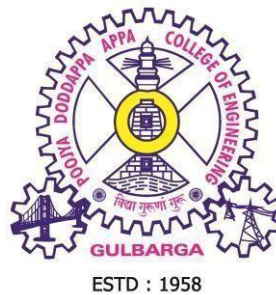


**CURRICULUM
FOR THE ACADEMIC YEAR 2023-2024**

DEPARTMENT OF COMPUTER SCIENCE AND ENGINEERING

B.E. (Computer Science & Design)

VI SEMESTER



**POOJYA DODDAPPA APPA COLLEGE OF ENGINEERING
(An autonomous college under VTU)
KALABURAGI**

About the institution: The Hyderabad Karnataka Education (HKE) society founded by Late Shri. Mahadevappa Rampure, a great visionary and educationist. The HKE Society runs 46 educational institutions. Poojya Doddappa Appa College of Engineering, Gulbarga is the first institution established by the society in 1958. The college is celebrating its golden jubilee year, setting new standards in the field of education and achieving greater heights. The college was started with 50% central assistance and 50% state assistance, and a desire to impart quality technical education to this part of Karnataka State. The initial intake was 120 with degree offered in three branches of engineering viz, Civil, Mechanical and Electrical Engineering. Now, it houses 11 undergraduate courses, 10 post Graduate courses and 12 Research centers, established in Civil Engg., Electronics & Communication Engg, Industrial & Production Engg, Mechanical Engg, Electrical Engg., Ceramic Cement Tech., Information Science & Engg., Instrumentation Technology, Automobile Engg., Computer Sc. and Engg., Mathematics and Chemistry All the courses are affiliated to Visveswaraya Technological University, Belgaum. At present the total intake at UG level is 980 and PG level 193.

The college receives grant in aid funds from state government. A number of projects have been approved by MHRD /AICTE, Govt. of India for modernization of laboratories. KSCST, Govt. of Karnataka is providing financial assistance regularly for the student's projects.

The National Board of Accreditation, New Delhi, has accredited the College in the year 2005-08 for 09 UG Courses out of which 08 courses are accredited for three years and 01 course is accredited for five years. And second time accredited for Six Course in the year 2009-2012

Our college is one among the 14 colleges selected under TEQIP, sponsored by World Bank. It has received a grant of Rs 10.454 Crores under this scheme for its development. The institution is selected for TEQIP phase II in year 2011 for four years. Institution is receiving a grant of Rs. 12.50 Crores under TEQIP Phase -II scheme for its development and selected for TEQIP-III as mentoring Institute for BIET Jhansi(UP).

Recognizing the excellent facilities, faculty, progressive outlook, high academic standards and record performance, the VTU Belgaum reposed abundant confidence in the capabilities of the College and the College was conferred Autonomous Status from the academic year 2007-08, to update its own programme and curriculum, to devise and conduct examinations, and to evaluate student's performance based on a system of continuous assessment. The academic programmes are designed and updated by a Board of Studies at the department level and Academic Council at the college level. These statutory bodies are constituted as per the guidelines of the VTU Belgaum. A separate examination section headed by a Controller of Examinations conducts the examinations.

At present the college has acquired the Academic autonomous status for both PG and UG courses from the academic year 2007-08 and it is one among the six colleges in the state of Karnataka to have autonomous status for both UG and PG courses.

One of the unique features of our college is, it is the first college in Karnataka State to start the Electronics and Communication Engineering branch way back in the year 1967, to join NIT Surathkal and IISc, Bangalore. Also, it is the only college in the state and one among the three colleges across the country, offering a course in Ceramic and Cement Technology. This

is the outcome of understanding by faculty and management about the basic need of this region, keeping in view of the available raw material and existing Cement Industries.

Bharatiya Vidya Bhavan National Award for an Engineering College having Best Overall Performance for the year 2017 by ISTE (Indian Society for Technical Education). In the year 2000, the college was awarded as Best College of the year by KSCST, Bangalore in the state level students projects exhibition.

The college campus is spread over 71 acres of land on either side of Mumbai-Chennai railway track and has a sprawling complex with gardens and greenery all around.

About the department: The Computer Science and Engineering department was started in the year 1984 with an intake of 40 students for UG. The department has seen phenomenal growth and now the department has increased UG intake to 120 students and offering two Post Graduation programmes: PG (Computer Science and Engineering with an intake of 25 students) and PG(Computer Network and Engineering with an intake of 18 students). The department is offering research program under its recognized research center. Computer Science and Design course was started from 2021 with an intake of 60 students. The department is having state- of-the-art computing facilities with high speed internet facilities and laboratories. The department library provides useful resources like books and journals. The department has well qualified and experienced teaching faculty. The department has been conducting several faculty development programs and student training programs.

Vision of the Institution

To be an institute of excellence in technical education and research to serve the needs of the industry and society at local and global levels.

Mission of the Institution

- To provide a high quality educational experience for students with values and ethics that enables them to become leaders in their chosen professions.
- To explore, create and develop innovations in engineering and science through research and development activities.
- To provide beneficial service to the national and multinational industries and communities through educational, technical, and professional activities

Vision of the Department

- To become a premier department in Computer education, research and to prepare highly competent IT professionals to serve industry and society at local and global levels.

Mission of the Department

- To impart high quality professional education to become a leader in Computer Science and Engineering.
- To achieve excellence in Research for contributing to the development of the society.
- To inculcate professional and ethical behaviour to serve the industry.

