3	3	2	3

3 is High, 2 is Moderate, 1 is Low & - is Not Applicable

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List of Tentative Practical

- P1 Molecular Biology Safety Lab (Labster virtual lab)
- P2 Molecular Biology Stock solution and Buffer preparation
- P3 Microscope View of a) Bacterial capsule b) Onion root c) Cheek smear
- P4 Gram staining
- P5 Cell Membrane and Transport
- P6 Mitosis on onion root tip
- P7 DNA isolation from Bacterial cells
- P8 DNA isolation from Plant cells
- P9 DNA isolation from Animal Cells
- P10 Plasmid DNA isolation from bacterial cells
- P11 Quantitation of DNA
- P12 PCR amplification
- P13 Bacterial Transformation
- P14 Molecular Cloning



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## COURSE HANDOUT (ABRIDGED)

**Session:** 2021-2022

**Sub Session:** Semester I (Jul-Dec)

**Course Name:** Biosafety, Ethics & IPR (BIO 212)

**L/T/P/C:** 3/0/0/3

### Course Description

This course in Biosafety & Ethics & PR will integrate the three domains of Biosafety, Ethics and IPR that governs the fundamental set of laws and rules that are to be followed in Biotechnology. Students will be introduced to legal aspects related to genes and health care. Moreover, equal emphasis will be given to biosafety which will include necessary biosafety measures, biosafety laboratory levels 1 and 2 along with other related topics. Students will also be made aware about patent laws and its various modalities including IPR.

### Course Outcomes

S.No.	Description
CO1	Inculcate ethics and understand the possible societal anticipations of outcomes from potential applications of biotechnology targeting the end-user
CO2	Learn and adopt the established guidelines with respect to biosafety practices in research and development sectors
CO3	Follow good laboratory procedures and practices and justify the design of confinement facilities at different Biosafety levels
CO4	Comprehend the applicable source, scope, and limitations of Intellectual Property within the purview of engineering domain with competence on various Legal issues pertaining to IPR

### Course outcome mapping with Programme Outcomes:

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

3 is High, 2 is Moderate, 1 is Low & - is Not Applicable

  
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## COURSE HANDOUT (ABRIDGED)

**Session:** 2021-2022

**Sub Session:** Semester I (Jul-Dec)

**Course Name:** Corporate Governance (BLA 301)

**L/T/P/C:** 3/0/0/3

### Course Description

The course intended to introduce students to the Corporate Governance and its application for the corporate world by combining theoretical foundations with real-world examples. The course familiarizing the students with theory and practice of Corporate Governance. Acquainting the students with the principles, roles of different stakeholders and legislative framework of Corporate Governance. The course provides an insight into the corporate governance practices & codes of ethics to be followed by the company. This course will give a brief introduction of relevance of the corporate Governance in market competition and environmental issues. The course will cover public policies and transition economies in the context of corporate governance. The course also covers issues like insider trading and vigilance mechanism in the organizations. The course discuss corporate governance in international context and different forums.

### Course Outcomes

S.No.	Description
CO1	Understand the importance, evaluation, laws, theories, and role of Corporate Governance.
CO2	Understanding corporate governance in context with board of directors, audit committee and shareholders of companies.
CO3	Understand CSR, CG in Indian Context and Identify and understand how public policy is related to CG.
CO4	Understand CG in the context of environment and market competition and business ethics.
CO5	Understand the functioning of CG in transition economies and different nations of world. Also study different CG forums.

### Course outcome mapping with Programme Outcomes:

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	2	2	3	3	2	1	2	1	2	3	1	3
CO2	2	3	2	3	3	1	2	2	1	3	2	2
CO3	3	2	2	2	2	1	1	1	2	3	2	3
CO4	2	3	1	3	3	2	2	1	3	3	3	2
CO5	2	2	2	3	2	3	2	3	3	3	2	1
Max.	3	3	3	3	3	3	2	3	3	3	3	3

3 is High, 2 is Moderate, 1 is Low & - is Not Applicable

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## COURSE HANDOUT (ABRIDGED)

**Session:** 2021-2022

**Sub Session:** Semester II (Jan-Jun)

**Course Name:** Banking Products & Operations (BNK 302)

**L/T/P/C:** 3/0/0/3

### Course Description

The course in Banking Products and Operations, aim at acquainting students with operational aspects of banking, their rationale and the subtle interrelations between practice and theory of banking as well as Banking products. The student will get an opportunity to know various products & services offered by them to offer & explain the same to its customers.

### Course Outcomes

S.No.	Description
CO1	Develop an understanding of the different operations in a bank and the rationale underlying those processes and procedures
CO2	Detailed knowledge of banking product/ services and their operational aspects
CO3	Develop analytical skills to deal with the customers and evaluating their requirements and Understanding different types of customers and related banking process.

### Course outcome mapping with Programme Outcomes:

CO	PO1	PO2	PO3	PO4	PO5
CO1	2	3	2	2	3
CO2	2	2	1	3	2
CO3	3	2	2	1	2
Max.	3	3	2	3	3

3 is High, 2 is Moderate, 1 is Low & - is Not Applicable

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## COURSE HANDOUT (ABRIDGED)

**Session:** 2021-2022

**Sub Session:** Semester I (Jul-Dec)

**Course Name:** Analytical Techniques (BT 212)

**L/T/P/C:** 3/0/2/4

### Course Description

The main objective of the course is to make the students aware about different instruments and their application for analysis of various biological components. It provides promising new approaches and developments in biological techniques followed by biologist, clinician and engineer working in the area of biotechnology. Approaches for characterization of biological species and their cellular components by specific instrumentation techniques. The course also offers delivering a more in depth knowledge of the specific analytical techniques relevant to their research projects.

### Course Outcomes

S.No.	Description
CO1	Understand the theoretical aspects of key analytical techniques and instruments used for biological analysis
CO2	Ability to apply the techniques to various samples for fulfilling research objectives, including selection of the most appropriate technique/instrumentation
CO3	Appropriate sample preparation and characterization prior to analysis by the chosen techniques
CO4	Acquire requisite data and their analysis to achieve the desired research objectives and represent them in publishable format
CO5	Understand the limitations and quality of the data to justify the sensitivity and accuracy of the applied analytical technique

### Course outcome mapping with Programme Outcomes:

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

3 is High, 2 is Moderate, 1 is Low & - is Not Applicable

### List of Tentative Practical

- P1: Separation and identification of DNA by Agarose gel electrophoresis
- P2: Separation and identification of protein by SDS-PAGE
- P3: Qualitative and quantitative analysis of inorganic and biological samples by UV-Vis Spectrophotometer
- P4: Metal Detection by Atomic Absorption Spectroscopy
- P5: Separation of amino-acids by thin layer chromatography
- P6: The determination of samples by Gas chromatography
- P7: The determination of samples by HPLC
- P8: Antigen-antibody interaction by ocherlony double-diffusion technique
- P9: Fractionation of plant cell organelles by differential centrifugation
- P10: To learn the proper steps in the operation of a compound light microscope

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## COURSE HANDOUT (ABRIDGED)

**Session:** 2021-2022

**Sub Session:** Semester II (Jan-Jun)

**Course Name:** Computational Biology (BT 302)

**L/T/P/C:** 3/0/3/4

### Course Description

Basic concept about biological databases, and submission and retrieval of biological information will be introduced. The principles and method of Nucleotide and Protein sequence retrieval and alignments will be instructed. The student will employ skills to make interpretations and analysis of a problem using uniform schema. Develop the practical skills for studying biological data such as protein, gene, DNA, regulatory regions, gene expression, transcription factor etc. by using open-access databases and software tools. This course will also help an individual develop the knowledge of protein structure prediction and modelling.

### Course Outcomes

S.No.	Description
CO1	Demonstrate the knowledge of retrieval of the biological data in the essential formats and its analysis.
CO2	Analyze the gene, protein and nucleotide data to find the degree of similarities and identifying the patterns to predict evolutionary history.
CO3	Predict genes and perform both gene and protein annotation so that they would be able to apply the drug designing methods for screening new targets and leads.
CO4	Predict the 2D as well as 3D structure of a protein and perform molecular docking.

### Course outcome mapping with Programme Outcomes:

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

3 is High, 2 is Moderate, 1 is Low & - is Not Applicable

### List of Tentative Practical

- P1. Nucleotide Sequence Databases (EMBL, Genebank and DDBJ etc.)
- P2. Protein Sequence Databases (Swissprot, TrEMBL and PIR etc.),
- P3. Structural Databases (CATH, SCOP, PDB and MMDB etc.) and different biological databases and softwares.
- P4. Pairwise and Multiple Sequence Alignment, Sequence Analysis (Blast, Fasta, ClustalW),
- P5. Comparative Phylogenetic Analysis using MEGA and Phylip
- P6. Biological Visualization and editing tools (spdbv, BioEdit, chimera)
- P7. Primer Designing (Primer3, Gene Runner)
- P8. Secondary Structure Prediction, Secondary Structure Blast
- P9. Multiple Template Selection, Protein Modelling
- P10. Loop Modeling, Structure Analysis, Verification and Energy Minimization
- P11. Ramachandran Plot and protein model validation
- P12. Protein Ligand Docking and interaction analysis

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## COURSE HANDOUT (ABRIDGED)

**Session:** 2021-2022

**Sub Session:** Semester II (Jan-Jun)

**Course Name:** Genetic Engineering (BT 311)

**L/T/P/C:** 3/0/3/4

### Course Description

This course aimed is to introduce student to basic techniques and concept of recombinant DNA technology and provide the information of genetic engineering applications in therapeutics, agriculture and medical industries. Current experimentation and advancement in rDNA technology as well as ethical consideration and biosafety regulation for genetic engineering research will be emphasized.

### Course Outcomes

S.No.	Description
CO1	Understand the concept of genetic engineering and their importance
CO2	Students will be skilled in manipulation of DNA, designing of expression vector and identification of suitable host for optimum expression of protein
CO3	Understanding of applications of recombinant DNA technology and genetic engineering from research and industrial perspective
CO4	Apply the approach of genetic engineering to produce engineered protein and development of vaccine
CO5	Evaluate the advantages and risks in the use of genetic engineering in different biotechnological fields

### Course outcome mapping with Programme Outcomes:

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

3 is High, 2 is Moderate, 1 is Low & - is Not Applicable

### List of Tentative Practical

- P1. Genomic DNA and Plasmid DNA isolation
- P2. Polymerase chain reaction using the isolated DNA as template
- P3. Competent Cell preparation and transformation by heat shock method
- P4. Isolation of Recombinant plasmid DNA from transformed cell
- P5. Confirmation of clone for the presence of recombinant plasmid by Restriction digestion
- P6. Restriction digestion of gene of interest from plasmid DNA and clone into E.coli BL21(DE3)
- P7. Electrocompetent Cell preparation and transformation by electroporation
- P8. Restriction Fragment length polymorphism

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## COURSE HANDOUT (ABRIDGED)

**Session:** 2021-2022

**Sub Session:** Semester I (Jul-Dec)

**Course Name:** Industrial Biotechnology (BT 312)

**LT/P/C:** 3/0/3/4

### Course Description

The main objective of the course is to make the students aware about different industrial processes that involves biological techniques. This course provides promising new approaches to pollution prevention, resource conservation, and cost reduction. This course has the potential to address some of the world's greatest challenges, such as feeding a growing population and offering new alternatives to our scarce natural resources. The course also offers businesses a way to reduce costs and create new markets while protecting the environment.

### Course Outcomes

S.No.	Description
CO1	Elucidate the functioning of fermenters and fermentation technology.
CO2	Aware themselves about different metabolites, bioactive molecules and biocatalysts used in various industrial processes.
CO3	Prepare themselves for future endeavors to work as scientist or clinicians across different areas of industry as well as research.
CO4	Update their knowledge about various use of microorganism and strategies for strain improvement.
CO5	Enhances the ideas about pollution control and biological leaching processes

### Course outcome mapping with Programme Outcomes:

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

3 is High, 2 is Moderate, 1 is Low & - is Not Applicable

### List of Tentative Practical

- P1: Design, formulation, preparation and sterilization of fermentation medium
- P2: Preparation and characterization of inoculum for fermentation
- P3: Assay of cell number, dry cell mass and product during fermentation (ethanol)
- P4: Production of an extracellular enzyme (cellulase)
- P5: Cell disintegration for isolation of intracellular enzyme
- P6: Isolation and partial purification of an enzyme
- P7: Immobilization of yeast cells
- P8: Invertase catalyzed hydrolysis of sucrose using immobilized cells

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## COURSE HANDOUT (ABRIDGED)

**Session:** 2021-2022

**Sub Session:** Semester I (Jul-Dec)

**Course Name:** Capstone Project I (BT 321)

**L/T/P/C:** 1/0/6/4

### Course Description

This course is developed and design for students enrolled in BTech Biotechnology programme to have capstone experience. The BTech Biotechnology programme aims to enhance the student's chances for employment and advancement in this career field, this capstone project will emphasize the performing of "real-world" projects that incorporate the scientific, ethical, regulatory, and business aspects of biotechnology. This course provides students with an opportunity to apply, integrate, and demonstrate the knowledge and skills they have acquired in Biotechnology and allied fields during their undergraduate programme. The problem statements for the project assignments are similar to those that students might typically encounter within industry, government, non-governmental organizations or academic research. Based on the complexity of the project, students will work individually or in small teams on a problem statement, defined by a faculty mentor, industry partner, or governmental sponsors.

### Course Outcomes

S.No.	Description
CO1	Apply the knowledge of Biotechnology and Bioinformatics majors and allied courses to solve scientific and societal problems
CO2	Develop their ability as scientists for identifying and addressing the socio-biological problems including ethical concerns
CO3	Build their abilities as leaders and team players
CO4	Effectively communicate biological information to the general public

### Course outcome mapping with Programme Outcomes:

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

3 is High, 2 is Moderate, 1 is Low & - is Not Applicable

### List of Tentative Practical

All experiments need be to perform in lab to achieve the preliminary objective of the defined work plan.

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## COURSE HANDOUT (ABRIDGED)

**Session:** 2021-2022

**Sub Session:** Semester I (Jul-Dec)

**Course Name:** Plant and Animal Biotechnology (BT 331)

**L/T/P/C:** 3/0/3/4

### Course Description

This course explores the use of biotechnology to both generate genetic variation in plants and to understand how factors at the cellular level contribute to the expression of genotypes and hence to phenotypic variation. The molecular mechanisms directing plant gene expression under diverse environmental and developmental stimuli, is one of the main focus discussed in detail. This knowledge is central to our ability to modify plant responses and properties for global food security and commercial gains in biotechnology and agriculture. The objective of this course is to introduce students to cutting edge biotechnologies that can be used for animal and human health and research. This class will cover basic cellular and molecular biology techniques and their applications in a real world research setting.

### Course Outcomes

S.No.	Description
CO1	Know the concepts and applications of plant genetics, transgenic plants, and transgenic animals
CO2	Understand the concept and methods of plant breeding.
CO3	Gain knowledge on techniques and applications of plant tissue culture and Animal cell culture.
CO4	To know plant biotechnology application, issues and concerns

### Course outcome mapping with Programme Outcomes:

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

3 is High, 2 is Moderate, 1 is Low & - is Not Applicable

### List of Tentative Practical

- P1. Plant DNA extraction by CTAB method
- P2. Isolation of total RNA from plant tissue
- P3. Agarose gel electrophoresis for visualization of Plant DNA and RNA
- P4. Restriction pattern of plant genomic DNA
- P5. PCR amplification of Plant gene
- P6. Virtual tissue culture lab for micro-propagation, callus formation and somatic embryogenesis
- P7. MTT assay for live and dead cell quantification.
- P8. CFSE based assay for cellular proliferation

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## COURSE HANDOUT (ABRIDGED)

**Session:** 2021-2022

**Sub Session:** Semester II (Jan-Jun)

**Course Name:** Biochemical and Bioprocess Engineering (BT 352)

**L/T/P/C:** 3/0/3/4

### Course Description

This course will help to achieve proper knowledge and skills related to biochemical processes and help in the development of corresponding bioprocess for product manufacturing. Sufficient insight will be provided for technological management, control and design of industrial bioprocesses as well as the scale-up of bioprocesses. Distinctive attention will be provided in different types of bioreactor, their parts, integrated bioreactor processes, efficient mass and energy balance processes. Application of skills for technological design, optimization and management of up-stream and down-stream processes.

### Course Outcomes

S.No.	Description
CO1	Understand the basic bioprocess principles over chemical process with emphasize on cell growth kinetics.
CO2	Detail understanding biochemical enzyme mechanisms and the mathematical models used to represent enzyme kinetics.
CO3	Learn to develop mathematical models for batch and continuous bioreactors by application of substrate, biomass, and product mass balances.
CO4	Study the application of fixed-bed immobilized enzyme and cell reactors.

