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||Jai Sri Gurudev||

Sri Adichunchanagiri Shikshana Trust (R.)

# SJC INSTITUTE OF TECHNOLOGY

**An Autonomous Institution under VTU from 2024-25**

AICTE Approved, Accredited by NAAC with A+ Grade & NBA (CSE, ISE, ECE, ME & CV), NIRF-151-300 in 2023,Gold Rated by QS I-Gauge

P.B. No.20, B.B Road, Chickballapur - 562 101, Karnataka

Estd : 1986

# V Semester
# Scheme & Syllabus of B.E. Programme
# Computer Science & Design
# (2024 Scheme)

## Core Values

**S**piritual, **J**udicious, **C**ommitment, **I**ntegrity, **T**rustworthy



NATIONAL INSTITUTIONAL RANKING FRAMEWORK 151-300

NAAC A+

QS I-GAUGE GOLD

INSTITUTION'S INNOVATION COUNCIL 4-Star Rating



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Sri Adichunchanagiri Shikshana Trust (R.)

# SJC INSTITUTE OF TECHNOLOGY

(An Autonomus Institute Under VTU Belagavi & Approved by AICTE, New Delhi)

Accredited by NAAC with A+ Grade & NBA (CSE, ISE, ECE, ME & CV ), NIRF (151-300), QS-I Gauge GOLD Rated

Post Box #20, B.B. Road, Chikkaballapur - 562 101, Karnataka

Estd.:1986

## 5th Semester, B.E. programme

## Scheme of Teaching and Examinations 2024

Outcome-Based Education (OBE) and Choice-Based Credit System (CBCS) (Effective from the academic year 2026-27)

# SJC INSTITUTE OF TECHNOLOGY, CHIKKABALLAPURA

*An Autonomous Institution under VTU from 2024 – 2025*

**AICTE Approved, Accredited by NBA(CSE, ISE, ECE, ME, CV, AE) and NAAC with 'A+' grade, QS – I Gauge Gold Rated**

## SCHEME OF TEACHING AND EXAMINATION – B.E. – CSD

(Applicable for students admitted from the Academic Year 2024-25 and onwards)

**5th Semester**

### Computer Science and Design

| Sl. No. | Course Code | Course Title | Course Type | TD/ PSB | Teaching Hours / Week | | | Examination | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | L | T | P | SEE Duration (Hrs) | CIE Marks | SEE Marks | Total Marks | Credits |
| 1 | BCS501 | Software Engineering and Project Management | PCC | CSD | 3 | 0 | 0 | **3** | **50** | **50** | **100** | **3** |
| 2 | BCS502 | Computer Networks | IPCC | CSD | 3 | 0 | 2 | **3** | **50** | **50** | **100** | **4** |
| 3 | BCS503 | Theory of Computation | PCC | CSD | 3 | 2 | 0 | **3** | **50** | **50** | **100** | **4** |
| 4 | BCGL504 | Object Oriented Design Pattern Lab | PCCL | CSD | 0 | 0 | 2 | **3** | **50** | **50** | **100** | **1** |
| 5 | BXX525x | Professional Elective Course – I | PEC | CSD | 3 | 0 | 0 | **3** | **50** | **50** | **100** | **3** |
| 6 | BCG536 | Mini Project | PROJ | CSD | 0 | 0 | 4 | **3** | **50** | **50** | **100** | **2** |
| 7 | BRM507 | Research Methodology and IPR | AEC | CSD | 2 | 2 | 0 | **3** | **50** | **50** | **100** | **3** |
| 8 | BCE508 | Competency Enhancement Course-3 | NCMC | CDCAC | 0 | 2 | 0 | - | **100** | - | **100** | **0** |
| 9 | BNS509 | National Service Scheme (NSS) | NCMC | NSS Coordinator | 0 | 0 | 2 | - | **100** | - | **100** | **0** |
| | BPE509 | Physical Education (PE) (Sports and Athletics) | | Physical Education Director | | | | | | | | |
| | BYO509 | Yoga | | Yoga Teacher | | | | | | | | |
| | BMU509 | Music | | Music Teacher | | | | | | | | |
| | | | | | | | | | **550** | **350** | **900** | **20** |

ASC: Applied Science Course, PCC: Professional Core Course, IPCC: Integrated Professional Core Course, PCCL: Professional Core Course laboratory, UHV: Universal Human Value Course, NCMC: Non Credit Mandatory Course, AEC: Ability Enhancement Course, SEC: Skill Enhancement Course, ESC:

Engineering Science Course, ETC: Emerging Technology Course, PLC: Programming Language Course, L: Lecture, T: Tutorial, P: Practical, CIE: Continuous Internal Evaluation, SEE: Semester End Evaluation.

**Professional Elective Course-I**

| Course Code | Course Name | Course Code | Course Name |
|---|---|---|---|
| BCG525A | Video Processing | BCG525C | Multimedia System Design |
| BIS525B | Foundations of AI | BIS525D | Embedded Systems and Sensor Technology |

**Professional Core Course (IPCC):** Refers to Professional Core Course Theory Integrated with practicals of the same course. Credit for IPCC can be 04 and its Teaching– Learning hours (L : T : P) can be considered as (3 : 0 : 2) or (2 : 2 : 2). The theory part of the IPCC shall be evaluated both by CIE and SEE. The practical part shall be evaluated by only CIE (no SEE). However, questions from the practical part of IPCC shall be included in the SEE question paper. For more details, the regulation governing the Degree of Bachelor of Engineering (B.E.) 2024-25 may please be referred.