Program Educational Objectives (PEO):

PEO1:	To prepare graduates with core competencies in mathematical and engineering fundamentals to solve and analyze computer science and engineering problems
PEO2:	To adapt to evolving technologies and tools for serving the society
PEO3:	To perform as team leader, effective communicator and socially responsible computer professional in multidisciplinary fields following ethical values
PEO4:	To encourage students to pursue higher studies, engage in research and to become entrepreneurs

Program Outcomes:

- 01. Engineering knowledge:** Apply the knowledge of mathematics, science, engineering fundamentals, and an engineering specialization to the solution of complex engineering problems.
- 02. Problem analysis:** Identify, formulate, review research literature, and analyze complex engineering problems reaching substantiated conclusions using first principles of mathematics, natural sciences, and engineering sciences.
- 03. Design/development of solutions:** Design solutions for complex engineering problems and design system components or processes that meet the specified needs with appropriate consideration for the public health and safety, and the cultural, societal, and environmental considerations.
- 04. Conduct investigations of complex problems:** Use research-based knowledge and research methods including design of experiments, analysis and interpretation of data, and synthesis of the information to provide valid conclusions.
- 05. Modern tool usage:** Create, select, and apply appropriate techniques, resources, and modern engineering and IT tools including prediction and modelling to complex engineering activities with an understanding of the limitations.
- 06. The engineer and society:** Apply reasoning informed by the contextual knowledge to assess societal, health, safety, legal and cultural issues and the consequent responsibilities relevant to the professional engineering practice.
- 07. Environment and sustainability:** Understand the impact of the professional engineering solutions in societal and environmental contexts, and demonstrate the knowledge of, and need for sustainable development.
- 08. Ethics:** Apply ethical principles and commit to professional ethics and responsibilities and norms of the engineering practice.
- 09. Individual and team work:** Function effectively as an individual, and as a member or leader in diverse teams, and in multidisciplinary settings.
- 10. Communication:** Communicate effectively on complex engineering activities with the engineering community and with society at large, such as, being able to comprehend and write effective reports and design documentation, make effective presentations, and give and receive clear instructions.
- 11. Project management and finance:** Demonstrate knowledge and understanding of the engineering and management principles and apply these to one's own work, as a member and leader in a team, to manage projects and in multidisciplinary environments.
- 12. Life-long learning:** Recognize the need for, and have the preparation and ability to engage in independent and life-long learning in the broadest context of technological change.

Program Specific Outcomes (PSOs):

PSO1:	Acquire competency in hardware and software working principles to analyze and solve computing problems.
PSO2:	Design quality software to develop scientific and business applications following Software Engineering practices.
PSO3:	Apply cutting edge technologies using modern tools to find novel solutions ethically to existing problems.

SCHEME OF TEACHING FOR VI SEMESTER – 21 SERIES for Academic year 2023-2024

Sl. No	Course and Course Code		Course Title	Teaching Hours/Week				Examination				Credits
				Theory Lecture (L)	Tutorial (T)	Practical	Self-Study (S)	Duration in hours	CIE Marks	SEE Marks	Total Marks	
1	HSMC	21HU61	Entrepreneurship, Management and Finance	3	0	0	0	3	50	50	100	3
2	IPCC	21CG62	Compiler design and System Software	3	0	2	0	3	50	50	100	4
3	PCC	21CG63	Artificial Intelligence and Machine Learning	3	0	0	0	3	50	50	100	3
4	PEC	21CG64x	Professional Elective -I	3	0	0	0	3	50	50	100	3
5	OEC	21CG65OEx	Open Elective-I	3	0	0	0	3	50	50	100	3
6	PCCL	21CGL66	Artificial Intelligence and Machine Learning lab	0	0	2	0	3	50	50	100	1
7	MP	21CGMP67	Mini Project	0	0	2	0	0	50	0	50	2
8	INT	21INT68	Research/ Industrial Internship	Completed during the intervening period of IV and V semesters.				0	50	0	50	3
			Total	15	0	6	0	18	400	300	700	22

Professional Elective-I	
21CG641	Multimedia and Virtual Reality
21CG642	Design of IOT system
21CG643	Computer Graphics and Fundamentals of Image Processing

Open Elective-I	
21CG65OE1	Digital Forensics

AUTONOMOUS SYLLABUS FOR B.E VI SEMESTER 2023-2024

Course Title: ENTREPRENEURSHIP, MANAGEMENT AND FINANCE		
Subject Code : 21HU61	Credits : 3	CIE: 50
Number of Lecture Hours/Week(L:T:P)	3:0:0 Hrs	SEE: 50
Total Number of Lecture Hours	42	SEE Hours: 03
Prerequisites: Nil		
<p>Course Objectives : To enable the students to obtain the basic knowledge about Entrepreneurship and Management and finance in the following topics:-</p> <ul style="list-style-type: none"> • The Meaning, Functions, Characteristics, Types, Role and Barriers of Entrepreneurship, • Government Support for Entrepreneurship • Management – Meaning, nature, characteristics, scope , functions, role etc and Engineers social responsibility and ethics • Preparation of Project and Source of Finance • Fundamentals of Financial Accounting • Personnel and Material Management, Inventory Control 		
MODULES		Teaching Hours
Module – I		
<p>ENTREPRENEUR: Meaning of Entrepreneur; Functions of an Entrepreneur; Characteristics of an entrepreneur, Types of Entrepreneur; Intrapreneurs – an emerging class ; Role of Entrepreneurs in economic development; Barriers to entrepreneurship, Government Support for Innovation and Entrepreneurship in India - Startup-India, Make-in-India, PMMY, AIM , STEP, BIRAC, Stand-up India, TREAD</p>		08 Hrs
Module - II		
<p>MANAGEMENT: Introduction – Meaning – nature and characteristics of Management, Scope and functional areas of management, Levels of Management, Henry Fayol - 14 Principles to Management , McKinsey’s 7-S Model, Management by objective(MBO) – Meaning, process of MBO, benefits and drawbacks of MBO</p>		09 Hrs
Module - III		
<p>PREPARATION OF PROJECT AND SOURCE OF FINANCE: PREPARATION OF PROJECT: Meaning of project; Project Identification; Project Selection; Project Report; Need and Significance of Report; Contents; SOURCE OF FINANCE: Long Term Sources(Equity, Preference, Debt Capital, Debentures, loan from Financial Institutions etc) and Short Term Source(Loan from commercial banks, Trade Credit, Customer Advances etc)</p>		08 Hrs
Module – IV		
<p>FUNDAMENTALS OF FINANCIAL ACCOUNTING: Definition, Scope and Functions of Accounting, Accounting Concepts and Conventions: Golden rules of Accounting, Final Accounts - Trading and Profit and Loss Account, Balance sheet</p>		09 Hrs