### Course outcome mapping with Programme Outcomes:

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

3 is High, 2 is Moderate, 1 is Low & - is Not Applicable

### List of Tentative Practical

- P1: Kinetic analysis of an enzyme catalysed reaction: hydrolysis of sucrose by amylase.  
 P2: Isolation / purification of alcohol dehydrogenase from yeast cells: Cell disintegration followed by fractional precipitation.  
 P3: Immobilization of an enzyme by entrapment.  
 P4: Bioconversion of sucrose to ethanol using immobilized yeast cells.  
 P5: Study of an anaerobic microbial process: bioconversion of sucrose to ethanol by *Saccharomyces cerevisiae*.  
 P6: Estimation of growth kinetic parameters in batch fermentation  
 P7: Kinetics of thermal death of microorganisms: sterilization of media.  
 P8: Bioreactor- Basics & Control Characteristics of pH Controller  
 P10: Determination of volumetric oxygen transfer coefficient (kLa) for an aerated / agitated vessel.

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## COURSE HANDOUT (ABRIDGED)

**Session:** 2021-2022

**Sub Session:** Semester II (Jan-Jun)

**Course Name:** Environmental Biotechnology (BT 401)

**L/T/P/C:** 3/0/3/4

### Course Description

Environmental biotechnology, the application of living organisms to environmental problems, is an increasingly important topic. Bioremediation an important technique in environmental biotechnology is used by microorganisms to clean up contaminated environments, including contaminated soils and sediments. Environmental biotechnology is an interface of biological science and engineering, which offers both substantial opportunities and boundaries. Effective application of environmental biotechnology requires professionals who have a background in both the areas. During the course candidates are introduced to various environmental aspects and figure out a solution to them.

### Course Outcomes

S.No.	Description
CO1	Key aspects of an ecosystem such diversity, function and adaptations of organisms within their ecological niches.
CO2	Reasons (Human activities, natural causes) behind contemporary and fast emerging environmental concerns such as climate change, energy crisis, hazardous pollutants, waste management, water recycling etc.
CO3	Practical biotechnological solutions to address environmental issues including domestic and industrial waste management
CO4	Implementing environmental engineering approaches to evaluate, monitor and remediate contaminated environments

### Course outcome mapping with Programme Outcomes:

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

3 is High, 2 is Moderate, 1 is Low & - is Not Applicable

### List of Tentative Practical

- P1: Determination of total bacterial population in sewage by standard plate count technique.
- P2: Determination of total bacteria population in drinking water by membrane filtration method.
- P3: Detection of coliform in water samples
- P4: Determination of total dissolved solids of water.
- P5: Bacteriological examination of water by multiple tube fermentation test
- P6: Determination of biological oxygen demand of sewage sample.
- P7: Isolation of xenobiotic degrading bacteria by selective enrichment technique
- P8: Estimation of nitrate in drinking water.
- P9: Isolation of bacteriophages from sewage.
- P10: Estimation of heavy metals in water/soil by Atomic absorption spectrophotometry.

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## COURSE HANDOUT (ABRIDGED)

**Session:** 2021-2022

**Sub Session:** Semester I (Jul-Dec)

**Course Name:** Food Biotechnology (BT 411)

**L/T/P/C:** 3/0/3/4

### Course Description

This course on Food Biotechnology encompasses the detailed understanding of different biological techniques employed in the Food industry. This course will categorize food products including new Food concepts. Along with the concepts on food and nutrition, it will also discuss about the microbes related to food industry and disposal and treatment of waste from Food industry.

### Course Outcomes

S.No.	Description
CO1	Understand the national and global technological advancement in the field of Food Biotechnology
CO2	Access modern advancement in the area of Food packaging and storage.
CO3	Overview of the different types of food in the Food Industry.
CO4	Update their knowledge to control as well as beneficial use of microorganisms in Food industry
CO5	Identify possible sources of waste and apply corrective strategies to improve overall waste management in Food Industry.

### Course outcome mapping with Programme Outcomes:

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

3 is High, 2 is Moderate, 1 is Low & - is Not Applicable

### List of Tentative Practical

- P1: Oxidative rancidity in potato chips  
 P2: Estimation of reducing and non-reducing sugar  
 P3: Evaluate the aroma and color of heated amino acid–glucose solutions. Maillard Reaction;  
 P4: To compare the content of vitamin C (ascorbic acid) in commercial tablets and in food drink with the content claimed by the manufacturer.  
 P5: Effects of enzyme rennin on milk protein.  
 P6: Subsurface mold growth  
 P7: Determination of peroxide value of oils.  
 P8: Determine the Protein content of Food

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## COURSE HANDOUT (ABRIDGED)

**Session:** 2021-2022

**Sub Session:** Semester II (Jan-Jun)

**Course Name:** Immunology (BT 461)

**L/T/P/C:** 3/0/3/4

### Course Description

This course on immunology will provide a detailed understanding about the how immune cells respond to different physiological stress. In doing so students will be learning about different types of immunity and immune cells which will later lay the foundation about the understanding of the diverse antigen response by B cell and T cells and various immunological disorders. This course will also acquaint the students about application of immunology in cutting edge areas such as immunophenotyping, Flow cytometry, confocal microscopy, Monoclonal antibodies and other related topics.

### Course Outcomes

S.No.	Description
CO1	Elucidate the mechanism of immune system and understand about immune responses.
CO2	Aware themselves about immunological assay techniques and antigen-antibody interaction.
CO3	Prepare for future endeavors to work as scientist or clinicians across different areas of biological research.
CO4	Updated knowledge about key healthcare advances of recent times, viz. vaccine development and cancer immunotherapy
CO5	This course enhances healthcare knowledge, which influences a healthy life style.

### Course outcome mapping with Programme Outcomes:

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

3 is High, 2 is Moderate, 1 is Low & - is Not Applicable

### List of Tentative Practical

- P1: Identification of human blood groups.  
 P2: To separate serum/ plasma and leucocytes from the blood sample.  
 P3: To perform Total Leukocyte Count (TLC) of the given blood sample.  
 P4: To perform Differential Leukocyte Count (DLC) of the given blood sample  
 P5: To perform Immunoprecipitation  
 P6: To perform immunodiffusion by Ouchterlony method.  
 P7: To demonstrate single radial immunodiffusion (SRID) technique  
 P8: To perform Dot ELISA  
 P9: To perform ELISA

  
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## COURSE HANDOUT (ABRIDGED)

**Session:** 2021-2022

**Sub Session:** Semester II (Jan-Jun)

**Course Name:** Synthetic Biology (BT 4111)

**L/T/P/C:** 3/0/3/4

### Course Description

Synthetic biology is an emerging, exciting, and interdisciplinary course, which emphasized on designing and construction of new biological entities, such as enzymes, genetic circuits, and cells, or the redesign of existing biological systems.

### Course Outcomes

S.No.	Description
CO1	students will able to understand the concept of synthetic biology and differentiate from genetic engineering
CO2	Apply engineering principle and engineering approach in synthetic biology by taking suitable examples like electric circuit and genetic circuit etc.
CO3	Students can think about the development of new cost effective DNA synthesis methods that can solve synthetic biology problems effectively and economically.
CO4	Students will skilled in designing of genetic circuit, and re-programming the uni-cellular and multi-cellular organisms.
CO5	Students can apply proper synthetic biology concepts and tools to solve the problems of Energy Crisis, Drug shortage against new pathogen, etc.

### Course outcome mapping with Programme Outcomes:

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

3 is High, 2 is Moderate, 1 is Low & - is Not Applicable

### List of Tentative Practical

- P1. Designing Synthetic DNA molecules and simulate the designed construct
- P2. Designing of gene regulatory circuit and Model the properties and behaviour of synthetic biological circuit
- P3. Retrieval and construction of new biological parts, devices and system
- P4. Construction of synthetic small regulatory RNA to shut down the expression of gene
- P5. Analyses and rationally designs large-scale biochemical networks at the molecular interaction level
- P6. Simulating basic molecular biology DNA unit operation such as restriction digestion, ligation, PCR primer design
- P7. Metabolic Pathway Prediction and Design
- P8. Drug-Design and Drug-Docking

  
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## COURSE HANDOUT (ABRIDGED)

**Session:** 2021-2022

**Sub Session:** Semester I (Jul-Dec)

**Course Name:** Waste Water Management (BT 4131)

**L/T/P/C:** 3/0/3/4

### Course Description

The course is designed to give extensive theoretical and practical knowledge in design and operation of relevant wastewater treatment process including physiochemical and biological. An overview of typical wastewater characteristics, how this may affect relevant treatment process will be delivered, in addition to the treatment and effluent requirements. This course will also cover the process of activated Sludge, Sludge treatment and disposal. With the study of this course we can understand wastewater treatment process in different type of industries such as food processing industries.

### Course Outcomes

S.No.	Description
CO1	Basic understanding about wastewater, its source, characteristics and application as a resource
CO2	Develop detail knowledge about wastewater treatment by conventional process and the advancement achieved over time.
CO3	Attain elemental facts about the importance of biological processes in wastewater treatment.
CO4	Learn the wastewater management process of various food and allied industries.

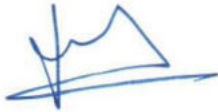
### Course outcome mapping with Programme Outcomes:

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

3 is High, 2 is Moderate, 1 is Low & - is Not Applicable

### List of Tentative Practical

- P1: Wastewater collection and sampling
- P2: Wastewater characteristics
- P3: pH, Temperature and DO
- P4: Determination of Solids (TS, TDS, TSS)
- P5: Determination of Solids (FS, VS, Settleable solids)
- P6: Dissolved Oxygen, Chemical Oxygen Demand
- P7: Biological Oxygen Demand
- P8: Biological Monitoring
- P9: Creating Mini Wastewater Treatment Plant
- P10: Wastewater Treatment Plant Virtual Tour

  
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## COURSE HANDOUT (ABRIDGED)

**Session:** 2021-2022

**Sub Session:** Semester I (Jul-Dec)

**Course Name:** Virology (BT 4181)

**L/T/P/C:** 3/1/0/4

### Course Description

The main objective of the course is to make the students understand about the different viruses that exist in nature along with their detection and propagation strategies. This course provides detailed understanding about the virus replication and virus-cell interaction. It also helps to delineate different antivirals and viral vaccines that are needed for combating viral infection.

### Course Outcomes

S.No.	Description
CO1	Overview of basic virology and classification of viruses.
CO2	Overview of the propagation of viruses.
CO3	Understanding virus detection and viral replication
CO4	Understand host-virus interaction along with antivirals and viral vaccines for combating viral infection

### Course outcome mapping with Programme Outcomes:

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

3 is High, 2 is Moderate, 1 is Low & - is Not Applicable

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## COURSE HANDOUT (ABRIDGED)

**Session:** 2021-2022

**Sub Session:** Semester II (Jan-Jun)

**Course Name:** Biomedical Engineering (BT 4201)

**L/T/P/C:** 3/1/0/4

### Course Description

The study of biomedical engineering involves a broad array of diagnostic and therapeutic applications. This course focuses on the integrity of engineering and sciences, a fascinating multidisciplinary area of study that entails the application of engineering techniques in order to assist practitioners like doctors and physicians in their healthcare practices. Study of this branch also helps them in the rehabilitation of disabled patients.

### Course Outcomes

S.No.	Description
CO1	Gaining knowledge about the mechanics, materials and operation of the human system
CO2	Learn and understand the operation of various biomedical imaging and instrumentations
CO3	Learn about the use and advancements in biomaterials and their biomedical applications
CO4	Learn and understand the operation of various biomedical instruments and point of care devices
CO5	To acquire knowledge of the basic principles of biomedical engineering

### Course outcome mapping with Programme Outcomes:

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

3 is High, 2 is Moderate, 1 is Low & - is Not Applicable

  
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## COURSE HANDOUT (ABRIDGED)

**Session:** 2021-2022

**Sub Session:** Semester I (Jul-Dec)

**Course Name:** Thermodynamics (CHM 201)

**LT/P/C:** 3/0/0/3

### Course Description

This course provides an introduction to the study of energy transformations in biological systems as well as thermodynamics and kinetics of structure formation and association of biomolecules. This subject has relevance to numerous pertinent biological engineering applications including central role of ATP in life processes, protein folding, aggregation, and binding; assembly of phospholipids bilayer and other biomaterials; the macroscopic mechanical properties of biomaterials including cells; design and operation of devices at the nano- and micro-scales; understanding the basis of mass and energy transport; relevance of receptor-ligand binding; the melting and annealing of genetic material. The concepts employed in this course have relevance to other biotechnological subjects like biochemical and bioprocess engineering.

### Course Outcomes

S.No.	Description
CO1	Recall the Laws of thermodynamics and explain heat, work, entropy, internal energy and determine their changes in cyclic and non-cyclic processes
CO2	Calculate the thermodynamic properties of pure substances, solutions (two phase) and mixtures involved in reactions
CO3	Evaluate heat and work involved in different thermodynamic processes and estimate heat-work inter-Conversions
CO4	Apply thermodynamic properties for equipment design and other biological applications

### Course outcome mapping with Programme Outcomes:

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

3 is High, 2 is Moderate, 1 is Low & - is Not Applicable

  
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## COURSE HANDOUT (ABRIDGED)

**Session:** 2021-2022

**Sub Session:** Semester I (Jul-Dec)

**Course Name:** Communication Networks (COM 212)

**LT/P/C:** 3/0/2/4

### Course Description

This course is to provide students with an overview of the concepts and fundamentals of data communication and computer networks.

Topics to be covered include: data communication concepts and techniques in a layered network architecture, communications switching and routing, types of communication. Network congestion, network topologies, network configuration and management, network model components, layered network models (OSI reference model, TCP/IP networking architecture) and their protocols.

Various types of networks (LAN, MAN, WAN and Wireless networks) and their protocols.

### Course Outcomes

S.No.	Description
CO1	Understand basics of Networking and Switching and Network topologies
CO2	Understanding the layers approach followed in communication systems
CO3	Understanding the design issues and algorithm deployed in different layers
CO4	Understanding the Routing issues and congestion control
CO5	Understand the basic concepts of Network security

### Course outcome mapping with Programme Outcomes:

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

3 is High, 2 is Moderate, 1 is Low & - is Not Applicable

### List of Tentative Practical

1. Study of different types of cables
2. Design of LAN cable
3. Study of Physical Layer
4. Study of Data link Layer.
5. Study of Network Layer
6. Study of Transport Layer
7. Study of Application Layer

  
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## COURSE HANDOUT (ABRIDGED)

**Session:** 2021-2022

**Sub Session:** Semester I (Jul-Dec)

**Course Name:** Introduction to Computing & Information Systems (CS 101)

**L/T/P/C:** 2/0/0/2

### Course Description

This course will provide an overview of the fundamental concepts of information systems, and the need for and role of information systems in business organizations. In particular, the course will deal with basic hardware concepts, the architecture of computers, the software hierarchy--from systems software to application programs, networks and applications. This course is to introduce the students with the basic issues related to information systems, its role in organization, support for decision-making and how information technology can be leveraged to provide business value.

### Course Outcomes

S.No.	Description
CO1	To acquire the knowledge of information systems in Global business today
CO2	To acquire the knowledge of Information Systems in Organization to finalize strategy
CO3	To acquire the knowledge of hardware and software used in modern business
CO4	To acquire the knowledge of database management systems and to understand the foundation of Business Intelligence
CO5	To acquire the knowledge of infrastructure, networks, telecommunication, Mobile communication, internet and the world wide web and importance in information Systems design
CO6	To acquire the knowledge of various computational techniques and algorithms
CO7	To develop clear understanding of Information Security, Systems Vulnerability
CO8	To develop clear understanding of various technologies such as Cloud, Big data, Artificial Intelligence, e-commerce in business

### Course outcome mapping with Programme Outcomes:

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	2	3	2	3	3	1	1	3	3	-	-	3
CO2	2	3	2	3	3	1	1	3	3	-	-	2
CO3	3	2	1	3	3	1	1	-	3	-	-	2
CO4	2	3	1	3	2	1	1	2	3	-	-	2
CO5	2	2	1	3	3	2	1	3	3	-	-	2
CO6	2	2	1	3	3	2	1	3	3	-	-	2
CO7	2	3	1	3	3	3	3	3	3	-	-	3
CO8	2	3	1	3	3	3	3	3	3	-	-	3
Max.	3	3	2	3	3	3	3	3	3	-	-	3

3 is High, 2 is Moderate, 1 is Low & - is Not Applicable

  
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## COURSE HANDOUT (ABRIDGED)

**Session:** 2021-2022

**Sub Session:** Semester II (Jan-Jun)

**Course Name:** Design & Analysis of Algorithms (CS 201)

**L/T/P/C:** 3/0/3/4

### Course Description

• Techniques for the design and analysis of efficient algorithms, emphasizing methods useful in practice. Topics include sorting; search trees, heaps, and hashing; divide-and-conquer; dynamic programming; greedy algorithms; amortized analysis; graph algorithms; and shortest paths.

• Advanced topics may include network flow, computational geometry, number-theoretic algorithms, polynomial and matrix calculations, caching, and parallel computing.

### Course Outcomes

S.No.	Description
CO1	Independently understand and Argue the correctness of algorithms using inductive proofs and invariant. Analyze worst-case running times of algorithms using asymptotic analysis.
CO2	Explain what competitive analysis of Algorithms as it applies. Perform competitive analysis.
CO3	Identify the uses, applications and deployment of various algorithms with all analytical behaviors.