**National Service Scheme /Physical Education/Yoga/Music:** All students have to register for any one of the courses namely National Service Scheme, Physical Education , Yoga and Music with the concerned coordinator / teacher of the course during the first week of 3$^{rd}$ semester. Activities shall be carried out between 3$^{rd}$semester to the 6$^{th}$ semester (for 4 semesters). Successful completion of the registered course and requisite CIE score is mandatory for the award of the degree. The events shall be appropriately scheduled by the colleges and the same shall be reflected in the calendar prepared for the NSS, PE, Yoga and Music activities. These courses shall not be considered for vertical progression as well as for the calculation of SGPA and CGPA, but completion of the course is mandatory for the award of degree.

| Semester: V | | | | | |
|---|---|---|---|---|---|
| **Software Engineering and Project Management** | | | | | |
| **Course Code** | : | BCS501 | **Credits** | : | 3 |
| **Hours/Week(L:T:P)** | : | 3:0:0 | **CIE** | : | 50 Marks |
| **Total Hours** | : | 40Hrs | **SEE** | : | 50 Marks |
| **Course Type** | : | PCC | **SEE Duration** | : | 3 Hours |

| **Prerequisites:** | |
|---|---|
| **Courses** | Data Structures and Algorithms, Object-Oriented Programming |
| **Knowledge on Fundamental Concepts** | Analytical thinking, Critical thinking |
| **Knowledge on Connected Tools (If any)** | UML Tools Star UML, Debuggers |

| **Course Learning Objectives: This course will enable the students to** | |
|---|---|
| **CLO1** | Outline software engineering principles and activities involved in building large software programs. |
| **CLO2** | Illustrate the methods used for gathering, categorizing, documenting, and validating software requirements |
| **CLO3** | Understand the Unified Modeling Language (UML) and its application in software design. |
| **CLO4** | Analyze software requirements to design effective test cases. |
| **CLO5** | Identify software quality parameters and quantify software using measurements and metrics. List software quality standards and outline the practices involved. |

| **Module – 1** | **08Hrs** |
|---|---|
| **Introduction:**<br>Professional software development, Software engineering ethics, Case studies.<br>**Software Processes**: Software Process models: The Waterfall model – A Case study, Incremental development, Reuse-oriented software engineering, Process activities: Software specification, Software design and implementation, Software validation, Coping with Change: Prototyping, Incremental Delivery, Boehm's Spiral Model.<br><br>**Textbook 1: Ch. 1:** 1.1 to 1.3, **Ch. 2:** 2.1 to 2.3 | |
| **Module – 2** | **08Hrs** |
| **Requirements Engineering**: Functional and non-functional requirements: Functional requirements. Non-functional requirements, Introduction to Requirements specification.<br>**Agile Software Development:** Agile methods- Plan driven and Agile Development, Introduction to Extreme Programming.<br><br>**Textbook 1: Ch. 3:** 3.1 to 3.3, **Ch. 4:** 4.1 to 4.4 | |
| **Module – 3** | **08Hrs** |
| **Design and Implementation**: Object-oriented design using UML: System Context and Interaction, Architectural design, Object Class identification, design Models, Interface Specification, Design Patterns, Implementation issues, Open Source development.<br><br>**Textbook 1: Ch. 7:** 7.1 to 7.4 | |
| **Module – 4** | **08Hrs** |

| |
|---|
| **Software Testing**: Development Testing: Unit Testing, Choosing Unit Test Cases, Component Testing, System Testing, Test Driven Development, Release Testing: Requirements Based Testing, Scenario Testing, Performance Testing, User Testing. A Demo of Selenium.<br><br>**Textbook 1: Ch. 8:** 8.1 to 8.4 |

| **Module – 5** | **08Hrs** |
|---|---|
| **Introduction to Project Management:**<br>Introduction Project and Importance of Project Management, Contract Management, Activities Covered by Software Project Management, Plans, Methods and Methodologies, Some ways of categorizing Software Projects, Stakeholders, Setting Objectives, Business Case, Project Success and Failure, Management and Management Control, Project Management life cycle.<br><br>**Textbook 2: Ch. 1:**1.1 to 1.17 | |

| **Course Outcomes: After completing the course, the students will be able to** | |
|---|---|
| **CO1** | Interpret the basic principles and practices of Software Engineering. |
| **CO2** | Apply Software Engineering Design Techniques and practices for developing Software. |
| **CO3** | Integrate requirement analysis, design strategies, and testing techniques to develop high-quality software systems |
| **CO4** | Design Models for different phases of software development to solve real world problems |
| **CO5** | Develop Projects by Estimating cost and time required for developing the Software Product. |