Module – V		
<p>PERSONNEL MANAGEMENT, MATERIAL MANAGEMENT AND INVENTORY CONTROL: PERSONNEL MANAGEMENT: Functions of Personnel Management, Recruitment, Selection and Training, Wages, Salary and Incentives.</p> <p>MATERIAL MANAGEMENT AND INVENTORY CONTROL: Meaning, Scope and Objects of Material Management. Inventory Control- Meaning and Functions of Inventory control ; Economic Order Quantity(EOQ) and various stock level (Re-order level, Minimum level, Maximum level, Average level and Danger level)</p>		08 Hrs
<p>Question paper pattern: The question paper will have ten questions. There will be 2 questions from each module, covering all the topics from a module. The students will have to answer 5 full questions, selecting one full question from each module.</p>		
<p>Text book:</p> <ol style="list-style-type: none"> 1. Financial Accounting -B S RAMAN- United Publishers Manglore, Maheswar S N & Maheswari S K-Vikas Publishing House. January 2018 2. Management & Entrepreneurship- K R Phaneesh- Sudha Publications January 2018 ,Prof Manjunatha & Amit kumar G – laxmi Publication , January 2011. Veerbhadrappa Havina - Published by New Age International (P) Ltd., 2009. 3. Principles of Management First Edition (English, G. Murugesan), Laxmi Publications – New Delhi 4. Management by Objectives (Mbo) in Enterprises: 21 December 2018 by Dr Wazir Ali Khan 		
<p>Reference Books:</p> <ol style="list-style-type: none"> 1. Industrial Organization & Engineering Economics-T R Banga & S C Sharma- Khanna Publishers, Dehli. 2. NPTEL : ENTREPRENEURSHIP: PROF. C BHAKTAVATSALA RAO Department of Management Studies IIT Madras https://nptel.ac.in/courses/110/106/110106141/ 3. https://www.businessmanagementideas.com/notes/management-notes/notes-on-management-in-an-organisation/4669 4. https://vskub.ac.in/wp-content/uploads/2020/04/Unit-5-ppmb.pdf 		
<p>Course outcomes: On completion of the course, the student will have the ability to:</p>		
Course code	CO #	Course Outcome (CO)
21HU61	CO1	Develop Entrepreneurship skills
	CO2	Apply the concepts of management and Management By Objective(MBO)
	CO3	Prepare project report & choose different Source of Finance.
	CO4	Apply Fundamentals of Financial Accounting and interpret the final accounts
	CO5	Apply personnel management skills, Material and inventory control techniques

Course Title: COMPILER DESIGN AND SYSTEM SOFTWARE (IPCC)		
Subject Code: 21CG62	Credits:03	CIE:50
Number of Lecture Hours/Week(L:T:P)	3:0:2 Hrs	SEE:50
Total Number of Lecture Hours	42	SEE Hours:03
Prerequisites :Nil		
Course Objectives : <ul style="list-style-type: none"> • Understand the Process involved in constructing compilers. • Understand various types of parsers, intermediate code generation, Target code generation, Optimization of target code. 		
MODULES		Teaching Hours
Module-I		
Introduction: Language Processors , The Structure of a Compiler, The Science of Building a Compiler, Applications of Compiler Technology. Simple Syntax directed Translator: Syntax Definition, Syntax Directed Translation, A translator for simple Expressions, Symbol Tables , Intermediate code generation. Lexical Analysis: the Role of Lexical Analyzer, Input buffering, specification of tokens, reorganization of tokens, the lexical analyzer generator Lex .		08 Hrs
Module-II		
Syntax Analysis: Introduction to Recursive-Descent, Top-Down parsing, Bottom-Up parsing, LL(1),Shift/Reduce , Operator Precedence, LR(0), SLR(1), LR(1), SLAR(1) and LALR(1) parsers, Parser generators-Yacc.		08 Hrs
Module- III		
Syntax Directed Translation: Syntax directed definitions, Evaluation orders for SDDs, Applications of syntax directed translation, Syntax directed Translations schemes. Intermediate code generation: Variants of syntax trees, three address code, pipes and declarations, translations of expression, Type checking, Control flow, Back patching, Switch statements, Intermediate code for processors.		09 Hrs
Module- IV		
Code Generation : Issues in the design of code generator, The target language, Address in the target code, Basic blocks and flow graphs, Optimization of basic blocks, A simple code generator, Peephole optimization, register allocation and assignment, Instructions selection by tree rewriting, Optimal code generation for expressions.		08 Hrs
Module- V		
Assemblers: Basic Assembler Functions, Machine-Dependent Assembler Features, Machine-Independent Assembler Features, Assembler Design Options, Loaders and Linkers: Basic Loader Functions, Machine- Dependent Loaders Features, Machine-Independent Loader Features, Loader Design Option.		09 Hrs

List of Programs

PART- A

Execution of the following programs using LEX

1. Write a Program to count the number of vowels and consonants in a given string
2. Develop a Program to count the number of words, lines, characters and blanks in a given input.
3. Develop a Program to count number of
 - a) Positives and Negative integers
 - b) Positive negative fractions.
4. Write a Program to count the number of comment lines in a given C program.
5. Develop a Program to count the number of printf's and scanf's statements in a C program. Replace them with CIN and COUT or read and write statements.
6. Develop a Program to recognize a valid arithmetic expression and identify the identifiers and operators. Print them separately
7. Write a Program to recognize whether a given sentence is a simple or compound.
8. Write a Program to recognize and count the number identifiers in a given input file.
9. Develop a program for generating symbol table.