### Course outcome mapping with Programme Outcomes:

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	3	2	2	1	3	3	1	1	2	1	2	3
CO2	3	1	2	1	3	3	2	2	1	1	2	1
CO3	3	3	1	3	1	3	-	3	1	1	1	3
Max.	3	3	2	3	3	3	2	3	2	1	2	3

3 is High, 2 is Moderate, 1 is Low & - is Not Applicable

### List of Tentative Practical

Searching Algorithms  
 Heaps  
 Sorting Algorithms  
 Skip Lists  
 Divide and Conquer, Backtracking, Branch and Bound.  
 Greedy Algorithms.  
 Dynamic Programming.  
 Data Structures for Disjoint Sets.  
 Graph Algorithms: DFS,BFS, Shortest Paths, Spanning Trees.  
 Approximation Algorithms.

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## COURSE HANDOUT (ABRIDGED)

**Session:** 2021-2022

**Sub Session:** Semester I (Jul-Dec)

**Course Name:** Introduction to Programming (CS 202)

**L/T/P/C:** 3/0/0/3

### Course Description

This course is an introduction to the Python programming language for students without prior programming experience. The course covers data types, control flow, variables, loops, and functions, object-oriented programming, and graphical user interface-driven applications and how to work with data using libraries. The examples and problems are drawn from diverse areas such as text processing, mathematical and statistical problems, simple graphics and business problems.

### Course Outcomes

S.No.	Description
CO1	To acquire knowledge about high level language programming
CO2	To acquire programming skills in core Python
CO3	To acquire skills to manage data structures and data files in Python
CO4	To develop the skill of designing applications, data management and data visualization using comprehensive libraries in Python

### Course outcome mapping with Programme Outcomes:

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	3	3	3	3	3	3	-	3	3	-	-	3
CO2	3	3	3	3	3	3	-	3	3	-	-	3
CO3	3	3	3	3	3	3	-	3	3	-	-	3
CO4	3	3	3	3	3	3	-	3	3	-	-	3
Max.	3	3	3	3	3	3	-	3	3	-	-	3

3 is High, 2 is Moderate, 1 is Low & - is Not Applicable

  
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## COURSE HANDOUT (ABRIDGED)

**Session:** 2021-2022

**Sub Session:** Semester I (Jul-Dec)

**Course Name:** Introduction to Communication System (CS 241)

**L/T/P/C:** 3/0/2/4

### Course Description

Introduction to Communication Systems in UG level introduces the fundamental of electrical communication systems, the elementary knowledge of electrical signals to multiple access transmission techniques. The in-depth knowledge of various modulation techniques in the analog and the digital domain is given. The mathematical representation of electrical communication systems and the wireless environment is also studied.

### Course Outcomes

S.No.	Description
CO1	Overview of Communication system, Introduction to signals and systems: analog and discrete signals, system representation, Fourier Transform.
CO2	Sampling and reconstruction, Analog to digital conversion: Sampling, Quantization, Coding
CO3	various multiplexing and line coding formats to be studied
CO4	Amplitude modulation, Phase modulation, Frequency modulation, Pulse modulation: PAM, PWM, PPM, PCM, Delta modulation, Digital modulation techniques
CO5	Wireless Communication, Cell Structure and, Spread Spectrum Modulation.
CO6	Analog and digital modulation techniques are to be tested on MATLAB software

### Course outcome mapping with Programme Outcomes:

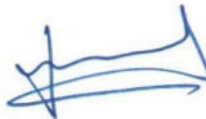
CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	3	-	-	-	-	3	2	-	-	1	-	3
CO2	3	3	3	3	2	1	1	2	1	3	-	1
CO3	3	3	3	3	2	3	3	2	2	1	-	1
CO4	3	3	3	3	2	2	3	2	3	1	1	1
CO5	-	-	1	3	3	3	3	2	1	2	1	1
CO6	2	2	2	-	-	-	-	1	1	2	3	-
Max.	3	3	3	3	3	3	3	2	3	3	3	3

3 is High, 2 is Moderate, 1 is Low & - is Not Applicable

  
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### List of Tentative Practical

1. Study and familiarization with various instruments like CRO and Function Generator.
2. Study and analysis of different types of Sampling techniques and their Reconstruction method. (i) Natural Sampling (ii) Sample and Hold Sampling (iii) Flat Top Sampling (Digital Communication Trainer System – DCS-B kit). Study the effect of various sampling frequencies and duty cycles on different sampling techniques. (DCS-B kit).
3. Study and analysis of Amplitude Modulation Transmitter and Receiver their Reconstruction.
4. Study and analysis of Frequency Modulation and Demodulation and their Reconstruction. (Frequency Modulation & Demodulation Trainer kit).
5. Study and analysis of Pulse Code Modulation (PCM) and Differential Pulse Code Modulation (DPCM). (DCS-B kit).
6. Study and analysis of (a) Pulse with Modulation (PWM) (b) Pulse Position Modulation (PPM) and (c) PRBS. (DCS-B kit).
7. Study and analysis of Signal Modulation Technique (a) Delta Modulation and Demodulation (b) Adaptive Delta Modulation and Demodulation. (DCS-B kit).
8. Study and analysis of the various carrier Modulation and Demodulation Technique. (a) ASK (b) FSK (c) PSK (DCS-B kit)
9. Study and analysis of Modulation and Demodulation of (a) BPSK (b) DPSK (c) QPSK (on Advance Digital Communication Trainer System – DCS-A kit).
10. Design and performance study of a basic communication system using MATLAB.



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## COURSE HANDOUT (ABRIDGED)

**Session:** 2021-2022

**Sub Session:** Semester I (Jul-Dec)

**Course Name:** Object Oriented Programming (CS 251)

**LT/P/C:** 2/0/4/4

### Course Description

Java is a large-scale object-oriented programming language. This course is designed to provide complete knowledge of Object-Oriented Programming through Java and to enhance the programming skills of the students by giving practical assignments to be done in labs.

### Course Outcomes

S.No.	Description
CO1	Understand different concepts of Object Oriented Programming paradigm
CO2	Input/output, code reusability and refinement using inheritance, static and dynamic binding, polymorphism, exception handling
CO3	Learn Virtual Function, Streams and Files, Templates and Exceptions
CO4	Write programs implementing object-oriented concepts

### Course outcome mapping with Programme Outcomes:

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

3 is High, 2 is Moderate, 1 is Low & - is Not Applicable

### List of Tentative Practical

- P1. Data types
- P2. Classes, Constructors and Method Overloading
- P3. Arrays
- P4. String
- P5. Inheritance concepts
- P6. Method overriding
- P7. Exception-handling Fundamentals
- P8. JavaFX
- P9. Event-handling
- P10. Databases
- P11. Clients & Servers
- P12. Java Threads

  
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## COURSE HANDOUT (ABRIDGED)

**Session:** 2021-2022

**Sub Session:** Semester II (Jan-Jun)

**Course Name:** Cryptography (CS 252)

**L/T/P/C:** 3/0/2/4

### Course Description

This course provides Knowledge of modern cryptography and communication security. It focuses on how cryptographic algorithms and protocols work and how to use them. The course covers the concepts of block ciphers and message authentication codes, public key encryption, digital signatures, and key establishment, and the Digital Signature Algorithm. Basic cryptanalytic techniques and examples of practical security solutions are explored to understand how to design and evaluate modern security solutions.

### Course Outcomes

S.No.	Description
CO1	Understand the concept of CIA, Cryptology
CO2	Understand the concept of Symmetric Cryptography
CO3	Understand the concept of Asymmetric Cryptography
CO4	Understand the different algorithm for maintaining authentication and Integrity by Hash, MAC and DSA, Digital Certificates

### Course outcome mapping with Programme Outcomes:

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

3 is High, 2 is Moderate, 1 is Low & - is Not Applicable

### List of Tentative Practical

1. Implement the Substitution Cipher-Caesar, Playfair Cipher.
2. Implement the Hill Cipher.
3. Implement or Demonstrate DES algorithm.
4. Implement or Demonstrate AES algorithm.
5. Implement RSA and Diffie Hillman Algorithm.
6. Demonstration of Hash Functions and Digital Signatures.
7. Demonstration of Email Security with GnuPG

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## COURSE HANDOUT (ABRIDGED)

**Session:** 2021-2022

**Sub Session:** Semester I (Jul-Dec)

**Course Name:** Computer Network (CS 261)

**L/T/P/C:** 3/0/2/4

### Course Description

This course is to provide students with an overview of the concepts and fundamentals of data communication and computer networks.

Topics to be covered include: data communication concepts and techniques in a layered network architecture, communications switching and routing, types of communication. Network congestion, network topologies, network configuration and management, network model components, layered network models (OSI reference model, TCP/IP networking architecture) and their protocols.

Various types of networks (LAN, MAN, WAN and Wireless networks) and their protocols.

### Course Outcomes

S.No.	Description
CO1	Independently understand basic computer network technology and different types of network topologies and protocols
CO2	Enumerate the layers of the OSI model and TCP/IP. Explain the function(s) of each layer.
CO3	Identify the different types of network devices and their functions within a network
CO4	Familiarity with the basic protocols of computer networks, and how they can be used to assist in network design and implementation.
CO5	Understand and explain Data Communications System and its components and system level simulation of advance communication networks

### Course outcome mapping with Programme Outcomes:

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

3 is High, 2 is Moderate, 1 is Low & - is Not Applicable

  
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### List of Tentative Practical

1. Implement single source shortest path technique using Dijkstra's Algorithm.
2. Implement single source shortest path technique using Bellman Ford Algorithm.
3. Implementation of error detection using Parity bits.
4. Implementation of error detection using CRC.
5. Implementation of error detection using Checksum.
6. Implementation of Framing techniques using Bit stuffing and Byte stuffing
7. Implementation of error correction scheme.
8. Basics of NS2, Installation, and commands and code understanding
9. Analyzing network parameters using TCP in NS2
10. Analyzing network parameters using UDP in NS2
11. Performance analysis using Awk scripting
12. Implementation of Routing protocols in NS2
13. Implementation of AODV and DSDV with NS2
14. Performance modeling and analysis



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## COURSE HANDOUT (ABRIDGED)

**Session:** 2021-2022

**Sub Session:** Semester II (Jan-Jun)

**Course Name:** Network Security (CS 262)

**LT/P/C:** 3/0/2/4

### Course Description

In this course, students are introduced to the core concepts of Network Security. The course focuses on the fundamental knowledge of Network Security. It includes a wide range of OSI Layered related attacks and corresponding defense mechanisms to build deep understanding of Network Security among the readers. The course also contains current network security technologies such as Firewalls, IPSEC, IDS. The attacks and defensive mechanisms are divided into various layers with practical tools and techniques. After completion of this course the students are expected to be capable in performing Network Security, apply defensive strategies to protect networks in an organization. Students are also expected to carry forward research in the domains of interest after thorough understanding of the security concepts in this course.

### Course Outcomes

S.No.	Description
CO1	Understand the concept of network security, its need and importance of network security.
CO2	Attacks of Data link layer and defense mechanism of different data link layer attacks.
CO3	Learn about the attacks and security implementation of OSI network layer.
CO4	Understand the Transport layer, its attacks and countermeasures of Transport Layer.
CO5	Learn about the Software-Defined Network, Network Security techniques and All about the Access Control.

### Course outcome mapping with Programme Outcomes:

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

3 is High, 2 is Moderate, 1 is Low & - is Not Applicable

### List of Tentative Practical

- P1. Understanding packet sniffing via Wireshark, tcpdump.
- P2. Understanding packet crafting via tools such as Hping.
- P3. Understanding network scanning via NMAP.
- p4. Packet Analyses by PCAP.
- P5. Realizing ARP spoofing/ DHCP spoofing attack
- P6. Realizing IP spoofing/ICMP flooding/Teardrop/Smurf attack
- P7. Deploying IP firewall in Linux for packet filtering
- P8. Learning deployment of NIDS snort and how it prevent attacks at various layers.
- P9. Realizing TCP/UDP based attacks.
- P10. Realizing wireless attacks such as Evil Twins via Aircrack Ng

  
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## COURSE HANDOUT (ABRIDGED)

**Session:** 2021-2022

**Sub Session:** Semester II (Jan-Jun)

**Course Name:** Introduction to Data Structure (CS 281)

**LT/P/C:** 3/0/0/3

### Course Description

This course aims at providing a solid foundation for design, analysis and implementation of robust and reusable automation framework. The course will discuss how to select and design data structures and concepts of queue, list, searching and sorting that are appropriate for problems that are encountered in business situations or for analysis.

### Course Outcomes

S.No.	Description
CO1	To introduce common structures for storing collections of data and the associated relations along with algorithms for retrieving/modifying the data
CO2	To introduce formal and experimental techniques for analysing the performance (time and space requirements) of such data structures
CO3	To apply the acquired knowledge to solve engineering and research problems

### Course outcome mapping with Programme Outcomes:

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	3	3	1	1	1	1	1	1	1	1	1	2
CO2	2	2	1	1	1	1	1	1	1	1	1	1
CO3	1	1	3	1	1	1	1	1	2	2	2	2
Max.	3	3	3	1	1	1	1	1	2	2	2	2

3 is High, 2 is Moderate, 1 is Low & - is Not Applicable

  
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## COURSE HANDOUT (ABRIDGED)

**Session:** 2021-2022

**Sub Session:** Semester I (Jul-Dec)

**Course Name:** Introduction to Cyber Security (CS 291)

**L/T/P/C:** 3/1/0/4

### Course Description

Introduction to Cyber Security provide the essential knowledge of Cyber Security and It will help students to understand the security issue related to Cyber Space. Knowledge of Cyber threats, Risk, Vulnerability and attacks. Student can also understand the Cyber Security measures and security techniques to protect their valuable assets.

### Course Outcomes

S.No.	Description
CO1	Understand the concept of Security, Its assets, Elements. Basic knowledge of attack and its protection. Need of cyber security, understand the difference between Hackers and Crackers. Techniques of Cyber Security protection.
CO2	Understanding of Information and Data, Structure Data and Unstructured Data, concept of Data Modelling, Introduction of Data Storage, Definition of Password, Complex Password, Secure Password.
CO3	Learn about the Security Threats and understand the different kids of threats.
CO4	Information Security Concept, Encoding and Decoding, Data Encryption, Applications for Data Encryption.
CO5	Check the best practice techniques to protect the cyber threats.

### Course outcome mapping with Programme Outcomes:

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

3 is High, 2 is Moderate, 1 is Low & - is Not Applicable

  
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## COURSE HANDOUT (ABRIDGED)

**Session:** 2021-2022

**Sub Session:** Semester I (Jul-Dec)

**Course Name:** Software Engineering (CS 301)

**LT/P/C:** 3/0/2/4

### Course Description

This course will provide an understanding of how to develop a software system by guiding them through the development lifecycle and different methodologies. This course will also provide knowledge and expertise of system design technique with object-oriented approach using UML. The course will help students to learn software requirements analysis process, object-oriented design technique, use case, test plan and test case preparation as part of problem-solving activities. This course will also provide students an overall understanding of Project Management with Software Project Estimation, Project Scheduling, Risk Management, Configuration Management, Software Quality Assurance and Software Maintenance.

### Course Outcomes

S.No.	Description
CO1	Knowledge about SE, SE activities, challenges and other issues
CO2	Understanding of software development life cycle, development methodologies, ability to select suitable methodology to use in software development. Ability to analyse, design and develop the system models.
CO3	Learn to apply different phase from Requirement Phase to testing and maintenance to a given project
CO4	Learn about the Process Planning and Estimation, Project Scheduling and Staffing, Risk Management, Quality Management, Software Quality control and Quality assurance, Metrics for Software Quality, Integrating Metrics within the Software Process
CO5	Learn to apply different Process Metrics and Project Metrics in a given project
CO6	Will be familiar with the new Software Engineering Process, technology as a driver, new modes of representing information, new tools and techniques

### Course outcome mapping with Programme Outcomes:

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	3	3	3	2	3	-	-	2	3	3	3	3
CO2	3	3	2	-	2	-	-	2	2	2	3	3
CO3	3	2	2	-	2	-	-	2	3	2	3	3
CO4	2	2	3	-	3	-	-	2	3	3	3	-
CO5	3	2	2	-	2	-	-	3	3	3	2	2
CO6	3	2	2	-	2	-	-	3	3	2	2	2
Max.	3	3	3	2	3	-	-	3	3	3	3	3

3 is High, 2 is Moderate, 1 is Low & - is Not Applicable

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### List of Tentative Practical

#### List of Practical Project Work

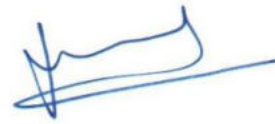
- Introduction to Github and Collaboration Tools
  - Software Requirements Specification (SRS) Document preparation
  - UML Use Cases diagrams
  - UML Class Diagrams
  - UML Sequence Diagram
  - Test cases preparation using JUnit Test Framework
  - 
  - Preparation of Project Deployment plan (Development to Production environment)
- Test cases preparation using JUnit Test Framework

Problem based on Software Metric: Write a program that takes a C program as input (input.c) and computes its Halstead complexity measures.