| **Textbooks** | |
|---|---|
| **1** | "Software Engineering", Ian Summerville, 9th Edition, Pearson Education, 2017 ISBN-13. 978-0137035151. |
| **2** | "Software Project Management", Bob Hughes, Mike Cotterell, Rajib Mall, 6th Edition, McGraw Hill Education, 2017. ISBN 0077122798. |

| **Reference Books** | |
|---|---|
| **1** | "Software Engineering an Engineering approach", James F. Peters, Witold Pedrycz, John Wiley. ISBN: 978-0-471-18964-0 |
| **2** | "Software Engineering principles and practice", Waman S Jawadekar, The Mc Graw-Hill Companies. ISBN: 9780070583719 |
| **3** | "Fundamentals of object-oriented design using UML Meiler page", Jones: Pearson Education. ISBN: 817808344 |

| **Web links and Video Lectures ( e – Resources )** | |
|---|---|
| **1** | https://onlinecourses.nptel.ac.in/noc20_cs68/preview |
| **2** | https://onlinecourses.nptel.ac.in/noc24_mg01/preview |
| **3** | https://nptel.ac.in/courses/106101061 |

**CO – PO MAPPING**

| | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 |
|---|---|---|---|---|---|---|---|---|---|---|---|
| **CO1** | 2 | | | 1 | | | | | | | |
| **CO2** | 3 | | 2 | | 2 | | | | | 1 | 1 |
| **CO3** | | 3 | 3 | 1 | | | | | | 2 | 1 |
| **CO4** | | | | 3 | 3 | | | | | 1 | 2 |
| **CO5** | | | 2 | | | | | 1 | 2 | 2 | 1 |

| Semester: V | | | | | |
|---|---|---|---|---|---|
| **Computer Networks** | | | | | |
| **Course Code** | : | BCS502 | **Credits** | : | 4 |
| **Hours/Week(L:T:P)** | : | 3:0:2 | **CIE** | : | 50 Marks |
| **Total Hours** | : | 40L+20P | **SEE** | : | 50 Marks |
| **Course Type** | : | IPCC | **SEE Duration** | : | 3 Hours |

| **Prerequisites:** | |
|---|---|
| **Courses** | Digital fundamentals, Basics of communication System, Courses in Programming and IoT. |
| **Knowledge on Fundamental Concepts** | Data communication principles. |
| **Knowledge on Connected Tools (If any)** | Tools such as Eclipse and network simulation software (NS2).<br>(Optional Check for CISCO Packet Tracker) |

| **Course Learning Objectives: This course will enable the students to** | |
|---|---|
| **CLO1** | Understand the architecture and protocols in the OSI and TCP/IP models. |
| **CLO2** | Learn error detection, framing, and flow control techniques at the data link layer. |
| **CLO3** | Explore IP addressing, routing protocols, and functions of the network layer. |
| **CLO4** | Comprehend transport layer operations including TCP and UDP. |
| **CLO5** | Examine on application layer protocols such as HTTP, FTP, and DNS. |

| **Module – 1** | **08Hrs** |
|---|---|
| **Introduction:** Data Communications, Networks, Network Types, Networks Models: Protocol Layering, TCP/IP Protocol suite, The OSI model, Introduction to Physical Layer: Transmission media, Guided Media, Unguided Media: Wireless. Switching and its types (circuit switching).<br><br>**Textbook 1: Ch. 1:** 1.1 - 1.3, **Ch. 2:** 2.1 - 2.3, **Ch. 7:** 7.1 – 7.3, **Ch. 8:** 8.3. | |
| **Module – 2** | **08Hrs** |
| **Data Link Layer:** Error Detection and Correction: Introduction, Block Coding, Cyclic Codes. Data link control: DLC Services: Framing, Flow Control, Error Control, Connectionless and Connection Oriented, Data link layer protocols, High Level Data Link Control. Media Access Control: Random Access, Controlled Access. Check Sum and Point to Point Protocol.<br><br>**Textbook 1: Ch. 10:** 10.1-10.4, **Ch. 11:** 11.1 -11.4, **Ch. 12:** 12.1 - 12.2 | |
| **Module – 3** | **08Hrs** |
| **Network Layer:** Network layer Services, Packet Switching, IPv4 Address, IPv4 Datagram, IPv6 Datagram, Introduction to Routing Algorithms, Unicast Routing Protocols: DVR, LSR, PVR, Unicast Routing protocols: RIP, OSPF, BGP, Multicasting Routing-MOSPF<br><br>**Textbook 1: Ch. 18:** 18.1, 18.2, 18.4, **Ch. 20:** 20.1-20.3, **Ch. 21:** 21.3.2, **Ch. 22:** 22.2 | |
| **Module – 4** | **08Hrs** |

| |
|---|
| **Introduction to Transport Layer:** Introduction, Transport-Layer Protocols: Introduction, User Datagram Protocol, Transmission Control Protocol: services, features, segments, TCP connections, flow control, Error control, Congestion control.<br><br>**Textbook 1: Ch. 23:** 23.1- 23.2, **Ch. 24:** 24.1-24.3.4, 24.3.6-24.3.9 |