PART – B

Execution of the following programs using YACC

1. Write a Program to test the validity of a simple expression involving operators +, -, *, and /
2. Write a Program to recognize nested IF control statement and displays the number of levels of nesting.
3. Write a Program to recognize the grammar $\{ a^n b^n c^m, m, n \geq 0 \}$
4. Write a Program to recognize the validity of a variable which starts with a letter, followed by any number of letters or digits.
5. Write a Program to evaluate an arithmetic expression involving operators +, -, *, and /
6. Write a Program to recognize strings 'aaab', 'abbb', 'ab' and 'a'. Using the grammar $(a^n b^n, n \geq 0)$
7. Write a Program to recognize the grammar $\{ a^n b, n \geq 0 \}$
8. Write a C program to implement the syntax-directed definition of "if E then S1" and "if E then S1 else S2".
9. Write a yacc program that accepts a regular expression as input and produce its parse tree as output.

Question paper pattern:

The question paper will have ten questions.

There will be 2 questions from each module, covering all the topics from a module.

The students will have to answer 5 full questions, selecting one full question from each module.

Text book:

1. Alfred V Aho, Monica S. Lam, Ravi Sethi, Jeffrey D Ullman: Compilers - Principles, Techniques and Tools, 2nd Edition, Pearson, 2007.
2. Leland L. Beck, D. Manjula : System Software "An Introduction to System Programming", 3rd Edition 2008

Reference Books:

1. Kenneth C Loudon: Compiler Construction Principles & Practice, Cengage Learning, 1997
2. Andrew W Apple: Modern Compiler Implementation in C, Cambridge University Press, 1997
3. Charles N. Fischer, Richard J. leBlanc, Jr.: Crafting a Compiler with C, Pearson, 1991.

Course outcomes:**On completion of the course, the student will have the ability to:**

Course Code	CO#	Course Outcome(CO)
21CG62	CO1	Describe the Science of Building a Compiler, Specification and recognition of Tokens using Lexical Analyzer tool – Lex.
	CO2	Design and analyze of Top-Down, Bottom-up, LR, LALR parsers and usage of Yacc tool to build parsers.
	CO3	Understanding SDD, SDT schemes and describe techniques for intermediate code generation.
	CO4	Demonstrate techniques for simple and optimal machine code generators.
	CO5	Understanding basic functions of assemblers, Loaders and Linkers.

Course Title: ARTIFICIAL INTELLIGENCE AND MACHINE LEARNING		
Subject Code: 21CG63	Credit :03	CIE: 50
Number of Lecture Hours/Week(L:T:P)	3:0:0 Hrs	SEE: 50
Total Number of Lecture Hours	42	SEE Hours: 03
Prerequisites: Discrete Mathematics, Statistics.		
Course Objectives: <ul style="list-style-type: none"> • To Apply a given AI technique to a given concrete problem • To Implement non-trivial AI techniques in a relatively large system • To understand uncertainty and Problem-solving techniques. • To understand various symbolic knowledge representation to specify domains and reasoning tasks of a situated software agent. • Acquiring the fundamentals of machine learning • Usage of various learning methods to develop an intelligent machine. 		
MODULES		Teaching Hours
Module I Artificial Intelligence: The AI Problems, The Underlying assumption, AI Technique, The Level of the model, Criteria for success. Problems, problem spaces, and search: Defining, the problem as a state space search, Production systems, Problem characteristics, Production system characteristics, Issues in the design of search programs. Heuristic search techniques: Generate-and-test, Hill climbing, Best-first search, Problem reduction.		09 Hrs
Module II Knowledge representation issues: Representations and mappings, Approaches to knowledge representation, Issues in knowledge representation, the frame problem. Using predicate logic: Representing simple facts in logic, representing instance and ISA relationships, Computable functions and predicates, Resolution, Natural Deduction Representing Knowledge Using Rules: Procedural versus Declarative knowledge, Logic programming, forward versus backward reasoning, matching, control knowledge.		08 Hrs
Module III Well posed learning problems, Designing a Learning system, Perspective and Issues in Machine Learning. Concept Learning: Concept learning task, Concept learning as search, Find-S algorithm, Version space, Candidate Elimination algorithm, Inductive Bias.		08 Hrs
Module – IV Decision Tree Learning: Decision tree representation, Appropriate problems for decision tree learning, Basic decision tree learning algorithm, hypothesis space searching decision tree learning, Inductive bias in decision tree learning, Issues in decision tree learning. Artificial Neural Networks: Introduction, Neural Network representation, Appropriate problems, Perceptrons, Multilayer networks and the Back propagation algorithm.		09 Hrs

Module V		08 Hrs
<p>Instance Based Learning: Introduction, k-nearest neighbour learning, locally weighted regression, radial basis function, cased-based reasoning. Bayesian Learning: Introduction, Bayes theorem, Bayes theorem and concept learning, ML and LS error hypothesis, ML for predicting probabilities, MDL principle, Naive Bayes classifier, Bayesian belief networks, EM algorithm.</p>		
<p>Question paper pattern: The question paper will have ten questions. There will be 2 questions from each module, covering all the topics from a module. The students will have to answer 5 full questions, selecting one full question from each module.</p>		
<p>TEXT BOOKS:</p> <ol style="list-style-type: none"> 1. Elaine Rich and Kevin Knight, “Artificial Intelligence”, Tata McGraw-Hill, 3rd Edition 2008 2. Tom M. Mitchell, “<i>Machine Learning</i>”, Indian Edition Paperback 2017, McGraw Hill Education. 		
<p>REFERENCES:</p> <ol style="list-style-type: none"> 1. Nils J. Nilsson, “Artificial Intelligence: A new Synthesis”, Harcourt Asia Pvt. Ltd. 2. George F. Luger, “Artificial Intelligence-Structures and Strategies for Complex Problem Solving”, Pearson Education/ PHI. 3. Trevor “<i>The Elements of Statistical Learning</i>”, 2nd edition, 2017, Springer series in statistics. Hastie, Robert Tibshirani, Jerome Friedman 4. Ethem Alpaydın, “<i>Introduction to machine learning</i>”, Third Edition, PHI Learning Pvt. Ltd. 2015 		
<p>Course outcomes: On completion of the course, the student will have the ability to:</p>		
Course Code	CO #	Course Outcome (CO)
21CG63	CO1	Discuss artificial intelligence techniques, problem and heuristic search algorithm
	CO2	Apply knowledge representation techniques and predicate Logic rules to solve reasoning programs.
	CO3	Identify the problems for machine learning.
	CO4	Apply supervised/ unsupervised learning for the given problem and Explain theory of probability and statistics related to machine learning.
	CO5	Estimate target function using Instance based learning