Problem based on CPM: Write a program that takes input as an activity chart and calculates the slack time and critical path.

#### Project Work:

- Create SRS based on a given system
- Create RDD and Design document based on the above system
- Project Discussion Individual Groups (Coding issues)
- Project Discussion Individual Groups (Testing)
- Preparation of Project Deployment plan (Development to Production environment)



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## COURSE HANDOUT (ABRIDGED)

**Session:** 2021-2022

**Sub Session:** Semester II (Jan-Jun)

**Course Name:** Introduction to Information Security (CS 461)

**LT/P/C:** 3/0/2/4

### Course Description

This course will introduce the concepts of the Cryptography and Information Security. It consists of topics on various cryptographic models available, Mail Protocols Standards, IP Security Architecture; Firewall Design Principles. Students will also learn implementation of some of the mechanisms through practical's.

- To provide introduction to the concept of Network Security Model and Cryptography systems.
- To give the knowledge of Digital Signature and other Security Measures available.
- To familiarize with the various techniques like PGP and S/MIME.
- To showcase IP Security Architecture & Transport Layer Security to identify the vulnerability of the Internet systems and recognize the mechanisms of the attacks.
- To explain the firewall design principles and various intrusion detection system

### Course Outcomes

S.No.	Description
CO1	Illustrate the concepts of Network Security and Compare Various Symmetric and Asymmetric Cryptographic methods used for Network Security.
CO2	Classify various Algorithms to be used at various TCP/IP Layers and to operate Digital Signature in Real World Situation
CO3	Summarize different Authentication Techniques and Describe programs like PGP and S/MIME
CO4	Implement IP Security Architecture and Transport Layer Security to identify the vulnerability of the Internet systems and recognize the mechanisms of the attacks, and apply them to design and evaluate counter-measure tools
CO5	Implement Firewall design principles and identify various intrusion detection systems and be able to achieve highest system security

### Course outcome mapping with Programme Outcomes:

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

3 is High, 2 is Moderate, 1 is Low & - is Not Applicable

### List of Tentative Practical

- P1. Implement the following SUBSTITUTION & TRANSPOSITION TECHNIQUES concepts:
  - a) Caesar Cipher
  - b) Playfair Cipher
  - c) Hill Cipher
  - d) Vigenere Cipher
  - e) Rail fence – row & Column Transformation
- P2. Implement the following algorithms
  - a) DES
  - b) RSA Algorithm
  - c) Diffie-Hellman
- P3. Implement the Signature Scheme - Digital Signature Standard
- P4. Demonstrate how to provide secure data storage, secure data transmission and for creating digital signatures (GnuPG)
- P5. Setup a honey pot and monitor the honeypot on network (KF Sensor)
- P6. Setup Firewall in Windows and Linux
- P7. Demonstrate intrusion detection system (ids) using any tool (snort or any other s/w)

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## COURSE HANDOUT (ABRIDGED)

**Session:** 2021-2022

**Sub Session:** Semester II (Jan-Jun)

**Course Name:** Information Retrieval (CS 481)

**L/T/P/C:** 3/1/0/4

### Course Description

The course is an advanced course on the theory and practice of modern Information Retrieval Systems

It aims to cover both basic and advanced algorithms and techniques for text retrieval systems as well as web retrieval systems.

The course also delivers on advanced retrieval systems that are multilingual, multimedia and XML in nature.

### Course Outcomes

S.No.	Description
CO1	Design and implement data structures for Information Retrieval systems
CO2	Design and build a tolerant and efficient Information retrieval system
CO3	Apply different Information Retrieval models
CO4	Understand web search
CO5	Perform XML retrieval
CO6	Understand Multi-lingual and multi-media retrieval

### Course outcome mapping with Programme Outcomes:

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	3	3	3	1	1	1	1	1	3	3	3	3
CO2	3	3	3	3	3	3	2	2	3	3	3	3
CO3	3	3	3	3	1	1	1	1	3	3	3	3
CO4	3	3	1	1	1	1	1	1	1	3	2	3
CO5	3	3	3	3	3	1	1	1	3	3	1	3
CO6	3	3	3	3	3	3	1	1	1	3	1	3
Max.	3	3	3	3	3	3	2	2	3	3	3	3

3 is High, 2 is Moderate, 1 is Low & - is Not Applicable

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## COURSE HANDOUT (ABRIDGED)

**Session:** 2021-2022

**Sub Session:** Semester II (Jan-Jun)

**Course Name:** Systems and Network Security (CS 511)

**L/T/P/C:** 3/0/2/4

### Course Description

In this course, students are introduced to the core concepts of system and network security. The course focuses on the fundamental knowledge of systems and networks. It includes a wide range of network attacks and corresponding defense mechanisms to build deep understanding of network security among the readers. The course also contains current network security technologies such as firewalls, IPSEC, intrusion detection and prevention systems, network security models, multilevel security, and security management and monitoring. The attacks and defensive mechanisms are divided into various layers while explanation and deep focus has been given in understanding of the practical tools and techniques to make the reader capable to play an active job role as a system security or network security professional. System security concepts such as operating system hardening, trusted computing, and access control are added for better understanding of operating system security issues. After completion of this course the students are expected to be capable in performing network scans, enumerations install and apply defensive strategies to protect systems and networks in an organization. Students are also expected to carry forward research in the domains of interest after thorough understanding of the security concepts in this course.

### Course Outcomes

S.No.	Description
CO1	Knowledge of Network and System Security, Protocols, Frame Formats and Concepts of Different Platforms, Its Threats and Security.
CO2	Understanding data link layer, attacks and defense mechanisms, Network Scanning, Network Layer Protocol, Network Level Attacks and Countermeasures with Hands-On.
CO3	Learn about the Transport Layer attacks and Security, Concepts of Buffer Overflow Attacks and Its Measures, TCP/UDP Based Attacks.
CO4	Perimeter securities, Firewall, Understanding IDS, Honeypot, IPSEC, Wireless and Bluetooth, Knowledge of Authentication, Multi types of Authentication.
CO5	Understanding Access Control, Access Control Types, and Case Studies Based on Systems and Network Security.

### Course outcome mapping with Programme Outcomes:

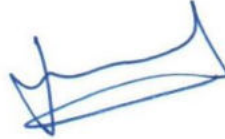
CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	1	2	1	2	-	-	2	2	-	2	-	3
CO2	1	2	1	2	-	-	2	2	2	2	-	3
CO3	2	2	1	2	2	-	1	3	2	3	-	3
CO4	2	2	1	2	2	-	1	3	2	3	-	3
CO5	2	2	1	2	2	-	1	2	-	3	-	3
Max.	2	2	1	2	2	-	2	3	2	3	-	3

3 is High, 2 is Moderate, 1 is Low & - is Not Applicable

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**List of Tentative Practical**

- P1. Understanding packet sniffing via Wireshark, tcpdump.
- P2. Understanding packet crafting via tools such as Hping.
- P3. Understanding network scanning via NMAP.
- p4. Packet Analyses by PCAP.
- P5. Realizing ARP spoofing/ DHCP spoofing attack
- P6. Realizing IP spoofing/ICMP flooding/Teardrop/Smurf attack
- P7. Deploying IP firewall in Linux for packet filtering
- P8. Learning deployment of NIDS snort and how it prevent attacks at various layers.
- P9. Realizing TCP/UDP based attacks.
- P10. Realizing wireless attacks such as Evil Twins via Aircrack Ng



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## COURSE HANDOUT (ABRIDGED)

**Session:** 2021-2022

**Sub Session:** Semester II (Jan-Jun)

**Course Name:** Cryptography (CS 531)

**LT/P/C:** 3/0/2/4

### Course Description

The course starts with some Simple Cryptosystems and their Cryptanalysis, OTP and perfect secrecy. Then we will study block ciphers and their analysis, stream ciphers, hash functions, their applications in Cryptography, message authentication codes. After this we will move into public key cryptography starting with the RSA cryptosystem, primality testing, ElGamal Cryptosystem and then after discussing some algorithms for Discrete Logarithm problem we will study Finite fields and elliptic curves. We will discuss Signatures schemes like RSA, ElGamal and its variants like Schnorr, DSA and ECDSA. We will briefly discuss some identification schemes and key distribution schemes. Finally we will study some modern aspects of Cryptography like Multi-party Computation, Zero-Knowledge and get a brief introduction to Post Quantum Cryptography.

### Course Outcomes

S.No.	Description
CO1	Learn how cryptographic systems work and why they are secure
CO2	Understand how two parties can securely exchange information when they have a shared key unknown to the attacker
CO3	Evaluate the importance of data confidentiality, data integrity
CO4	Understand the important concept of authenticated encryption
CO5	Grasp the concepts of public-key encryption and digital signatures, which allows two parties to communicate securely, without having a pre-shared secret key
CO6	Get a brief idea about cryptographic protocols for user identification, key exchange, zero knowledge, and secure computation

### Course outcome mapping with Programme Outcomes:

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	3	3	2	2	2	3	3	2	2	2	2	3
CO2	3	3	2	2	2	3	3	3	2	2	2	3
CO3	3	3	2	2	2	3	3	3	2	2	2	3
CO4	2	3	3	3	3	2	2	2	2	2	2	3
CO5	3	3	3	3	3	2	2	2	2	2	2	3
CO6	3	3	3	3	3	2	2	2	2	2	2	3
Max.	3	3	3	3	3	3	3	3	2	2	2	3

3 is High, 2 is Moderate, 1 is Low & - is Not Applicable

### List of Tentative Practical

There will be no Practical session for this course. The LT/PC structure for the Course is to be revised to 3-1-0-4. SO we will have 3 lecture sessions and 1 tutorial session every week. Almost every week, a Problem Set will be uploaded in the Learning Portal. The doubts faced by the students while solving these Problem or any other doubt related to the topics covered in the Lecture Session can be discussed in the Tutorial Sessions.

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## COURSE HANDOUT (ABRIDGED)

**Session:** 2021-2022

**Sub Session:** Semester II (Jan-Jun)

**Course Name:** Information Security Risk Assessment and Assurance (CS 541)

**L/T/P/C:** 3/1/0/4

### Course Description

This course gives a clarification about various aspects associated with information security; risk assessment and assurance. The concept of organizational security, different industry standards, functional requirements for security solutions, security management and implementations will be explained in this course.

### Course Outcomes

S.No.	Description
CO1	Understand various standards and regulations.
CO2	Understand information security models and information access management in a distributed environment.
CO3	Formulate computer security strategy from security requirements and risk assessment.
CO4	Develop ability to assess security risk for practical IT installations.
CO5	Ability to formulate organization wide information security policy and monitor it's implementation

### Course outcome mapping with Programme Outcomes:

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

3 is High, 2 is Moderate, 1 is Low & - is Not Applicable

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## COURSE HANDOUT (ABRIDGED)

**Session:** 2021-2022

**Sub Session:** Semester I (Jul-Dec)

**Course Name:** Advance Network Security Part-I (CS 542)

**LT/P/C:** 3/0/2/4

### Course Description

In this Course, students are introduced to the advanced persistent zero-day vulnerabilities and exploits in various platforms. Intelligence shared by major security vendors will be analysed, along with emerging technology solutions. Log management, and incident management will be introduced. Challenges to electronic payment systems will be discussed.

### Course Outcomes

S.No.	Description
CO1	Students will learn advanced persistent zero-day vulnerabilities and exploits in various platforms.
CO2	Student will find the information about intelligence shared by major security vendors, and it will be analysed, along with emerging technology solutions.
CO3	Student will apply the study to research and industry.

### Course outcome mapping with Programme Outcomes:

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	3	3	3	2	3	3	2	3	2	3	2	2
CO2	3	3	3	3	3	3	2	2	2	3	3	3
CO3	3	3	3	3	3	3	3	3	3	3	3	3
Max.	3	3	3	3	3	3	3	3	3	3	3	3

3 is High, 2 is Moderate, 1 is Low & - is Not Applicable

### List of Tentative Practical

Its a Industry based course and we perform the test and practicals as the need of the hours.

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## COURSE HANDOUT (ABRIDGED)

**Session:** 2021-2022

**Sub Session:** Semester II (Jan-Jun)

**Course Name:** Cyber Security Tools (CS 551)

**L/T/P/C:** 2/0/4/2

### Course Description

Cyber Security Tools course will provide the knowledge of Vulnerability Assessment, Scan Process and Exploits, Popular scripting languages and More Hands-on practice to all about the VAPT.

### Course Outcomes

S.No.	Description
CO1	Introduction to vulnerability assessment, Types of Vulnerability Assessments and its Requirements, Benefits. Labs/Scenarios for VA.
CO2	Knowledge of Scan Processes, Types of Scan and Hands-On, Introduction of Exploit, Types of Exploits and Hands-On.
CO3	Common Scripting language Constructs and Knowledge of Popular Scripting Languages.
CO4	Introduction to Penetration Testing, Methodologies, Reverse Engineering, Static and Dynamic Analysis and Setting-Up Pentest Lab.

### Course outcome mapping with Programme Outcomes:

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

3 is High, 2 is Moderate, 1 is Low & - is Not Applicable

### List of Tentative Practical

- P1. Information Gathering Practical.
- P2. Basic Practical of Vulnerability Assessment.
- P3. Open Source Tools uses for Vulnerability Assessment.
- P4. Advanced Tools uses of VA.
- P5. Basic Scanning Practical.
- P6. Port and Network Scanning Practical.
- P7. Advanced Scanning Practical.
- P8. Enumeration Practical.
- P9. Practical on Exploits.
- P10. Scanning for Exploit purpose Practical.
- P11. Shell Scripting Practical.
- P12. Common Scripting Languages Practical.
- P13. Penetration Practicals.
- P14. Demonstration of Privilege Escalation.
- P15. Practical of Debugging, covering tracks etc.

  
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## COURSE HANDOUT (ABRIDGED)

**Session:** 2021-2022

**Sub Session:** Semester I (Jul-Dec)

**Course Name:** Security Analytics (CS 552)

**L/T/P/C:** 3/0/2/4

### Course Description

1. The course is an introduction to information security, risk assessment and assurance.
2. Understand concept of organizational security and industry standards associate with various aspects of information security.
3. Teach process of identifying functional requirements for security solutions and security management.
4. Implementing security requirements and evaluate security functionality through tools and techniques will be explained in this course.
5. Understand established process for conducting security risk assessment

### Course Outcomes

S.No.	Description
CO1	Understand security data components associated with different types of security attacks.
CO2	Apply data analytics tools and techniques for building security intelligence platforms.
CO3	Analyze security log files using machine learning algorithms.
CO4	Evaluate security tools using simulation models.
CO5	Create dashboards for communication of insights derived from security analytics

### Course outcome mapping with Programme Outcomes:

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

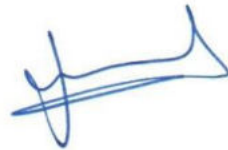
3 is High, 2 is Moderate, 1 is Low & - is Not Applicable

A handwritten signature in blue ink, appearing to be 'S. S. S.', written over a horizontal line.

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### List of Tentative Practical

1. Analytics and visualization with R and RStudio.
2. Python for analytics and data Visualization using canopy
3. Parsing, analysing and visualizing (security) network log data.
4. Risk/reliability heat maps and building contingency tables using python.
5. Analysing IP address and geo-mapping IP address and visualizing using Google Fusion Table and Google Maps chart
6. Analysing malicious nodes and malicious traffic.
7. Regression analysis and scatter plots for dealing with potwin effect.
8. Data visualization focussed on pre-attentive learning.
9. Analysing security breaches using Vocabulary for Event Recording and Incident Sharing (VERIS) framework
10. BigData analytics solution to analyse firewall log data. Also Exploring diversified data sources.
11. Malware analysis to identify infected hosts.
12. Using BigData Tools for analysing Security Breaches and building incident response.
13. Decision making using security simulation tools.
14. Analysing VPN logs for access anomalies.
15. Using text mining techniques for dealing with unstructured data.



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## COURSE HANDOUT (ABRIDGED)

**Session:** 2021-2022

**Sub Session:** Semester I (Jul-Dec)

**Course Name:** Advanced Cyber Security Tools for INFRASEC & VM (CS 562)

**L/T/P/C:** 0/0/4/4

### Course Description

This course will enable the students learning about malware analysis through hands on laboratory sessions and knowledge of core infra-security tools.

### Course Outcomes

S.No.	Description
CO1	Understand the concept of Malware and their types
CO2	Analyze the impact of malware in different Operating system
CO3	Analyze how malware interacts with any associated networks, identifying the type of information being targeted.
CO4	Demonstrate the ability to use various tools and techniques to safely perform static and dynamic analysis of software (or malware) of potentially unknown origin, including obfuscated malware, to fully understand the software functionality.
CO5	Recognize and understand the anti-disassembly, anti-debugging, and anti-VM techniques that are incorporated by the attacker to impede the analysis and reversing of malware

### Course outcome mapping with Programme Outcomes:

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

3 is High, 2 is Moderate, 1 is Low & - is Not Applicable

### List of Tentative Practical

Complete Syllabus is based on Practical. There is No Theory Lecture so everything will be discussed and perform in Lab hours.