| **Module – 5** | **08Hrs** |
|---|---|
| **Introduction to Application Layer:** Introduction, Client-Server Programming, Standard Client Server Protocols: World Wide Web and HTTP, FTP, Electronic Mail, Domain Name System (DNS), TELNET, Secure Shell (SSH)<br><br>**Textbook 1: Ch. 25:** 25.1-25.2, **Ch. 26:** 26.1-26.6 | |

| **Course Outcomes: After completing the course, the students will be able to** | |
|---|---|
| **CO1** | Understand network models, transmission media, and switching techniques. |
| **CO2** | Apply data link layer concepts like error control, framing, flow control, and MAC protocols. |
| **CO3** | Implement network layer protocols, IP addressing, and routing algorithms. |
| **CO4** | Analyze transport layer protocols (TCP/UDP) and their control mechanisms. |
| **CO5** | Examine the application layer protocols and client-server architecture in network applications. |

| **Textbook** | |
|---|---|
| **1** | "Data Communications and Networking", Behrouz A. Forouzan, 5th Edition, Tata McGraw- Hill,2013. ISBN-10: 1259064751, ISBN-13: 978-1259064753 |

| **Reference Books** | |
|---|---|
| **1** | "Computer Networks – A Systems Approach", Larry L. Peterson and Bruce S. Davie, 4th Edition, Elsevier, 2019. ISBN-10:0-12-370548-7, ISBN-13: 978-0-12-370548-8. |
| **2** | "Computer and Communication Networks", 2nd Edition, Pearson Education, Nader F. Mir: 2015. ISBN-10: 0133814742, ISBN-13: 9780133814743 |
| **3** | "Data and Computer Communication", 10th Edition, William Stallings, Pearson Education, Inc., 2014. ISBN-13: 9780133506488 (Global). |

| **Web links and Video Lectures ( e – Resources )** | |
|---|---|
| **1** | https://www.digimat.in/nptel/courses/video/106105183/L01.html |
| **2** | http://www.digimat.in/nptel/courses/video/106105081/L25.html |
| **3** | https://nptel.ac.in/courses/106105183 |

**PRACTICAL COMPONENT OF IPCC**

| **Sl #** | **Experiments** |
|---|---|
| **1.** | Implement three nodes point – to – point network with duplex links between them. Set the queue size, vary the bandwidth, and find the number of packets dropped. |
| **2.** | Implement transmission of ping messages/trace route over a network topology consisting of 6 nodes and find the number of packets dropped due to congestion. |
| **3.** | Implement an Ethernet LAN using n nodes and set multiple traffic nodes and plot congestion window for different source / destination. |
| **4.** | Develop a program for error detecting code using CRC-CCITT (16- bits). |
| **5.** | Develop a program to implement a sliding window protocol in the data link layer. |

| | |
|---|---|
| **6.** | Develop a program to find the shortest path between vertices using the Bellman- Ford and path vector routing algorithm. |
| **7.** | Using TCP/IP sockets, write a client – server program to make the client send the file name and to make the server send back the contents of the requested file if present. |
| **8.** | Develop a program on a datagram socket for client/server to display the messages on client side, typed at the server side. |
| **9.** | Develop a program for a simple RSA algorithm to encrypt and decrypt the data. |
| **10.** | Develop a program for congestion control using a leaky bucket algorithm. |

**Note: Experiments 1-3 (NS2/NS3) and Experiments 4-10 (Eclipse)**

**CO – PO**

| | **PO1** | **PO2** | **PO3** | **PO4** | **PO5** | **PO6** | **PO7** | **PO8** | **PO9** | **PO10** | **PO11** |
|---|---|---|---|---|---|---|---|---|---|---|---|
| **CO1** | 3 | 2 | 1 | | | | | | | | |
| **CO2** | 3 | 3 | 2 | | 2 | | | | | | |
| **CO3** | 3 | 3 | 2 | 1 | 2 | | | | | | |
| **CO4** | 3 | 3 | 2 | 1 | 2 | | | | | | |
| **CO5** | 2 | 2 | | | 2 | | | | 2 | 2 | |

| **Semester: V** | | | | | |
|---|---|---|---|---|---|
| **Theory of Computation** | | | | | |
| **Course Code** | **:** | BCS503 | **Credits** | **:** | 4 |
| **Hours/Week(L:T:P)** | **:** | 3:2:0 | **CIE** | **:** | 50 Marks |
| **Total Hours** | **:** | 50Hrs | **SEE** | **:** | 50 Marks |
| **Course Type** | **:** | PCC | **SEE Duration** | **:** | 3 Hours |

| **Prerequisites:** | |
|---|---|
| **Courses** | Discrete Mathematics, Data Structures, Programming Languages, Algorithms |
| **Knowledge on Fundamental Concepts** | Set Theory, Graph Theory, Logical Thinking, Problem-Solving |
| **Knowledge on Connected Tools (If any)** | JFLAP (Java Formal Languages and Automata Package) |

| **Course Learning Objectives: This course will enable the students to** | |
|---|---|
| **CLO1** | Introduce core concepts in Automata and Theory of Computation. |
| **CLO2** | Identify different Formal Language Classes and their Relationships. |
| **CLO3** | Learn concepts of Grammars and Recognizers for different formal languages. |
| **CLO4** | Prove or disprove theorems in automata theory using their properties. |
| **CLO5** | Determine the decidability and intractability of computational problems |