COURSE TITLE: MULTIMEDIA AND VIRTUAL REALITY		
Subject Code : 21CG641	Credit : 3	CIE: 50
Number of Lecture Hours/Week (L:T:P)	3:0:0 Hrs	SEE: 50
Total Number of Lecture Hours	42	SEE Hours: 03
Pre-requisites: Computer Networks.		
Course objectives: This course will enable students to <ul style="list-style-type: none"> • Define the Multimedia Communication Models • Explain Multimedia Transport in Wireless Networks • Solve the Security issues in multimedia networks • Illustrate technology used in virtual reality 		
Modules		Teaching Hours
Module I Multimedia Communications: Introduction, Multimedia information representation, multimedia networks, multimedia applications, Application and networking terminology, Network QoS and application QoS, Digitization principles		08 Hrs
Module II Information Representation : Text, images, audio and video Text and Image Compression: Introduction, Compression principles, text compression, image Compression.		08 Hrs
Module III Audio: Introduction, Audio compression, Video compression standards: H.261, H.263, MPEG, MPEG 1, MPEG 2, MPEG-4 and Reversible VLCs, MPEG 7 standardization process of multimedia content description, MPEG 21 multimedia framework.		09 Hrs
Module IV Defining Virtual Reality, Four Key Elements of Virtual Reality Experience, VR the Medium, Communicating through a Medium, A Medium's Content: A Virtual World, Ideas Transmission, Common Issues of Human Communication Media, Narrative: Immobile versus Interactive, Form and Genre, Experience Versus Information, The Role of Artists and Technologists Case Study: NICE - An Educational Experience, Crumbs - A Tool for Scientific Visualization.		08 Hrs
Module V Interface to the Virtual World-Input: user Monitoring (User Input to the Virtual World), World Monitoring (Dynamic Input to the Virtual World) Interface to the Virtual World-Output: Visual Displays, Aural Displays, Haptic Displays, Vestibular and Other Senses Case Study: Boeing Wire Bundles - An Augmented Reality System Placeholder- An Artistic Exploration		09 Hrs
Question paper pattern: The question paper will have ten questions. There will be 2 questions from each module, covering all the topics from a module. The students will have to answer 5 full questions, selecting one full question from each module.		
Text books: <ol style="list-style-type: none"> 1. Multimedia Communications- Fred Halsall, Pearson Education, 2001, ISBN - 9788131709948. 2. Understanding Virtual Reality: Interface, Application and Design – William R. Sherman, 		

Alan B , Morgan Kaufmann Publishers, 2003

Reference Books:

1. Multimedia: Computing, Communications and Applications- Raif steinmetz, Klara Nahrstedt, Pearson Education,2002.ISBN- 978817758Alberto Leon-Garcia and Indra
2. Virtual Reality Technology, Grigore C. Burdea, Philippe Coiffet, Wiley, 2nd Edition, ISBN: 978-1-119-48572-8
3. VIRTUAL REALITY, By Steven M. LaValle. Cambridge University Press, 2023

Course outcomes:

On completion of the course, the student will have the ability to:

Course Code	CO #	Course Outcome (CO)
21CG641	CO1	Analyse different media types to represent them in digital form and Networking terminologies
	CO2	Apply different representation and compression techniques on Text, Images
	CO3	Describe working of Audio, Video Compression standards and characteristics of digital communication
	CO4	Describe Virtual reality, key components and Communication media
	CO5	Describe technology used in Virtual reality for Input output and Case Study

Course Title: DESIGN OF IOT SYSTEM		
SubjectCode: 21CG642	Credits:03	CIE:50
Number of Lecture Hours/Week (L:T:P)	3:0:0 Hrs	SEE:50
Total Number of Lecture Hours	42	SEE Hours:03
Prerequisites: Microprocessors and Microcontrollers		
Course Objectives:		
<ul style="list-style-type: none"> • Understand basics of embedded systems and their design concepts • Introduce IoT technology and its communication mechanisms • Understand programming IoT development boards like Arduino and Raspberry pi • Acquire the data with sensors and perform data analysis 		
MODULES		Teaching Hours
Module I		
Introduction to Embedded Systems, Processor Embedded into a System, Embedded Hardware Units and Devices in a System, Embedded Software in a System ,Examples of Embedded Systems ,Embedded System-on-chip (So) and Use of VLSI Circuit Design Technology, Complex Systems Design and Processors, Design Process in Embedded System, Formalization of System Design, Design Process and Design Examples, Classification of Embedded Systems, Skills required for an Embedded system designer.		09 Hrs
Module II		
IoT, Genesis of IoT, IoT and Digitization, IoT Impact, Convergence of IT and IoT, IoT Challenges, IoT Network Architecture and Design, Drivers Behind new Network Architectures, Comparing IoT Architectures ,A Simplified IoT Architecture, The Core IoT Functional Stack, IoT Data Management and Compute Stack.		08 Hrs
Module III		
Smart Objects: The “Things” in IoT, Sensors, Actuators and Smart Objects, Sensor Networks, Connecting Smart Objects, Communications Criteria, IoT Access Technologies: IEEE802.15.4, IEEE802.15.4g, IEEE802.15.4e and 19012a, IP as the IoT Network Layer, The Business Case for IP, The need for Optimization, Optimizing IP from 6LoWPAN to 7Lo. Application Layer Protocols: Generic Web based protocols, COAP, MQTT protocol.		09 Hrs
Module IV		
Data and Analytics for IoT, An Introduction to Data Analytics for IoT, Machine Learning, Big Data Analytic Tools and Technology, Edge Streaming Analytic, Network Analytics, Securing IoT. Introduction to Arduino, Arduino UNO, Installing the Software, Fundamentals of Arduino Programming.		08 Hrs
Module V		
Raspberry Pi: Introduction to Raspberry Pi, About the Raspberry Pi Board: Hardware Layout, Operating Systems on Raspberry Pi, Configuring Raspberry Pi, Programming Raspberry Pi with Python, Wireless Temperature Monitoring System Using Pi, DS18B20 Temperature Sensor, Storing data into remote data server.		08 Hrs