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## COURSE HANDOUT (ABRIDGED)

**Session:** 2021-2022

**Sub Session:** Semester II (Jan-Jun)

**Course Name:** Systems and Network Security (CS 591)

**L/T/P/C:** 3/0/2/4

### Course Description

In this Course, students are introduced to the core concepts of network security, fundamentals of network security, network defense technologies are examined with emphasis given to the creation of a layered and diversified defense-in-depth architecture that begins with a security policy defining each layer. Students also identify the foundations of network auditing.

### Course Outcomes

S.No.	Description
CO1	Network Technologies, OSI Model vs TCP/IP Model, Advanced Networking Concepts and Infrastructure operations.
CO2	Concept of System and Network Security, Terminology of Security, Knowledge of Attacks Vectors, Protocol Base Security, IPSEC and There Detection and Prevention System.
CO3	Basic of Authentication Mechanism, Knowledge of different kind of Authentications, Basic Concept of Access Control, Kinds of Access Control, Management of Access Control.
CO4	Concept of Firewall, Auditing and Intrusion Detection, Types of Firewalls, Configurations of Firewall, IDS and Their Types, Honeypots, Unified Threat Management.
CO5	Knowledge of Denial-of-Service Attack, Types of Dos Attacks, Mitigation of Denial-of-Service Attack, Transport and Network Threats and Security Techniques.

### Course outcome mapping with Programme Outcomes:

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

3 is High, 2 is Moderate, 1 is Low & - is Not Applicable

### List of Tentative Practical

- P1. Understanding Network Concept via Packet Tracer
- P2. Understanding Switching and IP Routing.
- P3. Understanding Cyber Kill Chain Process.
- P4. Authentication based practical Like: Password, Remote User Authentication and etc.
- P5. Firewall implementation and configuration.
- P6. Learning deployment of IDS snort and how it prevent attacks at various layers.
- P7. Working Process of DOS and Its Mitigation practical.
- P8. Practical of Network Layer based Security.
- P9. Practical of Transport Layer based Security.

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## COURSE HANDOUT (ABRIDGED)

**Session:** 2021-2022

**Sub Session:** Semester II (Jan-Jun)

**Course Name:** Multi-device Programming (CS 3112)

**L/T/P/C:** 1/0/6/4

### Course Description

This course introduces students to the tools & technologies used for front end designing and development for a software product. In particular, it focuses on technologies to design, develop, debug and test front-end part of a software application. Additionally, brief introduction to IoT applications using Raspberry Pi and Arduino is also a part of this course.

After the end of the course the students are expected to learn the skills needed to design and develop robust, responsive and easy to test user interface (front-end) by following MVC based architecture using technologies like Angular and Bootstrap etc. Additionally, they get hands-on experience for the development of IoT applications.

### Course Outcomes

S.No.	Description
CO1	Design and develop robust, responsive and easy to test user interface (front-end) with Bootstrap, JQuery, JavaScript and HTML and Angular.
CO2	Design and develop mobile applications using Flutter.
CO3	Introduction to IoT application development using Raspberry Pi and Arduino.

### Course outcome mapping with Programme Outcomes:

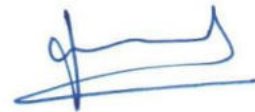
CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	-	-	2	-	3	-	-	3	2	3	2	3
CO2	-	-	2	-	3	-	-	3	2	3	2	3
CO3	-	-	2	-	3	-	-	3	2	3	2	3
Max.	-	-	2	-	3	-	-	3	2	3	2	3

3 is High, 2 is Moderate, 1 is Low & - is Not Applicable

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### List of Tentative Practical

- P1. HTML, CSS & Bootstrap Introduction, editors to write HTML, Syntax, Basic HTML Tags, Fonts, Properties & Attributes, HTML Tables, Forms, Lists, DIV, Hyperlink, CSS Introduction and basic rules, ID, Class, Fonts, Links, CSS Document Margin & Padding rules, CSS Box-Model, Borders & Floating properties, Using Bootstrap as a CSS framework
- P2 . Overview of Client Side Programming, JavaScript basic rules and syntax, Internal & External JS in web page, Browser Object Model & Document Object Model, JavaScript Form Validation
- P3. JavaScript Variables, Data-Types, Operators & Expressions & Arrays, Branching, Looping and JavaScript Objects, OOPs and First Class Functions, JQuery Introduction as a JavaScript Framework, Selectors & Events, JQuery CSS Classes, Sliding & Fading effects using JQuery
- P4. Introduction to MVC pattern in client side, Angular Introduction, Installation and Configuring Environment, Executing Example using Visual Studio Code, Introduction to TypeScript and basic syntax, Demonstrating TypeScript concepts using examples, TypeScript VS JavaScript
- P5. Understanding Angular Architecture, Angular Modules and @NgModule decorator, Components and Templates Introduction, Data Binding and Directives, Services Introduction and Dependency Injection
- P6. Directives in Detail Intro, Component Properties & Built-In Directives, Template Expressions, Data Binding & Binding Properties, One-Way Binding / Property Binding, Event Binding & Two-Way Binding, NgModel to implement Binding
- P7. Template Driven Forms, Component controlling Form, Show and hide validation error, Handling Form Submission using ngSubmit
- P8. Pipes Introduction, Built-In Pipes, Services in Angular, Built-In Service - \$http service, Get Request
- P9. Angular Routing, Configuration and Navigation, Parameterized and Nested Routs, Angular Modules, AppModule and RootModule
- P10. Mobile Application – Using Flutter and Designing Mobile App
- P11. Connecting Mobile App with Database
- P12. IoT implementation using Raspberry Pi



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## COURSE HANDOUT (ABRIDGED)

**Session:** 2021-2022

**Sub Session:** Semester I (Jul-Dec)

**Course Name:** Ethical Hacking (CS 3152)

**LT/P/C:** 3/0/2/4

### Course Description

In this course, students are introduced to the concept of ethical hacking, gain the knowledge of the Ethical Hacking terminology, difference between ethical hackers and unethical hackers, Steps of ethical hacking. This course also focusing on networking concept and virtualization, virtualization features and practical implementation of virtualization. In this course students can also learn about the information gathering technique, scanning concept, their uses for ethical hacking, how the unethical hackers hack the system password, hiding files and covering their footprints. Students also learn about the trojan, viruses, worms, ransomware etc., understanding the different types of attacks like- SQL Injection, XSS, DOS & DDOS, Wi-fi hacking and many more. Students can understand the concept of cryptography, its types and all about the vulnerability assessment and penetration testing framework for the organizations. In the Last students can learn all about the mitigation techniques of attacks.

After completion of this course the students are expected to be capable in performing ethical hacking techniques, perform vulnerability assessment to protect systems and networks in an organization.

### Course Outcomes

S.No.	Description
CO1	Understand concept of ethical hacking, their responsibilities, methodologies of hacking, Network technology, benefits and features of virtualization in an organization.
CO2	Knowledge of information gathering, techniques of information gathering, scanning methods, scanning technique, system hacking concept, password related attacks, files hiding and privilege escalation concept.
CO3	Understand and learn about the viruses, worms, trojan, ransomware, different kinds of hacking attacks, exploitation methods, Dos and DDos, and learn about the various attacks which uses for hacking.
CO4	Learn the concept of cryptography, goals of cryptography, types of cryptography and Methodology of Vulnerability Assessment, process of Penetration of Testing.

### Course outcome mapping with Programme Outcomes:

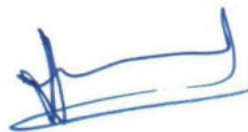
CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	1	1	-	2	3	-	1	3	2	2	-	2
CO2	2	1	2	2	3	-	1	3	2	2	-	3
CO3	2	3	2	3	3	-	2	3	3	2	-	3
CO4	2	3	2	3	3	-	2	3	3	2	-	3
Max.	2	3	2	3	3	-	2	3	3	2	-	3

3 is High, 2 is Moderate, 1 is Low & - is Not Applicable

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### List of Tentative Practical

- Lab-1 : - Creating Virtual Machine for the lab.
- Lab-2 : - Practical of information gathering by the tools and websites.
- Lab-3 : - Use of Scanning tools for the port scanning.
- Lab-4 : - Practical of Network and Vulnerability scanning.
- Lab-5 : - Password Cracking Methods practical.
- Lab-6 :- Clearing logs practical.
- Lab-7 : - Lab practical of Virus and Trojan.
- Lab-8 :- Packet Sniffing with Wireshark.
- Lab-9 :- ICMP based Attacks /Ping of Death
- Lab-10 :- SQL Injection and XSS Attack.
- Lab-11 :- Website Vulnerability scanning by tools.
- Lab-12 :- Disk Encryption practical/Hash Checksum practical.



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## COURSE HANDOUT (ABRIDGED)

**Session:** 2021-2022

**Sub Session:** Semester I (Jul-Dec)

**Course Name:** Introduction to Linear and Non Linear Optimization (CS 4101)

**L/T/P/C:** 3/0/2/4

### Course Description

This course is an introduction to linear and nonlinear optimization using mathematical techniques. Many problems from data science, machine learning, engineering, and economics can be formulated as an optimization problem. The objective of this course is to introduce various types of optimization problem, build the theoretical foundation, and build practical; solution methods. The course will also provide opportunity to use freely available software for solving optimization problems.

### Course Outcomes

S.No.	Description
CO1	Understand the difference between a local optimum and global optimum. Understand the ideas of convex sets, convex functions using which one can identify the feasible region.
CO2	Formulate finite-dimensional optimization problems. Apply some sufficiency conditions to an optimization method to test whether a minimum or a maximum exists, and whether they are unique.
CO3	Use the first and second order conditions for unconstrained optimum to calculate maxima and minima. Use various computational algorithms for unconstrained optimization.
CO4	Obtain analytic solutions to some optimization problems with equality and inequality constraints. Using various computational algorithms for constrained optimization including penalty and barrier methods.
CO5	Formulate some engineering design problems as linear/non-linear programs and obtain optimum designs using freely available software. Use both linear and non-linear programming as effective tools to solve engineering design problems.

### Course outcome mapping with Programme Outcomes:

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	3	3	3	2	2	1	1	1	2	3	1	3
CO2	3	3	3	3	3	2	2	2	1	3	2	3
CO3	3	3	2	3	2	1	2	1	2	3	2	3
CO4	3	3	3	3	3	3	2	2	3	3	3	3
CO5	3	3	3	3	3	3	2	2	3	3	2	3
Max.	3	3	3	3	3	3	2	2	3	3	3	3

3 is High, 2 is Moderate, 1 is Low & - is Not Applicable

### List of Tentative Practical

NA

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## COURSE HANDOUT (ABRIDGED)

**Session:** 2021-2022

**Sub Session:** Semester I (Jul-Dec)

**Course Name:** Web Intelligence & Algorithms (CS 4121)

**L/T/P/C:** 3/0/2/4

### Course Description

The aim of the course is to introduce algorithmic techniques used in various web applications to extract intelligence. The course has special focus on search engines, recommender systems and on linked data and the semantic web. The student will also learn practical implementations of the algorithms and design and development of intelligent systems

### Course Outcomes

S.No.	Description
CO1	Understand algorithms behind various Intelligent Web Applications
CO2	Apply algorithmic techniques to improve web search results
CO3	Implement algorithmic techniques in Recommender Systems
CO4	Understand algorithmic techniques to extract intelligence from social network graphs
CO5	Implement and apply concepts of processing stream data
CO6	Implement technologies of semantic web and its standards

### Course outcome mapping with Programme Outcomes:

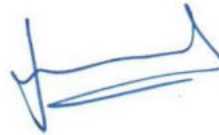
CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	3	3	2	1	1	1	1	2	1	1	1	3
CO2	3	3	3	3	3	1	1	1	1	2	3	3
CO3	3	3	3	3	3	2	1	2	3	3	3	3
CO4	3	3	3	3	1	2	1	1	2	2	3	3
CO5	3	3	3	3	3	1	1	1	3	3	3	3
CO6	3	3	3	3	3	1	1	1	3	3	3	3
Max.	3	3	3	3	3	2	1	2	3	3	3	3

3 is High, 2 is Moderate, 1 is Low & - is Not Applicable

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### List of Tentative Practical

- P1. A Java program to recommend a movie to a customer
- P2. Using Apache Mahout, display the neighbourhood and generate recommendations for all users in the data set.
- P3. Using Preference interface of Mahout build a recommendation system
- P4. Other Recommendation systems in mahout
- P5. SVDRecommender and dimensionality reduction in Mahout
- P6. Using Vector Maths perform various aggregate functions
- P7. Using Guava and the Iterable library build a recommendation system based on criteria as told in lab. Filter movies based on user given criteria.
- P8. Kafka window
- P9. Kafka window
- P10. Model the given ontology into relations using N3, N-Triples and Turtle
- P11. Model the given ontology into relations using RDF/XML
- P12. Advanced features in RDF/XML
- P13. Model the given ontology into relations using OWL
- P14. Advanced features in OWL



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## COURSE HANDOUT (ABRIDGED)

**Session:** 2021-2022

**Sub Session:** Semester II (Jan-Jun)

**Course Name:** Computer Vision (CS 4111)

**LT/P/C:** 3/0/2/4

### Course Description

This course introduces the basic concepts of Computer Vision to the students of undergraduate level.

### Course Outcomes

S.No.	Description
CO1	Understand basic concepts, theory, models, and methods in Computer Vision
CO2	Understand the basic idea of image formation in camera
CO3	Understand and develop algorithms for feature detection and matching
CO4	Understand the concept of segmentation in images
CO5	Get an idea of stereo vision as well as 3D vision
CO6	Understand and develop algorithms for object recognition

### Course outcome mapping with Programme Outcomes:

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	3	3	2	1	3	2	3	3	1	3	1	3
CO2	3	3	3	3	2	2	3	3	1	3	1	3
CO3	3	3	3	3	3	3	3	3	3	3	3	3
CO4	3	3	3	3	3	3	3	3	3	3	3	3
CO5	3	3	3	3	3	3	3	3	3	3	3	3
CO6	3	3	3	3	3	3	3	3	3	3	3	3
Max.	3	3	3	3	3	3	3	3	3	3	3	3

3 is High, 2 is Moderate, 1 is Low & - is Not Applicable

### List of Tentative Practical

1. Feature Detection and Matching
2. Segmentation
3. Texture
4. Motion Analysis
5. Recognition

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## COURSE HANDOUT (ABRIDGED)

**Session:** 2021-2022

**Sub Session:** Semester I (Jul-Dec)

**Course Name:** Cyber Security (CS 4151)

**L/T/P/C:** 3/0/2/4

### Course Description

The course starts with discussion of Cyber security threat landscape on the Internet and covers most of the areas of web, application and network security which a student working in this domain should know. The subject covers some protocols including HTTP, TLS, DNS, SMTP, FTP etc. and talks about specific cyber security attacks including Phishing, Spoofing, Denial of Service and many more. Students will also learn some security frameworks and modeling techniques to understand threat in a system and develop their countermeasures. Cyber security laws will help them with the necessary information that will be required when they will work in Cyber policing in future. Overall this course will help them understand Cyber security in detail.

### Course Outcomes

S.No.	Description
CO1	Understand basic principles and concepts of computer security including confidentiality, availability, integrity, information assurance, threat, attacks, vulnerabilities etc.
CO2	Understand the concepts of threat modeling, web security, operating system security, information and Cyber Attacks, Get in-depth distributed denial of service attacks, phishing, email security, cross site scripting, SQL injection and knowledge of defense techniques.
CO3	Understand and learn about the Security protocols like- HTTPS, TLS/SSL DNSSEC, etc and Learn about the concept of Malware, types of malware, working process of viruses, worms, trojans, ransomware, mitigation methods of malwares.
CO4	Learn about the VAPT, get the knowledge to how to VAPT tools works, also learn about the IDS/IPS and Honeypots and its tool such as Snort etc.. Understanding about Cyber Security Compliance, NIST and PCI, SOC and SIEM. Knowledge of IT Governance, Cyber Law, Risk Management and Data privacy.

### Course outcome mapping with Programme Outcomes:

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

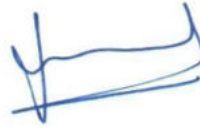
3 is High, 2 is Moderate, 1 is Low & - is Not Applicable



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### List of Tentative Practical

- P1. Virtualization practical (VMs)
- P2. Footprinting and Scanning.
- P3. Sniffing via Kali Linux.
- P4. Email Spoofing.
- P5. Phishing Attacks.
- P6. Denial of Service Attacks.
- P7. Practical of Viruses construction.
- P8. Trojan & Backdoor.
- P9. Password Cracking Tools.
- P10. Web Vulnerability Scanning.
- P11. Cross Site Scripting and Session Hijacking.
- P12. Firewall rules configuration.
- P13. Practical of Honeypot+IDS with KFSensor.
- P14. Disk Encryption via Vera-Crypt.
- P15. Practical of Burp-Suite.