| **Module – 1** | **10 Hrs** |
|---|---|
| Introduction to Finite Automata, Structural Representations, Automata and Complexity. The Central Concepts of Automata Theory. Deterministic Finite Automata, Nondeterministic Finite Automata, An Application: Text Search, Finite Automata with Epsilon-Transitions.<br><br>**Textbook 1: Ch. 1, Ch. 2.** | |
| **Module – 2** | **10 Hrs** |
| Regular Expressions, Finite Automata and Regular Expressions, Proving Languages not to be Regular. Closure Properties of Regular Languages, Equivalence and Minimization of Automata, Applications of Regular Expressions.<br><br>**Textbook 1: Ch. 3, Ch. 4.** | |
| **Module – 3** | **10 Hrs** |
| Context-Free Grammars, Parse Trees, Ambiguity in Grammars and Languages, Ambiguity in Grammars and Languages, Definition of the Pushdown Automaton, The Languages of a PDA, Equivalence of PDA's and CFG's, Deterministic Pushdown Automata.<br><br>**Textbook 1: Ch. 5, Ch. 6.** | |
| **Module – 4** | **10 Hrs** |
| Normal Forms for Context-Free Grammars, The Pumping Lemma for Context-Free Languages, Closure Properties of Context-Free Languages. | |

| **Textbook 1: Ch. 7.** | |
|---|---|
| **Module – 5** | **10 Hrs** |
| Introduction to Turing Machines: Problems That Computers Cannot Solve, The Turing Machine, Programming Techniques for Turing Machines, Extensions to the Basic Turing Machine, Undesirability: A Language That Is Not Recursively Enumerable.<br><br>**Textbook 1: Ch. 8, Ch. 9** | |

| **Course Outcomes: After completing the course, the students will be able to** | |
|---|---|
| **CO1** | Model and analyse various abstract computational devices (Finite Automata, Pushdown Automata, and Turing Machines) and their structural behaviours, limitations, and operational characteristics. |
| **CO2** | Design appropriate mathematical representations, grammars, and language recognizers to solve specific formal language problems. |
| **CO3** | Prove or disprove language properties using mathematical tools and closure properties. |
| **CO4** | Design pushdown automata and analyze the properties and normal forms of context-free grammars |
| **CO5** | Design Turing Machines to solve computational problems and analyze the limits of decidability |

| **Textbook** | |
|---|---|
| **1** | "Introduction to Automata Theory, Languages and Computation", John E. Hopcroft, Rajeev Motwani, Jeffrey D. Ullman, Third Edition, Pearson Education, 2006, ISBN: 978-0321455369. |

| **Reference Books** | |
|---|---|
| **1** | "Automata, Computability and complexity", Elain Rich, 1st Edition, Pearson Education,2018. |
| **2** | "Theory of Computer Science", K.L.P Mishra, N Chandrasekaran, 3rd Edition, PHI, 2012. |
| **3** | "An introduction to Formal Languages and Automata ", Peter Linz, 3rd Edition, Narosa Publishers,1998. |
| **4** | "Introduction to the Theory of Computation", Michael Sipser, 3rd edition, Cengage learning,2013. |

| **Web links and Video Lectures ( e – Resources )** | |
|---|---|
| **1** | https://archive.nptel.ac.in/courses/106/105/106105196/ |
| **2** | https://archive.nptel.ac.in/courses/106/106/106106049/ |
| **3** | https://nptelvideos.com/course.php?id=717 |

**CO – PO**

| | **PO1** | **PO2** | **PO3** | **PO4** | **PO5** | **PO6** | **PO7** | **PO8** | **PO9** | **PO10** | **PO11** |
|---|---|---|---|---|---|---|---|---|---|---|---|
| **CO1** | 3 | 2 | 2 | | | | | | | | 1 |
| **CO2** | 2 | 3 | 2 | 1 | | | | | | | 1 |
| **CO3** | 2 | 2 | 2 | | | | | | | | 1 |
| **CO4** | 2 | 2 | 2 | | | | | | | | 1 |
| **CO5** | 2 | 2 | 2 | 1 | | | | | | | 1 |

| **Semester: V** | | | | | |
|---|---|---|---|---|---|
| **Object Oriented Design Pattern Lab** | | | | | |
| **Course Code** | **:** | BCGL504 | **Credits** | **:** | 1 |
| **Hours/Week(L:T:P)** | **:** | 0:0:2 | **CIE** | **:** | 50 Marks |
| **Total Hours** | **:** | 15P | **SEE** | **:** | 50 Marks |
| **Course Type** | **:** | PCCL | **SEE Duration** | **:** | 3 Hours |

| **Prerequisites:** | |
|---|---|
| **Courses** | Object-Oriented Programming with C++ |
| **Knowledge on Fundamental Concepts** | Classes and Objects. |
| **Knowledge on Connected Tools (If any)** | IDEs, Git. |