Question paper pattern:

The question paper will have ten questions.

There will be 2 questions from each module, covering all the topics from a module.

The students will have to answer 5 full questions, selecting one full question from each module.

Text Books:

1. Rajkamal, “Embedded System Architecture, Programming and Design”, second edition Tata McGraw- Hill publishing company limited.
2. David Hanes, Gonzalo Salgueiro, Patrick Grossetete, Robert Barton, Jerome Henry, “IoT Fundamentals: Networking Technologies, Protocols, and Use Cases for the Internet of Things”, 1st Edition, Pearson.
3. Srinivasa K G, “Internet of Things”, CENGAGE Learning India, 2017
4. Internet Of Things A hands on Approach, Arashdeep Bhaga, Vijay Madiseeti

Reference Books:

1. Vijay Madisetti and Arshdeep Bahga, “Internet of Things (A Hands-on Approach)”, 1st Edition, VPT, 2014.
2. RajKamal, “Internet of Things: Architecture and Design Principles”, 1st Edition, Mc Graw Hill Education, 2017.

Course outcomes:

On completion of the course, the student will have the ability to:

Course Code	CO#	Course Outcome(CO)
21CG642	CO1	Understanding embedded system and its classification.
	CO2	Illustrate the impact and challenges posed by IoT networks leading to new architectural models.
	CO3	Deployment of smart objects and the technologies to connect them to network and its protocols for efficient network communication.
	CO4	Describe the need for Data analytics and Security in IoT. Understand Arduino board and programming and developing simple projects using Arduino UNO board.
	CO5	Understand Raspberry pi board and programming and develop simple projects using Raspberry pi and sensors.

COURSE TITLE: COMPUTER GRAPHICS AND FUNDAMENTALS OF IMAGE PROCESSING		
Subject Code: 21CG643	Credits:03	CIE:50
Number of Lecture Hours/Week (L:T:P)	3:0:0 Hrs	SEE:50
Total Number of Lecture Hours	42	SEE Hours:03
Prerequisites:		
Course Objectives:		
<ul style="list-style-type: none"> • Identity and explain the core concepts of computer graphics. • Apply graphics programming techniques and create effective OpenGL programs. • To Study the Image fundamental and mathematical transformations necessary for image processing. • Understand the image enhancement techniques, image restoration and segmentation techniques. 		
MODULES		Teaching Hours
<p style="text-align: center;">Module-I</p> <p>Basics of Computer Graphics and OpenGL: Computer Graphics: Basics of computer graphics, Application of Computer Graphics, Video Display Devices, graphics software. OpenGL: Introduction to OpenGL ,coordinate reference frames, specifying two-dimensional world coordinate reference frames in OpenGL, OpenGL point functions, OpenGL line functions, point attributes, line attributes, curve attributes, OpenGL point attribute functions, OpenGL line attribute functions, Line drawing algorithms(DDA, Bresenham's), circle generation algorithms (Bresenham's).</p>		09 Hrs
<p style="text-align: center;">Module-II</p> <p>Fill area Primitives, 2D Geometric Transformations and 2D viewing : Fill area Primitives: Polygon fill-areas, OpenGL polygon fill area functions, fill area attributes, general scan line polygon fill algorithm, OpenGL fill-area attribute functions. 2DGeometric Transformations: Basic 2D Geometric Transformations, matrix representations and homogeneous coordinates. Inverse transformations, 2DComposite transformations, other 2D transformations, raster methods for geometric transformations, OpenGL raster transformations, OpenGL geometric transformations function, 2D viewing: 2D viewing pipeline, OpenGL 2D viewing functions.</p>		09 Hrs
<p style="text-align: center;">Module-III</p> <p>Digital Image Fundamentals: Introduction to Digital Image Processing, Examples of fields that use DIP, Fundamental Steps in Digital Image Processing, Image Sensing and Acquisition: image acquisition using a single sensing element, image acquisition using sensor strips, image acquisition using sensor arrays, a simple image formation model, Image Sampling and Quantization: basic concepts in sampling and quantization, representing digital images, Some Basic Relationships between Pixels.</p>		08 Hrs
<p style="text-align: center;">Module-IV</p> <p>Image Enhancement in the Spatial Domain: Basics of intensity transformations and spatial filtering, Some Basic Intensity Transformation Functions, Histogram Processing: Histogram equalization, and Matching, Fundamentals of Spatial Filtering, Smoothing Spatial Filters, Sharpening Spatial Filters,</p> <p>Frequency Domain: Preliminary Concepts, The Discrete Fourier Transform (DFT) of One variable, The Discrete Fourier Transform (DFT) of Two Variables.</p>		08 Hrs
<p style="text-align: center;">Module-V</p> <p>Restoration: A model of the image degradation/restoration process , Noise models, Restoration in the Presence of Noise Only using Spatial Filtering and</p>		08 Hrs