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## COURSE HANDOUT (ABRIDGED)

**Session:** 2021-2022

**Sub Session:** Semester I (Jul-Dec)

**Course Name:** Capstone Project II (CS 4191)

**L/T/P/C:** 1/0/6/4

### Course Description

By empowering students with the skills necessary to access, understand and evaluate Information, Capstone Project will support students in the achievement of 21st century learning expectations. Students work in teams to develop or implement a real world IT solution

### Course Outcomes

S.No.	Description
CO1	Make a project according to specialisation.
CO2	Use of collaboration tool for Version Control System (Git and Github)
CO3	Usage of Maven / Python build tool
CO4	Using Jenkins for Continuous Integration and Continuous Deployment
CO5	Use of Docker
CO6	Working with Selenium

### Course outcome mapping with Programme Outcomes:

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	3	3	3	3	3	3	3	3	3	3	3	3
CO2	2	2	2	2	3	3	1	3	3	3	3	3
CO3	2	2	2	2	3	2	1	3	3	3	3	3
CO4	2	2	2	2	3	2	1	3	3	3	3	3
CO5	2	2	2	2	3	2	1	3	3	3	3	3
CO6	2	2	2	2	3	2	1	3	3	3	3	3
Max.	3	3	3	3	3	3	3	3	3	3	3	3

3 is High, 2 is Moderate, 1 is Low & - is Not Applicable

### List of Tentative Practical

Lab Coverage:

1. Project Work
2. Git & Github
3. Maven
4. Jenkins
5. Docker
6. pyb
7. Selenium
8. Angular
9. React
8. Angular and ReactJS

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## COURSE HANDOUT (ABRIDGED)

**Session:** 2021-2022

**Sub Session:** Semester I (Jul-Dec)

**Course Name:** Blockchain Technology and Application (CS 4201)

**L/T/P/C:** 3/0/2/4

### Course Description

Blockchain is an emerging technology which supports decentralization. This course will focus on core concepts of Blockchain such as distributed consensus mechanisms, cryptographic primitives as well as available blockchain platforms such as Bitcoin, Hyperledger, Ethereum and Algorand. This course will also focus on writing smart contracts in some of these platforms. The prerequisite for attending this course is knowledge of information security and strong background in mathematics.

### Course Outcomes

S.No.	Description
CO1	Understand the internals of Blockchain and how trust-driven consensus is the underpinning of Blockchain using Bitcoin as an example. Also understand Mixing, Basecoin, Zerocoin and Zerocash.
CO2	Get hands-on with Ethereum Platform and write and deploy smart contracts on Ethereum
CO3	Get hands-on with Hyperledger - run the hyperledger fabric and deploy contracts on it
CO4	Learn about the possible security attacks that can be unleashed on Blockchain such as mining attack, 51% attack and others

### Course outcome mapping with Programme Outcomes:

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	3	3	3	3	3	2	2	-	-	-	-	3
CO2	3	3	3	3	3	2	2	-	-	-	-	3
CO3	3	3	3	3	3	3	3	-	-	-	-	3
CO4	3	3	3	3	3	2	2	-	-	-	-	3
Max.	3	3	3	3	3	3	3	-	-	-	-	3

3 is High, 2 is Moderate, 1 is Low & - is Not Applicable

### List of Tentative Practical

- P1. Understand Ethereum platform.
- P2. Writing smart contract for Ethereum platform.
- P3. Deployment of smart contract for Ethereum platform
- P4. Understand Hyperledger platform.
- P5. Writing smart contract for Hyperledger platform.
- P6. Deployment of smart contract for Hyperledger platform.



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## COURSE HANDOUT (ABRIDGED)

**Session:** 2021-2022

**Sub Session:** Semester I (Jul-Dec)

**Course Name:** Fog and Edge Networks (CS 4231)

**L/T/P/C:** 3/0/2/4

### Course Description

In this course, we will study significant tools and applications that comprise today's cloud computing platform, with a special focus on using the cloud for networks and mankind applications.

The course content will come directly from research papers, articles, and documentation of cloud and data center, architectures, technologies and applications.

We will work together to develop a deep understanding of this content through class presentations and discussions of this material.

### Course Outcomes

S.No.	Description
CO1	Describe the key architectures and working and applications in edge computing
CO2	Critically evaluate research publications on cloud services and edge computing
CO3	Develop and deliver oral presentations for research publications on cloud and edge computing
CO4	Implement software using standard open source cloud and edge computing software real life issues

### Course outcome mapping with Programme Outcomes:

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

3 is High, 2 is Moderate, 1 is Low & - is Not Applicable

### List of Tentative Practical

Architecture design for fog and edge networks  
 Performance observation and analysis of simulated architecture.  
 QoE and QoS parameters improvement  
 Research Presentation and publication

A handwritten signature in blue ink, appearing to be 'Neemrana'.

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## COURSE HANDOUT (ABRIDGED)

**Session:** 2021-2022

**Sub Session:** Semester II (Jan-Jun)

**Course Name:** Business and Management Accounting II (ACC 102)

**L/T/P/C:** 3/0/0/3

### Course Description

Accounting knowledge is very essential for managing the business. It provides tools and methodology for recording, summarising, analysing and planning on the basis of accounting information and transactions. Business enterprises prepare and use Financial Statements, Marginal Costing and CVP Analysis, Ratio Analysis, Budget and Budgetary Control, Inventory Management etc. for analysing profitability, business trends, cost control and decision making. All these information are used by the stakeholders of the companies.

This course intended to impart knowledge of Financial Statements, Financial Statement Analysis, Generally Accepted Accounting Principles, Annual Reports and Accounting for Partnership in detail. The course will also help acquaint the students with cost and management accounting mechanics, process and system, with an emphasis on how to use accounting information for decision making, performance evaluation and control. This course will also provide detail knowledge of Cost Sheet, Marginal Costing and CVP Analysis, Ratio Analysis, Budget and Budgetary Control, Inventory Management.

At the completion of course students will be able to apply their Accounting knowledge and skills to prepare and analyse Financial statements and able to use the Management Accounting concepts for decision making, performance evaluation and control.

### Course Outcomes

S.No.	Description
CO1	Understand and interpret how the informational content of corporate financial statements is useful and the way they are used by different parties
CO2	Understanding the accounting concepts and the methodology of preparing accounts
CO3	Understanding the application of Indian Accounting Standards and IFRSs
CO4	Analyse and interpret financial statements using comparative, common size analysis and trend analysis
CO5	Understand the Annual Reports and to interpret all the items shown in that
CO6	Understand the importance of CFS and why they are made.
CO7	Understand the different types of Auditors' reports while analysing the annual report of companies.
CO8	Understand the concepts of inventory valuation and its role in costing.
CO9	Understand the types of taxes and tax system of the country.

### Course outcome mapping with Programme Outcomes:

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CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	2	-	3	1	3	1	1	2	1	3	2	2
CO2	3	3	2	1	1	1	1	3	3	2	3	3
CO3	3	3	3	3	3	2	2	2	2	2	2	2
CO4	3	3	3	3	3	2	2	2	2	2	2	2
CO5	-	-	-	-	-	-	-	-	-	-	-	-
CO6	-	-	-	-	-	-	-	-	-	-	-	-
CO7	-	-	-	-	-	-	2	3	3	-	-	-
CO8	2	3	-	-	2	-	3	3	2	2	-	-
CO9	3	-	-	-	2	-	-	-	-	2	-	-
Max.	3	3	3	3	3	2	3	3	3	3	3	3

3 is High, 2 is Moderate, 1 is Low & - is Not Applicable

  
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## COURSE HANDOUT (ABRIDGED)

**Session:** 2021-2022

**Sub Session:** Semester I (Jul-Dec)

**Course Name:** Financial Analytics (BA 504)

**L/T/P/C:** 4/0/0/4

### Course Description

This course delves deep into financial analytics. This course provides a framework to understand and apply various tools and techniques required to answer some crucial financial questions. It develops an understanding how to use financial indicators, benchmarks and ratios to detect and prevent a possible fraud. This course enables the candidate to appreciate the use of analytics in Banking/Retail/Insurance to provide a meaningful business solution.

### Course Outcomes

S.No.	Description
CO1	Develop an understating of various fraud detection models
CO2	To be able to apply Fraud Detection Models and to find the possible manipulations
CO3	To understand the various VaR models and their applications
CO4	Understand Credit risk and its Modelling
CO5	Understanding the Bond Price Yield relationship and its application

### Course outcome mapping with Programme Outcomes:

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

3 is High, 2 is Moderate, 1 is Low & - is Not Applicable

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## COURSE HANDOUT (ABRIDGED)

**Session:** 2021-2022

**Sub Session:** Semester I (Jul-Dec)

**Course Name:** Machine Learning (BA 411)

**L/T/P/C:** 3/0/0/3

### Course Description

The course aims to provide a rigorous concepts underlying machine learning, like, what is learning? How can a machine learn? How do we quantify the resources needed to learn a given concept? Is learning always possible? , Can we know whether the learning process succeeded or failed?

The course also presents several key machine learning algorithms. Specific attention to algorithms appropriate for large scale learning is also covered, with the applications where data is plentiful and computation time becomes the bottleneck. Validations are taken with accuracy and computation time.

### Course Outcomes

S.No.	Description
CO1	Understand the fundamental process of Machine Learning, univariate, bivariate and multivariate data modelling, supervised and unsupervised learning
CO2	Understand how to use machine learning tools to analyze real-life business problems
CO3	Create data models and compare them through model diagnostics
CO4	Understand model selection and boosting of models

### Course outcome mapping with Programme Outcomes:

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	3	-	-	-	-	-	3	3	-	-	-	-
CO2	-	3	-	-	-	-	3	3	-	-	-	-
CO3	3	3	-	-	3	-	-	3	3	-	2	-
CO4	3	3	-	-	3	-	-	3	3	-	3	-
Max.	3	3	-	-	3	-	3	3	3	-	3	-

3 is High, 2 is Moderate, 1 is Low & - is Not Applicable

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## COURSE HANDOUT (ABRIDGED)

**Session:** 2021-2022

**Sub Session:** Semester I (Jul-Dec)

**Course Name:** Data Visualization (BA 512)

**L/T/P/C:** 3/0/0/3

### Course Description

This course will help students understand how data is visualized. This course will also help students acquire the expertise and the tools needed for presenting data-based evidence with impact, across images, graphics, and visualizations of big data and for conveying their ideas in ways that are convincing and catchy.

### Course Outcomes

S.No.	Description
CO1	Understand the basics of data visualization, visualization as a medium, and representation of the data.
CO2	Understand and learn exploration of data visually.
CO3	Understand and learn the process of data visualization using tools like Excel, Tableau and build visuals using programming language R, Python.
CO4	Understand and learn to use data calculations to enhance the visualization.
CO5	Understand and learn to use qualitative and quantitative data analysis and visualization useful for business.
CO6	Understand the process of creating dashboards using advance Excel and Tableau.
CO7	Understand the basic ingredients of storytelling.
CO8	Understand the different analytical/visualization tools for visualization.
CO9	Slicing and dicing data with Excel to help business understand the insights using visualization

### Course outcome mapping with Programme Outcomes:

CO	PO1	PO2	PO3	PO4	PO5
CO1	3	3	2	-	1
CO2	3	3	3	-	3
CO3	3	3	3	-	1
CO4	2	2	2	-	1
CO5	2	2	-	-	1
CO6	2	2	3	3	3
CO7	2	2	-	3	3
CO8	3	3	3	-	3
CO9	3	3	3	-	3
Max.	3	3	3	3	3

3 is High, 2 is Moderate, 1 is Low & - is Not Applicable

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## COURSE HANDOUT (ABRIDGED)

**Session:** 2021-2022

**Sub Session:** Semester II (Jan-Jun)

**Course Name:** Predictive Analytics (BA 522)

**L/T/P/C:** 3/0/0/3

### Course Description

This course covers the key concepts used for extracting stored data elements, understand what they imply, and transform their formats and derive new relationships among them to produce a dataset suitable for analytical modelling. The course aims to help students produce a fully processed data set compatible for building powerful predictive models that can be deployed to increase productivity and profitability. Students will also be able to use forecasting models for predicting future values of variables (such as future sales from past data) etc.

### Course Outcomes

S.No.	Description
CO1	Understand the fundamental process of business analytics, univariate, bivariate and multivariate data modelling, supervised and unsupervised learning
CO2	Understand data cleaning, preparation, and data visualization.
CO3	Develop predictive model based on neural networks, decision trees, logistic Regression and Bayesian network models to solve Business Problem using R
CO4	Perform time series analysis using R
CO5	Learn classification techniques based on clustering, random forest, SVM and Association rules.

### Course outcome mapping with Programme Outcomes:

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

3 is High, 2 is Moderate, 1 is Low & - is Not Applicable

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## COURSE HANDOUT (ABRIDGED)

**Session:** 2021-2022

**Sub Session:** Semester I (Jul-Dec)

**Course Name:** Python & Bio Python (BI 431)

**L/T/P/C:** 3/0/2/4

### Course Description

#### IMPORTANCE OF PYTHON

The course gives an insight to the python programming language and the bioinformatics tools that this language provides. Course coverage would include a detailed introduction to the language and then will proceed to its applicability to Bioinformatics applications. Python focuses on the problem solving rather than lower level details. Python has been used in a lot of scientific applications, parallel programming, and benchmarking systems. Due to its versatility it has been a preferred language at NASA, Google etc.

Applicability to Bioinformatics:

Python has great applicability in Bioinformatics applications due to the availability of a rich and updated toolset for bioinformatics libraries making it a powerful platform superseding erstwhile BioPerl. The course holds great value and applicability for students of Computer Science, Biotech and Electronics streams.

### Course Outcomes

S.No.	Description
CO1	Python Programming Basics, syntax, constructs, datatypes and building logic using the constructs
CO2	Primitive and Non-Primitive Data types of Python such as Numbers, Strings, Lists, Dictionaries, Sets, Tuples and Files
CO3	Using python functions libraries and modules and defining our own functions and modules
CO4	Regular Expressions, advanced features such as Lambda, Map, Filter, Reduce etc
CO5	BioPython modules and working with Bioinformatic resources and databases on the Internet

### Course outcome mapping with Programme Outcomes:

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

3 is High, 2 is Moderate, 1 is Low & - is Not Applicable

### List of Tentative Practical

To be shared during course delivery

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## COURSE HANDOUT (ABRIDGED)

**Session:** 2021-2022

**Sub Session:** Semester I (Jul-Dec)

**Course Name:** Remedial Biology (BIO 001)

**L/T/P/C:** 3/0/2/4

### Course Description

This course will provide a comprehensive overview of microbial world, understanding fundamental structure differences in prokaryotic and eukaryotic cells. Structure of cell organelles, their function with cell cycle and cell division will be studied in details. Function of various biomolecules, their involvement in various biochemical pathways, mineral nutrients and their transport to the cell will be considered. Advances in biotechnology and its application to human welfare will be discussed.

### Course Outcomes

S.No.	Description
CO1	Understand hierarchy of biological world and able to compare various cells
CO2	Acquire basic knowledge of structure and functions of the cell, biomolecules, essential physiological and biochemical processes.
CO3	Explain genetics, gene interaction mechanism in plants and animals, inheritance pattern, and techniques to interpret the results.
CO4	Recombinant DNA technology and its applications in biotechnology.

### Course outcome mapping with Programme Outcomes:

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

3 is High, 2 is Moderate, 1 is Low & - is Not Applicable

### List of Tentative Practical

- P1. To study structure and working of a compound microscope; identify and study the morphology of plant cell, animal cell and prokaryote.
- P2. To make a temporary stained mount of  
 A) Onion peel and study, it under microscope- a plant cell  
 B) To make a temporary mount of cheek epithelial cells of man- Animal cell.
- P3. To prepare slides of bacteria and yeasts-microbial cells.
- P4. Hanging drop technique for demonstrating motility of bacteria.
- P5. To estimate the glucose concentration in a given sample
- P6. To estimate the protein concentration in a given sample by Biuret test.
- P7. Cell viability assay with trypan blue exclusion method.
- P8. To study the enzyme reaction – cellulase or amylase and effect of temperature and pH on enzymatic reaction.
- P9. To study of different stages of mitosis in onion root tip cells.
- P10. To study the effect of colchicine on mitosis in onion root tip cell.
- P11. To study various stages of meiosis.

  
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## COURSE HANDOUT (ABRIDGED)

**Session:** 2021-2022

**Sub Session:** Semester I (Jul-Dec)

**Course Name:** Biological Chemistry (BIO 201)

**L/T/P/C:** 3/0/3/4

### Course Description

This course in Biochemistry gives an insight about the application of chemistry in understanding the biological processes. Course coverage includes detailed concepts about biomolecules and their metabolism along with its application in interdisciplinary areas such as drug discovery, immunology and cell biology. Biochemistry will focus on laying the fundamentals about chemical structure, enzyme catalysed reactions and application of biomolecules including proteins, lipids, carbohydrates and nucleotides in life processes.

### Course Outcomes

S.No.	Description
CO1	Understand the molecular basis of life including biochemical properties of water.
CO2	Overview of the different major macromolecules and their biochemical properties.
CO3	Gain the knowledge of Enzyme Kinetics, Mechanism and their biochemical properties.
CO4	Understand bioenergetics and metabolism of biomolecules.