| **Course Learning Objectives:** This course will enable the students to | |
|---|---|
| **CLO1** | Understand the principles and application of multiple design patterns in collaborative software projects with proper documentation. |
| **CLO2** | Apply and select appropriate design patterns to address common Software Design Problems |
| **CLO3** | Analyze the core principles and purposes of design patterns in Object-Oriented Development. |
| **CLO4** | Evaluate the advantages and limitations of design patterns in real-world applications. |
| **CLO5** | Implement various design patterns using Object-Oriented Programming through hands-on practice. |

| **Sl. No** | **Experiments** |
|---|---|
| List of Problems for which the students should design & implement in the laboratory | |
| 1 | ShapeFactory class that generates different types of Shape objects (Circle, Square, Rectangle) based on input parameters using Factory Design Pattern. |
| 2 | An AbstractFactory class to create families of related or dependent objects with respect to decathlon store without specifying their concrete classes using Abstract Factory. |
| 3 | A Complex object like a House using a step-by-step Builder pattern, allowing different representations of the house (wooden, brick, etc.). |
| 4 | To Extend a Coffee object with dynamic features (e.g., milk, sugar, whipped cream) using Decorators. |
| 5 | A Logger class ensuring a single instance throughout the application |
| 6 | a. An Adapter Pattern for a Music System.<br><br>b. An iterator pattern. |
| 7 | An Observer pattern for a news agency to notify subscribers of updates. |
| 8 | A Facade pattern for home theatre system. |
| 9 | A Template Method for Document Processing (word, pdf, excel) |

| | |
|---|---|
| 10 | Weather monitoring system that notifies multiple display devices whenever the weather conditions change that follows the Observer Design Pattern. |
| 11 | A Proxy pattern to control access to an object (e.g., a protected resource or remote service). |
| 12 | a. A Mediator pattern to manage communication between a set of objects (e.g., chat room with multiple participants).<br>b. A Singleton pattern |

| **Course Outcomes:** After completing the course, the students will be able to | |
|---|---|
| **CO1** | Understand the fundamental concepts of Object-Oriented Design Patterns. |
| **CO2** | Analyze the results and produce substantial written documentation. |
| **CO3** | Design the solution for the given real world problem using Design Patterns. |
| **CO4** | Implement modern tools and collaborative techniques for Software Development. |
| **CO5** | Develop the model for the given problem using UML notations. |

| **Text Books** | |
|---|---|
| **1** | Design Patterns Explained – A New Perspective on Object Oriented Design, Alan Shalloway, James R Trot, 2nd Edition, 4th Impression 2010, Pearson, ISBN-10: 8131700077. |
| **2** | Head First Design Patterns, Eric Freeman, Elisabeth Freeman, 2nd Edition, October 2004, O'reilly Publications, ISBN-13: 978-1492078005 |

| **Reference Books** | |
|---|---|
| **1** | Object Oriented Analysis and Design with Unified Process, Satzinger, Jackson, Burd, 1st Indian Reprint 2007, Thomson Learning, ISBN-10: 8131501915. |

| **Web links and Video Lectures ( e – Resources )** | |
|---|---|
| **1** | https://www.udemy.com/course/design-patterns-java/ |
| **2** | https://nptel.ac.in/courses/106105153 |

**CO – PO MAPPING**

| | **PO1** | **PO2** | **PO3** | **PO4** | **PO5** | **PO6** | **PO7** | **PO8** | **PO9** | **PO10** | **PO11** |
|---|---|---|---|---|---|---|---|---|---|---|---|
| **CO1** | 2 | 1 | 3 | 2 | 1 | 1 | | 1 | | 1 | |
| **CO2** | 2 | 2 | 1 | 2 | 1 | | | | 1 | 2 | |
| **CO3** | 2 | 2 | 3 | 2 | 2 | 1 | 2 | | 1 | 1 | |
| **CO4** | 1 | 1 | 2 | 1 | 3 | | 2 | | 3 | 1 | 2 |
| **CO5** | 2 | 3 | 2 | 2 | 2 | | | 2 | 1 | 1 | |

| **Semester: V** | | | | | |
|---|---|---|---|---|---|
| **Video Processing** | | | | | |
| **Course Code** | **:** | BCG525A | **Credits** | **:** | 3 |
| **Hours/Week(L:T:P)** | **:** | 3:0:0 | **CIE** | **:** | 50 Marks |
| **Total Hours** | **:** | 40L | **SEE** | **:** | 50 Marks |
| **Course Type** | **:** | PEC | **SEE Duration** | **:** | 3 Hours |

| **Prerequisites:** | |
|---|---|
| **Courses** | Computer Graphics & Visualization. |
| **Knowledge on Fundamental Concepts** | Fourier Transforms, Filtering Concepts. |
| **Knowledge on Connected Tools (If any)** | Python IDEs, basic usage of visualization tools like Matplotlib, Python (OpenCV). |

| **Course Learning Objectives: This course will enable the students to** | |
|---|---|
| **CLO1** | Describe the fundamentals of digital video processing, including video representation, sampling, interpolation, transmission, and motion detection. |
| **CLO2** | Explain video enhancement, restoration, stabilization, mosaicing, and segmentation techniques for digital video. |
| **CLO3** | Demonstrate motion tracking, transform coding, and video compression techniques for efficient video processing. |
| **CLO4** | Compare MPEG-1, MPEG-2, MPEG-4, and H.264/AVC video coding standards based on performance and applications. |
| **CLO5** | Apply video processing techniques and software tools to develop solutions for multimedia and video communication applications. |