Frequency Domain Filtering Image segmentation: Detection of discontinuities, edge linking and boundary detection, Thresholding, Region based		
Question paper pattern: The question paper will have ten questions. There will be 2 questions from each module, covering all the topics from a module. The students will have to answer 5 full questions, selecting one full question from each module.		
Text Books: 1. Donald Hearn & Pauline Baker: Computer Graphics with OpenGL Version,3rd / 4th Edition, Pearson Education,2011 2. Gonzalez and. Richard E. Woods' Digital Image Processing , Fourth Edition, Global Edition 2018.		
Reference Books: 1. Digital Image Processing- S.Jayaraman, S. Esakkirajan,T. Veerakumar, Tata Mc Graw Hill 2014. 2. Digital Image Processing (with Matlab and Labview), Vipul Singh, Elsevier.Filip learning 3. William M Newman and Robert F Sproull, Principles of Interactive Computer Graphics, McGraw Hill, 2001.		
Course outcomes: On completion of the course, the student will have the ability to:		
Course Code	CO#	Course Outcome (CO)
21CG643	CO1	Describe the basics of Computer Graphics and OpenGL.
	CO2	Illustrate 2D Transformations and Viewing.
	CO3	Describe the fundamentals concepts of digital image processing
	CO4	Demonstrate the techniques for Image enhancement in Spatial and frequency domain.
	CO5	Analyze Images restoration and Segmentation operations.

Course Title: DIGITAL FORENSICS		
Subject Code :21CG65OE1	Credit :3	CIE: 50
Number of Lecture Hours/Week(L:T:P)	3:0:0 Hrs	SEE: 50
Total Number of Lecture Hours	42	SEE Hours: 03
Prerequisites: Nil		
<p>Course Objectives: This course will enable students to</p> <ul style="list-style-type: none"> To explore the basic digital forensics and techniques for conducting the forensic examination on different digital devices. To understand how to examine digital evidences such as the data acquisition, identification analysis. 		
MODULES		Teaching Hours
Module I		09 Hrs
<p>Understanding Incident Response: The IR process, The role of digital forensics, The IR frame work, The IR charter, CSIRT team, The IR plan, Incident classification, The IR playbook/handbook ,Escalation process, Testing the IR framework</p> <p>Managing Cyber Incidents: Engaging the incident response team, CSIRT engagement models, Investigating incidents, The CSIRT war room, Communications, Rotating staff, SOAR, Incorporating crisis communications, Internal communications, External communications, Public notification, Incorporating containment strategies</p> <p>Getting back to normal eradication, recovery, and post-incident activity</p> <p>Fundamentals of Digital Forensics: An overview of forensic science, Locardas exchange principle ,Legal issues in digital forensics, Law and regulations, Rules of evidence, Forensic procedures in incident response ,A brief history of digital forensics, The digital forensics process, The digital forensics lab.</p>		
Module II		08 Hrs
<p>Investigation Methodology: An intrusion analysis case study: The Cuckooâs Egg, Types of incident investigation analysis, Functional digital forensic investigation methodology, Identification and scoping, Collecting evidence, The initial event analysis, The preliminary correlation, Event normalization, Event deconfliction, The second correlation, The timeline, Kill chain analysis, Reporting, The cyber kill chain, The diamond model of intrusion analysis, Diamond model axioms, A combined diamond model and kill chain intrusion analysis, Attribution</p> <p>Collecting Network Evidence: An overview of network evidence, Preparation, A network diagram, Configuration, Firewalls and proxy logs, Firewalls, Web application firewalls, Web proxy servers ,NetFlow,, Packet capture, tcpdump, WinPcap and RawCap, ,Evidence collection</p>		
Module III		08 Hrs
<p>Acquiring Host-Based Evidence: Preparation, Order of volatility, Evidence acquisition, Evidence collection procedures, Acquiring volatile memory, FTK Imager, WinPmem, RAM Capturer, Virtual systems, Acquiring non-volatile evidence, FTK obtaining protected files, The CyLR response tool</p> <p>Kroll Artifact Parser and Extractor</p> <p>Remote Evidence Collection: Enterprise incident response challenges,</p>		

<p>Endpoint detection and response, Velociraptor overview and deployment, Velociraptor server, Velociraptor Windows collector, Velociraptor scenarios, Velociraptor evidence collection, CyLR, WinPmem.</p> <p>Forensic Imaging: Understanding forensic imaging, Image versus copy, Logical versus physical volumes, Types of image files, SSD versus HDD, Tools for imaging, Preparing a staging drive, Using write blockers, Imaging techniques, Dead imaging, Live imaging, Virtual systems, Linux imaging.</p>	
<p style="text-align: center;">Module IV</p> <p>Analyzing Network Evidence: Network evidence overview, Analyzing firewall and proxy logs, SIEM tools, The Elastic Stack, Analyzing NetFlow, Analyzing packet captures, Command-line tools, Real Intelligence Threat Analytics, Network Miner, Arkime, Wireshark</p> <p>Analyzing System Memory: Memory analysis overview, Memory analysis methodology, SANS six-part methodology, Network connections methodology, Memory analysis tools, Memory analysis with Volatility, Volatility Workbench, Memory analysis with Strings, Installing Strings, Common Strings searches</p> <p>Analyzing System Storage: Forensic platforms, Autopsy, Installing Autopsy, Starting a case, Adding evidence, Navigating Autopsy, Examining a case, Master File Table analysis, Prefetch analysis, Registry analysis</p> <p>Analyzing Log Files: Logs and log management, Working with SIEMs, Splunk, Elastic Stack, Security Onion, Windows Logs, Windows Event Logs, Analyzing Windows Event Logs, Acquisition, Triage, Detailed Event Log analysis.</p>	09 Hrs
<p style="text-align: center;">Module V</p> <p>Writing the Incident Report: Documentation overview, What to document, Types of documentation, Sources, Audience, Executive summary, Incident investigation report, Forensic report, Preparing the incident and forensic report, Note-taking, Report language</p> <p>Ransom ware Preparation and Response :History of ransom ware: Crypto Locker, CryptoWall, CTB-Locker, Tesla Crypt, Sam Sam: Locky, Wanna Cry, Ryuk, Conti ransom ware case study: Background, Operational disclosure, Tactics and techniques, Exfiltration, Impact, Proper ransom ware preparation, Ransom ware resiliency, Prepping the CSIRT, Eradication and recovery, Containment, Eradication, Recovery</p> <p>Ransomware Investigations: Ransom ware initial access and execution, Initial access, Execution, Discovering credential access and theft, Proc Dump, Mimikatz, Investigating post-exploitation frameworks, Command and Control, Security Onion ,RITA, Arkime, Investigating lateral movement techniques.</p>	08 Hrs
<p>Question paper pattern: The question paper will have ten questions. There will be 2 questions from each module, covering all the topics from a module. The students will have to answer 5 full questions, selecting one full question from each module.</p>	
<p>Text books:</p> <ol style="list-style-type: none"> Gerard johansen, Digital Forensics and Incident Response: Incident response techniques and procedures to respond to modern cyber threats, 2nd Edition 	
<p>Reference Books:</p> <ol style="list-style-type: none"> Vacca, J, <i>Computer Forensics, Computer Crime Scene Investigation</i>, 2nd Ed, Charles River Media, 2005, ISBN: 1-58450-389. 	