### Course outcome mapping with Programme Outcomes:

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

3 is High, 2 is Moderate, 1 is Low & - is Not Applicable

### List of Tentative Practical

- P1: Calibration of laboratory pipettes, and pH-meter
- P2: Preparation of buffers and molar solution.
- P3: Isoelectric precipitation of proteins
- P4: Qualitative analysis of amino acids
- P5: Titration curve of amino acids
- P6: Protein estimation
- P7: Glucose estimation
- P8: Spectrophotometric analysis of some inorganic chemicals
- P9: Protein conformation study
- P10: Acid hydrolysis of polysaccharides.
- P11: Influence of substrate concentration, temperature, pH and inhibitors on enzyme activity
- P12: Estimation of saponification value of fats and oils

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**List of Tentative Practical**

- P1 Molecular Biology Safety Lab (Labster virtual lab)
- P2 Molecular Biology Stock solution and Buffer preparation
- P3 Microscope View of a) Bacterial capsule b) Onion root c) Cheek smear
- P4 Gram staining
- P5 Cell Membrane and Transport
- P6 Mitosis on onion root tip
- P7 DNA isolation from Bacterial cells
- P8 DNA isolation from Plant cells
- P9 DNA isolation from Animal Cells
- P10 Plasmid DNA isolation from bacterial cells
- P11 Quantitation of DNA
- P12 PCR amplification
- P13 Bacterial Transformation
- P14 Molecular Cloning



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## COURSE HANDOUT (ABRIDGED)

**Session:** 2021-2022

**Sub Session:** Semester I (Jul-Dec)

**Course Name:** Biosafety, Ethics & IPR (BIO 212)

**L/T/P/C:** 3/0/0/3

### Course Description

This course in Biosafety & Ethics & PR will integrate the three domains of Biosafety, Ethics and IPR that governs the fundamental set of laws and rules that are to be followed in Biotechnology. Students will be introduced to legal aspects related to genes and health care. Moreover, equal emphasis will be given to biosafety which will include necessary biosafety measures, biosafety laboratory levels 1 and 2 along with other related topics. Students will also be made aware about patent laws and its various modalities including IPR.

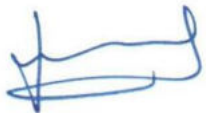
### Course Outcomes

S.No.	Description
CO1	Inculcate ethics and understand the possible societal anticipations of outcomes from potential applications of biotechnology targeting the end-user
CO2	Learn and adopt the established guidelines with respect to biosafety practices in research and development sectors
CO3	Follow good laboratory procedures and practices and justify the design of confinement facilities at different Biosafety levels
CO4	Comprehend the applicable source, scope, and limitations of Intellectual Property within the purview of engineering domain with competence on various Legal issues pertaining to IPR

### Course outcome mapping with Programme Outcomes:

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

3 is High, 2 is Moderate, 1 is Low & - is Not Applicable

  
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## COURSE HANDOUT (ABRIDGED)

**Session:** 2021-2022

**Sub Session:** Semester I (Jul-Dec)

**Course Name:** Molecular Biology (BIO 202)

**L/T/P/C:** 3/0/3/4

### Course Description

This course covers the detailed analysis of molecular mechanism of various stages of cell cycle and their regulation. This course is aimed to understand the basic concept of gene regulation at all levels, and the structure-function relationships of nucleic acids and proteins. In this course Biological systems will be studied at molecular level. Major emphasis will give to understand the concept of DNA damage, DNA repair, replication, genetic recombination, transcriptional and post-transcriptional processes. Molecular biology techniques and the logic of experimental design will be highlighted.

### Course Outcomes

S.No.	Description
CO1	The course aims to prepare students with basic knowledge of the structural and functional properties of cell and cell organelles.
CO2	Student will be able to understand the concept of Cell division and its regulation through cell cycle.
CO3	Learn the structure and function of DNA, RNA and the molecular processes (replication, transcription, translation etc.) that occur in and between cells.
CO4	Explain the concept of gene structure and function, gene regulation, gene expression, microbial genetics, mutation and DNA repair mechanism.
CO5	Student will able to execute a range of laboratory experiments such as DNA isolation, purification and manipulation by using standard conventional methods and molecular biology techniques.

### Course outcome mapping with Programme Outcomes:

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

3 is High, 2 is Moderate, 1 is Low & - is Not Applicable

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## COURSE HANDOUT (ABRIDGED)

**Session:** 2021-2022

**Sub Session:** Semester I (Jul-Dec)

**Course Name:** Corporate Governance (BLA 301)

**L/T/P/C:** 3/0/0/3

### Course Description

The course intended to introduce students to the Corporate Governance and its application for the corporate world by combining theoretical foundations with real-world examples. The course familiarizing the students with theory and practice of Corporate Governance. Acquainting the students with the principles, roles of different stakeholders and legislative framework of Corporate Governance. The course provides an insight into the corporate governance practices & codes of ethics to be followed by the company. This course will give a brief introduction of relevance of the corporate Governance in market competition and environmental issues. The course will cover public policies and transition economies in the context of corporate governance. The course also covers issues like insider trading and vigilance mechanism in the organizations. The course discuss corporate governance in international context and different forums.

### Course Outcomes

S.No.	Description
CO1	Understand the importance, evaluation, laws, theories, and role of Corporate Governance.
CO2	Understanding corporate governance in context with board of directors, audit committee and shareholders of companies.
CO3	Understand CSR, CG in Indian Context and Identify and understand how public policy is related to CG.
CO4	Understand CG in the context of environment and market competition and business ethics.
CO5	Understand the functioning of CG in transition economies and different nations of world. Also study different CG forums.

### Course outcome mapping with Programme Outcomes:

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	2	2	3	3	2	1	2	1	2	3	1	3
CO2	2	3	2	3	3	1	2	2	1	3	2	2
CO3	3	2	2	2	2	1	1	1	2	3	2	3
CO4	2	3	1	3	3	2	2	1	3	3	3	2
CO5	2	2	2	3	2	3	2	3	3	3	2	1
Max.	3	3	3	3	3	3	2	3	3	3	3	3

3 is High, 2 is Moderate, 1 is Low & - is Not Applicable

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## COURSE HANDOUT (ABRIDGED)

**Session:** 2021-2022

**Sub Session:** Semester II (Jan-Jun)

**Course Name:** Banking Products & Operations (BNK 302)

**L/T/P/C:** 3/0/0/3

### Course Description

The course in Banking Products and Operations, aim at acquainting students with operational aspects of banking, their rationale and the subtle interrelations between practice and theory of banking as well as Banking products. The student will get an opportunity to know various products & services offered by them to offer & explain the same to its customers.

### Course Outcomes

S.No.	Description
CO1	Develop an understanding of the different operations in a bank and the rationale underlying those processes and procedures
CO2	Detailed knowledge of banking product/ services and their operational aspects
CO3	Develop analytical skills to deal with the customers and evaluating their requirements and Understanding different types of customers and related banking process.

### Course outcome mapping with Programme Outcomes:

CO	PO1	PO2	PO3	PO4	PO5
CO1	2	3	2	2	3
CO2	2	2	1	3	2
CO3	3	2	2	1	2
Max.	3	3	2	3	3

3 is High, 2 is Moderate, 1 is Low & - is Not Applicable

  
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## COURSE HANDOUT (ABRIDGED)

**Session:** 2021-2022

**Sub Session:** Semester II (Jan-Jun)

**Course Name:** Computer Architecture & Organisation (CS 122)

**LT/P/C:** 3/0/2/4

### Course Description

This course is about the design of computers. It covers both the overall design architecture and their internal detailed organization. Computer Architecture refers to those attributes of a system visible to programmer or that have direct impact on the logical execution of a program. Computer Organization refers to the operational units and their interconnection that realize the architectural specifications.

At the end of this course, a student must not only be aware of various aspects of architecture but also must be in a position to evaluate the effects of the same on high level software.

### Course Outcomes

S.No.	Description
CO1	To understand the basics of computer organization and architecture.
CO2	To learn the architecture of computer memory.
CO3	To learn the concept of parallel processing.

### Course outcome mapping with Programme Outcomes:

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	2	2	2	2	1	1	1	1	1	1	1	3
CO2	3	3	2	2	1	1	1	1	1	1	1	3
CO3	3	3	2	2	1	1	1	1	1	1	1	3
Max.	3	3	2	2	1	1	1	1	1	1	1	3

3 is High, 2 is Moderate, 1 is Low & - is Not Applicable

### List of Tentative Practical

Objective: To learn the basics of Logisim

1. Installation and usage instructions for Logisim.
2. To understand the working of flip-flops
3. To understand the working of flip-flops half-adder and full-adder
4. To understand the implementation of ripple carry adder
5. To understand the implementation of carry look ahead adder
6. To understand the implementation of register
7. To understand the implementation of counter
8. To understand the implementation of multiplier
9. To implement an Arithmetic Logic Unit

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## COURSE HANDOUT (ABRIDGED)

**Session:** 2021-2022

**Sub Session:** Semester I (Jul-Dec)

**Course Name:** Advance Network Security-II (CS 5212)

**L/T/P/C:** 3/0/2/4

### Course Description

In this Course, students are introduced to the Firewalls and its different modules functionality, Network Traffic Monitoring and Analysis, Network Risk and Vulnerability Management, VPN technology and its variants, Anti-Virus, Email Security, Advance threat protection and WAF and Anti-Bot technologies. This course is required course for INFRASEC & VM stream.

### Course Outcomes

S.No.	Description
CO1	Student will learn the Network Traffic Monitoring and Analysis, Network Risk and Vulnerability Management, VPN technology.
CO2	Student will apply the academic study in research and industry.
CO3	Students will learn new skills, it will develop their analytical, problem solving, critical thinking, and decision making skills.

### Course outcome mapping with Programme Outcomes:

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	3	3	3	3	3	2	2	2	2	3	3	3
CO2	3	2	2	3	3	3	3	3	3	3	3	3
CO3	3	2	2	3	3	2	3	3	3	3	2	3
Max.	3	3	3	3	3	3	3	3	3	3	3	3

3 is High, 2 is Moderate, 1 is Low & - is Not Applicable

### List of Tentative Practical

Its a industry based courser, therefore we perform practicals and test as per the need of the hours.

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## COURSE HANDOUT (ABRIDGED)

**Session:** 2021-2022

**Sub Session:** Semester I (Jul-Dec)

**Course Name:** Social Media, Behavioural Aspects (CS 592)

**L/T/P/C:** 3/0/0/3

### Course Description

The course covers the impact of social media on individuals, governments, societies; changing nature of information and its instant reach to disrupt societies through demonstrations, revolutions. False propaganda, spread of terrorism. Also freedom of expression and privacy concerns.

### Course Outcomes

S.No.	Description
CO1	Understand the concept of Technology in social Media, Challenges related to Technologies
CO2	Learn about Social Media Ethics and Governance, law and Regulation
CO3	Evaluate Impact of Social Media in society

### Course outcome mapping with Programme Outcomes:

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	3	2	2	2	3	2	1	1	1	2	2	3
CO2	1	1	2	2	2	2	2	3	2	2	2	2
CO3	1	1	2	3	2	3	2	2	3	3	3	3
Max.	3	2	2	3	3	3	2	3	3	3	3	3

3 is High, 2 is Moderate, 1 is Low & - is Not Applicable

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## COURSE HANDOUT (ABRIDGED)

**Session:** 2021-2022

**Sub Session:** Semester II (Jan-Jun)

**Course Name:** Platform and Cloud Security (CS 521)

**L/T/P/C:** 3/0/2/4

### Course Description

Students will learn about Platform security and Cloud security that refers to the security architecture, tools and processes of the secure cloud and computing platform. In this they will use security software, systems and processes to enable the security of a computing platform hardware, software, network etc. They will also learn how to prevent unauthorized access to cloud technology infrastructure resources.

### Course Outcomes

S.No.	Description
CO1	Learn different platforms, like windows, Unix, Linux, database and emerging Cloud Computing. Learn about security requirements of platforms and cloud computing. Learn security architecture and security models to design secure systems.
CO2	Understanding of security features built in the platform and cloud computing.
CO3	Apply and evaluate security requirements to know vulnerabilities and threats in platforms and cloud computing environment. And work out security controls and countermeasures
CO4	Analyze the risk of the vulnerabilities and threats to the IT resources in platforms and cloud computing environment.
CO5	Evaluate loss to IT resources / business due to threats and vulnerabilities in the platforms and the cloud environment.
CO6	Create controls and countermeasures for platforms and cloud computing environment to protect the information system assets, secure the data and safe guard business interests.

### Course outcome mapping with Programme Outcomes:

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	3	3	3	2	2	2	2	3	3	3	2	3
CO2	3	3	3	2	2	2	2	3	3	2	2	3
CO3	3	3	3	2	2	2	2	3	3	3	3	3
CO4	3	3	3	3	3	2	2	3	3	3	3	3
CO5	3	3	3	3	3	2	2	3	3	3	3	3
CO6	3	3	3	3	3	2	2	3	3	3	3	3
Max.	3	3	3	3	3	2	2	3	3	3	3	3

3 is High, 2 is Moderate, 1 is Low & - is Not Applicable

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### List of Tentative Practical

Practical #1: To explore security setting on Laptop OS, basic platform (endpoint) to connect to IT systems.

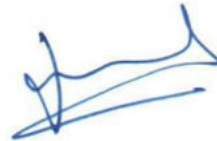
Practical #2: To understand security settings and explore them on mobile OS namely Android and iOS.

Practical #3: Secure by Configuration - To study and prepare OS hardening document for Windows Sever 2016 / 2019.

Practical #4: Compare security features of mobile OS - Android with iOS.

Practical #5: Secure by Configuration - To study and prepare OS hardening document for Distribution independent Linux.

Practical #6 Oracle Database 19c Benchmark settings.



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## COURSE HANDOUT (ABRIDGED)

**Session:** 2021-2022

**Sub Session:** Semester II (Jan-Jun)

**Course Name:** Analytics and Big Data (CS 502)

**L/T/P/C:** 3/0/2/4

### Course Description

The course covers techniques to build and maintain reliable and scalable systems capable of handling large amounts of data using Apache Hadoop, its extensions, libraries and related technologies. The second part of the course introduces descriptive and predictive models for data analysis

### Course Outcomes

S.No.	Description
CO1	Build programs to use analytical and processing tools of Hadoop framework
CO2	Architect full data pipelines
CO3	Build Dashboards for Data Visualization
CO4	Build descriptive and predictive algorithms for analytics of big data

### Course outcome mapping with Programme Outcomes:

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	3	3	3	3	1	1	1	1	2	3	1	3
CO2	3	3	3	3	3	1	1	1	2	3	1	3
CO3	3	3	3	3	3	1	1	1	2	2	1	3
CO4	3	3	3	3	3	1	1	1	2	2	1	2
Max.	3	3	3	3	3	1	1	1	2	3	1	3

3 is High, 2 is Moderate, 1 is Low & - is Not Applicable

### List of Tentative Practical

1. Basic reading and writing files in Hadoop
2. Map Reduce implementation in Java
3. Data processing in Pig
4. Data processing in Hive
5. Data processing in HBase
6. Data processing in Spark
7. Implementing predictive and machine learning algorithms

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## COURSE HANDOUT (ABRIDGED)

**Session:** 2021-2022

**Sub Session:** Semester II (Jan-Jun)

**Course Name:** Natural Language Processing (CS 491)

**L/T/P/C:** 3/0/2/4

### Course Description

The course is an introduction to Natural Language Processing (NLP). The main objective of the course is to learn the fundamental concepts used in processing natural language. NLP requires learning material from several fields: linguistics, machine learning and statistical analysis, and core natural language techniques. The course includes algorithms and data structures required to develop practical computer systems capable of performing intelligent tasks on natural language: analyze, understand and generate written text. The course also includes techniques to use the information extracted from natural language in various applications like sentiment analysis, question answering, conversational interfaces. Implementation of NLP applications using the Natural Language Toolkit or NLTK and Python is covered.


### Course Outcomes

S.No.	Description
CO1	Student should be able to understand why they are going to learn NLP, what are the challenges of using NLP in the Industry/Research areas. Give idea about ambiguities and issues of Natural language and how to distinguish between Natural Language processing applications from other data processing systems.
CO2	Discuss application on document similarity - Need of Relations of words, Know how to extract possible synonyms of given word using WordNet.
CO3	Discuss application on document similarity - Need of Understanding morphological analysis. Apply morphological analyzer to create a modified Porter stemmer
CO4	Understanding language modelling using N-Gram and HMM technique. Application is Spell Checker.
CO5	Parsing - Understanding Parsing as Search, Top-Down Parsing, Bottom-Up Parsing, Repeated Parsing of Subtrees. Application for parsing like Machine translation. WSD- Understanding the Word Sense Disambiguation both in category, senses with Knowledge based and other approaches. Application for WSD is text categorization, information retrieval. NER- Understanding identification of Named entities from text document. Plays an important role in document summarization, classification of documents, opinion forming
CO6	Learning to apply different algorithms to extract pronoun to corresponding noun. Applicable to develop different applications like to provide the abstract of the text document and to remove the ambiguities in Software Requirement Specification document.
CO7	Hands on practice: how to apply the different aspects of Natural Language processing in doing the text analytics - Machine translation, document summarization, spell checker etc.