| **Module-1** | **08 Hrs** |
|---|---|
| **Introduction to video processing:** Introduction, Sampled video, Video transmission.<br>**Video Sampling and Interpolation:** Introduction, Spatio-temporal sampling structures, Sampling and reconstruction of continuous time varying imagery, Sampling structure conversion.<br>**Motion Detection:** Introduction, Notation and Preliminaries, Motion detection.<br><br>**Text Book 1: Ch 1: 1.1,1.2, Ch 2: 2.1 - 2.4, Ch 3: 3.1,3.2, 3.3** | |
| **Module – 2** | **08 Hrs** |
| **Video Enhancement and Restoration:** Introduction, Spatio-temporal noise filtering, Coding artifact reduction, Blotch detection and removal, Vinegar syndrome removal, Intensity flicker correction, Koinescope Moire removal, Scratch removal.<br><br>**Text Book 1: Ch 4: 4.1 - 4.8** | |
| **Module – 3** | **08 Hrs** |
| **Video Stabilization and Mosaicing**: Introduction, Biological Motivation: Insect Navigation, Camera Model and Image Motion Model, Flow-Based Approaches, Stabilization and Mosaicing, Stabilization and Mosaicing With Additional Information.<br>**Video Segmentation**: Introduction, Scene Change Detection, Spatiotemporal Change Detection, Motion Segmentation.<br><br>**Text Book 1: Ch 5: 5.1 - 5.6, Ch 6: 6.1 - 6.4** | |

| **Module –4** | **08 Hrs** |
|---|---|
| **Motion Tracking in Video:** Introduction, Rigid Object Tracking, Articulated Object Tracking. **Basic Transform Video Coding**: Introduction to Video Compression, Video Compression Application Requirements, Digital Video Signals and Formats, Video Compression Techniques, Transform Coding: Introduction to the Video Encoding Standards.<br><br>**Text Book 1: Ch 7: 7.1,7.2,7.3, Ch 8: 8.1 - 8.5** | |
| **Module –5** | **08 Hrs** |
| **MPEG-1 and MPEG-2 Video Standards:** MPEG-1 Video Coding Standard, MPEG-2 Video Coding Standard. **MPEG-4 Visual and H.264/AVC: Standards for Modern Digital Video**: Introduction, Terminology, MPEG-4 Part 2, MPEG-4 Part10:H.264/AVC, MPEG-4 Compression Performance, MPEG-4 Video Applications.<br><br>**Text Book 1: Ch 9: 9.1,9.2, Ch 10: 10.1 - 10.6** | |

| **Course Outcomes: After completing the course, the students will be able to** | |
|---|---|
| **CO1** | Understand the fundamental concepts of digital video processing, including video representation, sampling, interpolation, transmission, and motion detection. |
| **CO2** | Analyze video enhancement, restoration, stabilization, mosaicing, and segmentation techniques for digital video. |
| **CO3** | Apply motion tracking, transform coding, and video compression techniques for efficient video processing. |
| **CO4** | Evaluate MPEG-1, MPEG-2, MPEG-4, and H.264/AVC video coding standards based on their performance and applications. |
| **CO5** | Create video processing solutions by integrating enhancement, compression, tracking, and coding techniques for multimedia applications. |

| **Text Book** | |
|---|---|
| **1** | The Essential Guide to Video Processing, Alan C. Bovik, 2nd edition, 2009, Academic Press, ISBN: 978-0123744562. |

| **Reference Books** | |
|---|---|
| **1** | Digital Video Processing for Engineers: A Foundation for Embedded Systems Design, Suhel Dhanani and Michael Parker, 1st edition, 2012, ISBN: 978-0124157606. |

| **Web links and Video Lectures ( e – Resources )** | |
|---|---|
| **1** | https://docs.opencv.org/4.x/dd/d43/tutorial_py_video_display.html |
| **2** | https://www.geeksforgeeks.org/python/python-process-images-of-a-video-using-opencv/ |
| **3** | https://www.coursera.org/learn/digital |

**CO – PO MAPPING**

| | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 |
|---|---|---|---|---|---|---|---|---|---|---|---|
| **CO1** | 3 | 2 | | | 1 | | | | | | |
| **CO2** | 2 | 3 | 2 | 2 | 2 | 1 | 1 | | | | |
| **CO3** | 2 | 2 | 3 | 2 | 3 | | 1 | | 1 | | |
| **CO4** | 2 | 3 | 2 | 3 | 2 | 1 | | 1 | | 1 | 1 |
| **CO5** | 2 | 2 | 3 | 3 | 3 | | | 1 | 2 | 2 | 2 |

| **Semester: V** | | | | | |
|---|---|---|---|---|---|
| **Foundations of AI** | | | | | |
| **Course Code** | **:** | BIS525B | **Credits** | **:** | 3 |
| **Hours/Week( L:T:P)** | **:** | 3:0:0 | **CIE** | **:** | 50 Marks |
| **Total Hours** | **:** | 40L | **SEE** | **:** | 50 Marks |
| **Course Type** | **:** | PEC | **SEE Duration** | **:** | 3 Hours |