Course outcomes: On completion of the course, the student will have the ability to:		
Course Code	CO #	Course Outcome (CO)
21CG65OE1	CO1	Understand process of IR and study fundamental of digital forensics
	CO2	Describe the process of conducting intrusion analysis and collection of network evidence
	CO3	Explore tools for evidence collection and forensic images.
	CO4	Analyze digital evidence and examine various aspects of analyzing system memory, storage and log files
	CO5	Prepare incident report study tools and tech by Ramsomware.

Course Title: ARTIFICIAL INTELLIGENCE AND MACHINE LEARNING LAB		
Subject Code : 21CGL66	Credit :01	CIE: 50
Number of Practical Hours/Week/batch(L:T:P)	0:0:2 Hrs	SEE: 50
		SEE Hours: 03
Prerequisites: Discrete Mathematics ,Statistics, Java/Python Programming		
Course Objectives:		
Learn implementation and applications of Artificial Intelligence Algorithms.		
Learn implementation and applications of Machine Learning Algorithms.		
Understand the usage of various datasets for implementing ML Algorithms.		
PROGRAMS		
<ol style="list-style-type: none"> 1. Write a Program to Implement Tic-Tac-Toe game using Python. 2. Write a Program to implement 8-Puzzle problem using Python. 3. Write a Program to Implement Water-Jug problem using Python. 4. Write a Program to Implement AO* Algorithm using Python. 5. Implement and demonstrate the FIND-S algorithm for finding the most specific hypothesis based on a given set of training data samples. Read the training data from a .CSV file. 6. For a given set of training data examples stored in a .CSV file, implement and demonstrate the Candidate-Elimination algorithm to output a description of the set of all hypotheses consistent with the training examples. 7. Write a program to demonstrate the working of the decision tree based ID3 algorithm. 8. Use an appropriate data set for building the decision tree and apply this knowledge to classify a new sample. Build an Artificial Neural Network by implementing the Back propagation algorithm and test the same using appropriate datasets. 9. Write a program to construct a Bayesian network considering medical data. Use this model to demonstrate the diagnosis of heart patients using standard Heart Disease Data Set. You can use Java/Python ML library classes/API 10. Apply EM algorithm to cluster a set of data stored in a .CSV file. Use the same data set for clustering using k-Means algorithm. Compare the results of these two algorithms and comment on the quality of clustering. You can add Java/Python ML library classes/API in the program. 11. Write a program to implement k-Nearest Neighbour algorithm to classify the iris data set. Print both correct and wrong predictions. Java/Python ML library classes can be used for this problem. 12. Implement the non-parametric Locally Weighted Regression algorithm in order to fit data points. Select appropriate data set for your experiment and draw graphs. 		

Question paper pattern: For SEE, two programs from the Exercise programs list will be asked.

Course outcomes: On completion of the course, the student will have the ability to:

Course Code	CO #	Course Outcome (CO)
21CGL66	CO1	Understand the implementation procedures for the Artificial Intelligence algorithms.
	CO2	Design Python programs for various Learning algorithms.
	CO3	Apply appropriate data sets to the Machine Learning algorithms.
	CO4	Perform Classification and clustering of Data using ML algorithms.
	CO5	Apply Machine Learning algorithms to solve real world problems.

Course Title: MINI-PROJECT		
Subject Code: 21CGMP67	Credit:2	CIE: 50
Number of Practical Hours/Week(L:T:P)	0:0:2Hrs	
Pre-requisite: Programming languages, Operating Systems		
Course Objectives:		
<ul style="list-style-type: none"> • Acquire the ability to integrate different areas of knowledge and evaluate and formulate a problem • Acquire skills to communicate effectively and present their ideas and collaborate to work as a team. • Understand the procedure of documentation and presentation of Mini-project 		
Guidelines for Mini project:		
<ul style="list-style-type: none"> • Mini project is to be carried out individually or by a team of two to three students • Student has to carry out literature survey to identify and formulate the problem. • Student has to design and develop H/W or S/W model in any domain of Computer Science. • CIE evaluation will be done timely by a committee constituted by the department. The committee shall consist of respective guide and two faculty members. • At the end of the semester students have to prepare and submit a project report 		
Course outcomes:		
On completion of the course, the student will have the ability to:		
Course Code	CO#	Course Outcome(CO)
21CGMP67	CO1	Demonstrate skills to identify and formulate given problem
	CO2	Apply basic engineering knowledge learnt in developing system individually or in group
	CO3	Evaluate current research status by conducting literature survey
	CO4	Design and develop real time application
	CO5	Apply the programming skills in software development life cycle model for project implementation and well-organized report