### Course outcome mapping with Programme Outcomes:

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	3	3	3	3	3	2	2	2	3	2	2	3
CO2	2	3	3	3	1	3	3	2	2	3	2	2
CO3	3	3	2	2	2	3	2	2	2	2	3	2
CO4	3	3	3	3	3	2	2	2	3	3	3	2
CO5	3	3	2	2	3	3	3	3	3	3	3	2
CO6	3	3	2	2	2	3	2	2	3	2	3	2
CO7	3	3	3	3	3	3	2	2	3	2	3	3
Max.	3	3	3	3	3	3	3	3	3	3	3	3

3 is High, 2 is Moderate, 1 is Low & - is Not Applicable

  
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### List of Tentative Practical

- - Tokenize text without punctuation and with punctuation and analysis
- Analysis of Porter Stemmer and apply new rules
- Extract possible synonyms of given word using WordNet
- Identification of POS tag and Chunk level for a given text
- % of overlapping (stop words)
- Parsing a given sentence in word level
- Spell checker
- Identify the correct sense of ambiguous words
- Identification of Named entities (5 categories) from text document using Stanford NER tool - Extract pronoun to corresponding noun to develop different applications
- WSD
- document similarity, opinion mining, Machine translation



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## COURSE HANDOUT (ABRIDGED)

**Session:** 2021-2022

**Sub Session:** Semester I (Jul-Dec)

**Course Name:** Data Mining (CS 451)

**L/T/P/C:** 3/0/2/4

### Course Description

This course provides an introduction to fundamental aspects of data mining which is extraction of valid, novel, potentially useful, understandable patterns from data sources such as, databases, texts, web, images, etc. This course covers the importance of data preprocessing, major tasks in data preprocessing, association rule mining, different types of clustering techniques, decision tree construction, and evaluation of classifier performance and outlier detection techniques. The theoretical aspects are supported by a lab component.

### Course Outcomes

S.No.	Description
CO1	Understanding concepts of data pre-processing and data quality
CO2	Apply and implement algorithmic techniques for pattern mining
CO3	Apply and implement different algorithmic techniques for classification
CO4	Apply and implement algorithmic techniques for clustering
CO5	Apply and implement algorithmic techniques for outlier detection
CO6	Evaluate various models

### Course outcome mapping with Programme Outcomes:

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	3	1	1	3	3	1	1	1	1	1	1	3
CO2	3	3	3	3	3	3	1	1	3	3	3	3
CO3	3	3	3	3	3	3	1	1	3	3	3	3
CO4	3	3	3	3	3	3	1	1	3	3	3	3
CO5	3	3	3	3	3	3	1	1	3	3	3	3
CO6	2	2	1	1	2	1	1	3	3	3	3	3
Max.	3	3	3	3	3	3	1	3	3	3	3	3

3 is High, 2 is Moderate, 1 is Low & - is Not Applicable

### List of Tentative Practical

- P1. Installation and basic functionality.
- P2. Getting started with Weka.
- P3. Evaluation
- P4. Simple Classifiers
- P5. Additional Classifiers
- P6. Putting the together
- P7. Demonstration of preprocessing
- P8. Demonstration of Association rule process using apriori algorithm
- P9. Demonstration of classification rule process
- P10. Demonstration of clustering rule process using simple k-means.

  
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## COURSE HANDOUT (ABRIDGED)

**Session:** 2021-2022

**Sub Session:** Semester I (Jul-Dec)

**Course Name:** Compiler Design (CS 332)

**L/T/P/C:** 3/0/2/4

### Course Description

This course aims to teach students the principals involved in compiler design. It will cover all the basic components of a compiler, but not the advanced material on optimizations and machine code generation. The course will have a project where students will have to develop a compiler for a subset of C language using tools like Lex and Yacc. The target environment will be SPIM simulator.

### Course Outcomes

S.No.	Description
CO1	Describe the design of a compiler which includes its phases and components
CO2	Develop a well-structured software system that implements various phases of a compiler
CO3	Understand the role of the compiler in ensuring the security, privacy and integrity of data

### Course outcome mapping with Programme Outcomes:

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	3	3	3	3	3	3	2	3	3	3	3	3
CO2	3	2	3	3	3	3	3	3	3	2	2	2
CO3	3	2	3	3	3	3	3	-	3	3	3	2
Max.	3	3	3	3	3	3	3	3	3	3	3	3

3 is High, 2 is Moderate, 1 is Low & - is Not Applicable

### List of Tentative Practical

1. Get tokens and divide them into identifiers, keywords, special symbols and operators and constants.
2. Program to check the syntax of the for loop
3. Implement recursive descent parser
4. Program to find first of a grammar
5. Program to find the follow of a grammar
6. Get operator relation table for a given grammar
7. Implement SLR parser
8. Implement LALR parser
9. Implement LR parser

  
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### List of Tentative Practical

OOPs  
HTML and CSS  
Javascript  
JQuery  
BootStrap  
Web Application using Django  
Web Application using Flask  
Use of Templates  
Database Connectivity  
Login Exercise  
Session and Cookies Demo  
Collaboration and Project Management



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## COURSE HANDOUT (ABRIDGED)

**Session:** 2021-2022

**Sub Session:** Semester II (Jan-Jun)

**Course Name:** Theory of Computation (CS 302)

**L/T/P/C:** 3/1/0/4

### Course Description

In this course, the following topics will be covered - Finite Automata (deterministic and nondeterministic), regular operations. Regular Expression, Equivalence of DFA, NFA and REs, closure properties. Non regular languages and pumping lemma, Minimization of states of DFAs, Myhill-Nerode Theorem. CFGs, Chomsky Normal Form. Non CFLs and pumping lemma for CFLs, PDAs, Equivalence of PDA and CFG. Properties of CFLs, DCFLs, Cocke-Younger-Kasami algorithm for Context Free Grammars. Turing Machines and its variants. Configuration graph, closure properties of decidable and Turing-recognizable languages, decidability, Diagonalization Proof. Undecidability, Halting Problem and its undecidability. Introduction to complexity theory, time complexity, P and NP, SAT, Poly-time Reducibility, NP-completeness, Cook-Levin Theorem, Space Complexity, PSPACE, TQBF, L and NL, NL is equal to co-NL.

### Course Outcomes

S.No.	Description
CO1	Understand the key notions of computation through problem solving
CO2	Understand finite automata, regular grammars, and regular expression representations of regular languages
CO3	Determine if a language is context-free
CO4	Explain the concept of undecidability
CO5	List examples of undecidable problems
CO6	Gather a fair idea of important complexity classes like P, NP, PSPACE, L, NL, BPP, IP

### Course outcome mapping with Programme Outcomes:

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	3	3	3	2	2	1	1	1	2	1	1	2
CO2	3	3	3	2	2	1	1	1	2	1	1	2
CO3	3	3	3	2	2	1	1	1	2	1	1	2
CO4	3	3	3	2	2	1	1	1	2	1	1	2
CO5	3	3	3	2	2	1	1	1	2	1	1	3
CO6	3	3	3	3	2	1	1	1	2	1	1	3
Max.	3	3	3	3	2	1	1	1	2	1	1	3

3 is High, 2 is Moderate, 1 is Low & - is Not Applicable

  
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## COURSE HANDOUT (ABRIDGED)

**Session:** 2021-2022

**Sub Session:** Semester II (Jan-Jun)

**Course Name:** Artificial Intelligence (CS 322)

**L/T/P/C:** 3/0/2/4

### Course Description

Artificial Intelligence is a core course in sixth semester of B. Tech. (CS) for all students who wish to specialize in the area of artificial intelligence and machine learning. The course lays the foundations of this area and discusses several classical algorithms. In addition, it deals with the important area of knowledge representation. The course also deals with soft computing topics like genetic algorithms and fuzzy logic.

### Course Outcomes

S.No.	Description
CO1	Understanding agents, environment and search spaces. Developing models for defining the search spaces using the PEAS for a specific problem and developing rules for navigating the space.
CO2	Learning and applying algorithms for searching the optimal solution in the search space. Includes uninformed, informed (heuristic) searches, constraint satisfaction and adversarial search.
CO3	Understanding what is knowledge; learning representations of knowledge, applying knowledge representations to draw inferences, reasoning, reasoning under uncertainty
CO4	Understanding fuzzy sets and their algebra. Modelling subjectivity and imprecision using fuzzy sets. Drawing inferences using fuzzy sets.
CO5	Genetic algorithms, their theoretical foundations. Solving optimization problems using genetic algorithms.

### Course outcome mapping with Programme Outcomes:

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	3	2	2	1	2	2	1	2	1	1	1	2
CO2	3	3	3	2	2	2	1	2	1	2	1	3
CO3	3	3	2	3	3	2	1	2	1	2	1	3
CO4	3	3	2	3	2	3	1	2	1	1	1	2
CO5	3	3	2	3	2	3	1	2	1	1	1	2
Max.	3	3	3	3	3	3	1	2	1	2	1	3

3 is High, 2 is Moderate, 1 is Low & - is Not Applicable

### List of Tentative Practical

To be announced based on class progress

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## COURSE HANDOUT (ABRIDGED)

**Session:** 2021-2022

**Sub Session:** Semester I (Jul-Dec)

**Course Name:** Discrete Mathematics (CS 232)

**L/T/P/C:** 3/1/0/4

### Course Description

This course emphasises on problem solving, understanding of mathematical definitions and proofs, grasping basic mathematical structures that are useful in Computer Science. Topics covered in this course are Logic and proofs, Graph Theory, Counting and Number Theory. Propositional logic, first order logic, proof by contradiction, induction, invariant method etc. will be covered in Logic. In Graph Theory the topics to be covered include degree sequence, Eulerian graphs, isomorphism, trees, stable and bipartite matching, graph coloring, planar graphs etc. Sets, functions, number sequences, counting by mapping, pigeonhole principle, recursion and generating functions are some of the topics to be covered in Counting, while in Number Theory topics like Extended Euclidean Algorithm, Modular Arithmetic, Chinese Remainder Theorem and an introduction to Public Key Cryptography will be covered. Relations, sub-algebras, semigroups, monoids, groups, rings, integral, domains, fields to be covered in Abstract Algebra. The prerequisites for this course is High School Algebra.

### Course Outcomes

S.No.	Description
CO1	Learn basic mathematical concepts like sets, functions, graphs, extended Euclidean Algorithm etc. and be familiar with formal mathematical reasoning.
CO2	Understand the art of problem solving through mathematical aspects of computing
CO3	Ability to grasp the importance of various research problems in Computer Science
CO4	Appreciate the various applications of Discrete Mathematics in Real life
CO5	Learn some concepts of Abstract Algebra like Relations, sub-algebras, semigroups, monoids, groups, rings, integral, domains, fields

### Course outcome mapping with Programme Outcomes:

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	3	3	1	1	1	2	1	1	1	1	1	2
CO2	3	3	1	1	1	2	1	1	1	1	1	2
CO3	3	3	2	3	2	2	2	2	2	1	1	3
CO4	3	3	2	1	2	2	2	2	2	1	1	3
CO5	3	2	3	3	2	1	1	1	1	2	2	2
Max.	3	3	3	3	2	2	2	2	2	2	2	3

3 is High, 2 is Moderate, 1 is Low & - is Not Applicable

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## COURSE HANDOUT (ABRIDGED)

**Session:** 2021-2022

**Sub Session:** Semester II (Jan-Jun)

**Course Name:** Database Management Systems (CS 231)

**L/T/P/C:** 3/0/2/4

### Course Description

This is an introductory course on relational database systems. Its aim is to introduce basic concepts of databases and database management systems. At the end of this course it is expected that students will have a reasonably good theoretical as well as practical foundation on database systems. In particular, they will have a good understanding of relational data model, relational query languages, and database processing, SQL and PLSQL, physical database, storage and indexing structures, transaction management, database recovery.

### Course Outcomes

S.No.	Description
CO1	Have a high level of understanding of enterprise data and relational database concepts
CO2	Model high level system requirements using conceptual modeling (ER)
CO3	Develop refined relational and physical database design
CO4	Compose advanced queries, triggers and procedure writing using SQL and PLSQL
CO5	Implement transactions of a real application
CO6	Understand algorithms and techniques to recover from data loss

### Course outcome mapping with Programme Outcomes:

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	3	2	1	1	-	1	1	1	1	1	1	3
CO2	3	3	3	3	3	3	1	1	3	3	3	3
CO3	3	3	3	3	3	3	1	1	3	3	3	3
CO4	3	3	3	3	3	3	1	1	3	3	3	3
CO5	3	3	3	3	3	3	1	1	3	3	3	3
CO6	3	3	3	3	1	1	1	1	1	1	1	3
Max.	3	3	3	3	3	3	1	1	3	3	3	3

3 is High, 2 is Moderate, 1 is Low & - is Not Applicable

  
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### List of Tentative Practical

1. Database installation and user creation
2. DDL statements
3. DML statements
4. Joins and DML
5. Aggregates and DML
6. Combination of Joins, Aggregates, Delete
7. Data time functions
8. ER diagrams
9. Converting ER into relations
10. Views and Triggers
11. Stored Procedures
12. Advanced Stored Procedures
13. DB Transactions
14. Physical Database Management
15. Deadlocks



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## COURSE HANDOUT (ABRIDGED)

**Session:** 2021-2022

**Sub Session:** Semester II (Jan-Jun)

**Course Name:** Operating System (CS 211)

**L/T/P/C:** 3/0/2/4

### Course Description

This course provides an introduction to different fundamental aspects of Operating Systems. The course covers the operating system structure, their major components and organization as well as the underlying architectural support. The main prima face of the course is given on the concepts of multi-programming, multi-tasking, multiprocessing, time-sharing, processes, threads, their synchronization, scheduling and management, concurrency control and underlying issues of deadlock, memory management, virtual memory, page replacement algorithms and file management system. The entire course is supported through illustrated examples. Some introduction is also provided to the concepts of networking, distributed systems and different security issues.

### Course Outcomes

S.No.	Description
CO1	Understand different fundamental aspects of Operating Systems
CO2	Understand operating system structure, their major components and organization, functioning as well as the underlying architectural support
CO3	Implement simple operating system mechanisms
CO4	Understand different types of operating systems and their functioning

### Course outcome mapping with Programme Outcomes:

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	3	2	2	3	2	2	2	2	2	2	2	2
CO2	3	2	2	2	2	2	3	1	3	2	2	2
CO3	2	3	2	2	2	2	2	2	2	3	3	3
CO4	2	1	2	3	2	2	2	1	2	1	2	2
Max.	3	3	2	3	2	2	3	2	3	3	3	3

3 is High, 2 is Moderate, 1 is Low & - is Not Applicable

  
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### List of Tentative Practical

1. Basics of UNIX commands.
2. Shell programming
3. Implementation of CPU scheduling.
  - i. Round Robin
  - ii. SJF
  - iii. FCFS
  - iv. Priority
4. Implement all file allocation strategies
5. Implement Semaphores
6. Implement of File Organization Techniques
7. Implement Bankers algorithm for Dead Lock Avoidance
8. Implement an Algorithm for Dead Lock Detection
9. Implement the all page replacement algorithms
  - i. FIFO
  - ii. LRU
  - iii. LFU
10. Implement Shared memory and IPC
11. Implement Paging Technique for memory management.
12. Implement Threading & Synchronization Applications



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## COURSE HANDOUT (ABRIDGED)

**Session:** 2021-2022

**Sub Session:** Semester I (Jul-Dec)

**Course Name:** Machine Learning (CS 4131)

**L/T/P/C:** 3/0/2/4

### Course Description

1. This course will provide an introduction to machine learning, particularly to approaches that are widespread throughout research and applications of machine learning.
2. The students will be made able to design and implement machine learning solutions to classification, regression, and clustering problems; and be able to evaluate and interpret the results of the algorithms.
3. The course also offers delivering a more in-depth knowledge of the specific analytical techniques relevant to their research projects.

### Course Outcomes

S.No.	Description
CO1	Get in-depth knowledge of the fundamental concepts of machine learning and their applications
CO2	Understand supervised and unsupervised learning. Discuss regression, classification and clustering models.
CO3	Understand in detail support vector machines, decision trees, ensemble methods, density estimation, neural networks, dimensionality reduction, reinforcement learning.
CO4	Learn to implement the well-known machine learning algorithms to solve known engineering and research problems.
CO5	Understanding of the nature of data and problem possessed and understanding advantages and limitations of the different machine learning methods

### Course outcome mapping with Programme Outcomes:

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	3	3	3	2	2	3	1	1	2	1	1	3
CO2	3	3	3	3	3	3	2	1	1	1	2	3
CO3	3	3	3	3	3	3	1	1	1	1	1	2
CO4	3	3	3	3	3	2	2	1	2	1	3	3
CO5	3	3	3	2	2	3	1	1	1	3	2	3
Max.	3	3	3	3	3	3	2	1	2	3	3	3

3 is High, 2 is Moderate, 1 is Low & - is Not Applicable

### List of Tentative Practical

Will be announced in the class depending to the topic covered.

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