| **Prerequisites:** | |
|---|---|
| **Courses** | Discrete Mathematical structure, Problem solving through Programming, Introduction to python Programming, Data Structures. |
| **Knowledge on Fundamental Concepts** | Mathematical Foundations, Programming Concepts, Problem-solving using algorithms**.** |
| **Knowledge on Connected Tools (If any)** | Python, Jupyter Notebook, VS Code. |

| **Course Learning Objectives: This course will enable the students to** | |
|---|---|
| **CLO1** | Learn the basic principles and theories of artificial intelligence. |
| **CLO2** | Study key AI areas such as machine learning, neural networks, natural language processing, and robotics. |
| **CLO3** | Apply AI techniques like search algorithms, optimization, and decision-making to real-world problems. |
| **CLO4** | Understand the ethical and legal issues related to AI, including bias, fairness, and accountability. |
| **CLO5** | Explore the societal impact of AI on the workforce and privacy. |

| **Module – 1** | **08 Hrs** |
|---|---|
| **Introduction:** What Is AI? , Foundations and History of AI, The State of The Art.<br><br>**Intelligent Agents:** Agents and environment, Concept of Rationality, The nature of Environment, The structure of agents.<br><br>**Text Book 1: Ch 1 : 1.1-1.4, Ch 2 : 2.1- 2.4** | |
| **Module – 2** | **08 Hrs** |
| **Problem-solving:** Problem-solving agents, Example problems, Searching for Solutions Uninformed Search Strategies, Informed Search Strategies, Heuristic functions.<br><br>**Text Book 1: Ch 3 : 3.1-3.6** | |
| **Module – 3** | **08 Hrs** |
| **Logical Agents:** Knowledge–based agents, The Wumpus world, Logic, Propositional logic, Reasoning patterns in Propositional Logic.<br><br>**Text Book 1: Ch 7 : 7.1-7.4** | |
| **Module – 4** | **08 Hrs** |
| **First Order Logic:** Representation Revisited, Syntax and Semantics of First Order logic, Using First Order logic, Knowledge Engineering In First-Order Logic.<br><br>**Inference in First Order Logic:** Propositional Versus First Order Inference, Unification, Backward Chaining, Resolution Forward Chaining.<br><br>**Text Book 1: Ch 8: 8.1- 8.4 , Ch 9: 9.1-9.5** | |
| **Module – 5** | **08 Hrs** |

| |
|---|
| **Uncertain Knowledge and Reasoning:** Quantifying Uncertainty: Acting under Uncertainty, Basic Probability Notation, Inference using Full Joint Distributions, Independence, Baye's Rule and its use. Wumpus World Revisited.<br>**Expert Systems:** Representing and using domain knowledge, ES shells, Explanation, knowledge acquisition<br><br>**Text Book 1: Ch 13: 13.1-13.6**<br>**Text Book 2: Ch 20: 20.1-20.4** |

| **Course Outcomes: After completing the course, the students will be able to** | |
|---|---|
| **CO1** | Apply the architecture and components of intelligent agents in their interaction with the AI environment. |
| **CO2** | Apply problem-solving agents and various search strategies to solve a given problem. |
| **CO3** | Utilize logical reasoning and knowledge representation using propositional and first-order logic. |
| **CO4** | Integrate first-order logic to represent knowledge and solve problems in artificial intelligence applications. |
| **CO5** | Analyze the use of probability and expert system techniques to build intelligent systems that handle uncertainty in specific domains. |

| **Text Books** | |
|---|---|
| **1** | Artificial Intelligence: A Modern Approach, Russell, S. J., and Norvig, P., 4th Edition, 2020, Pearson Education. ISBN-13: 978-0134610993. |
| **2** | Artificial Intelligence, Elaine Rich, Kevin Knight, 3rd edition, 2013, Tata McGraw Hill. ISBN-13: 978-0-07-008770-5, ISBN-10: 0-07-008770-9. |

| **Reference Books** | |
|---|---|
| **1** | Artificial Intelligence Structure and strategies for complex, George F Lugar, 5th Edition, 2011, Pearson Education. ISBN :0 321263189 |
| **2** | Artificial Intelligence, Kaushik, S., 2nd Edition, Cengage Learning India, 2022, ISBN: 978-9355730428. |
| **3** | Principles of Artificial Intelligence, Nils J. Nilsson, 1st Edition, Elsevier, 1980. ISBN 0-934613-10-9 |

| **Web links and Video Lectures ( e – Resources )** | |
|---|---|
| **1** | https://www.kdnuggets.com/2019/11/10-free-must-read-books-ai.html |
| **2** | https://www.udacity.com/course/knowledge-based-ai-cognitive-systems--ud409 |
| **3** | https://nptel.ac.in/courses/106106140 |
| **4** | https://www.coursera.org/learn/introduction-to-ai |

**CO – PO MAPPING**

| | **PO1** | **PO2** | **PO3** | **PO4** | **PO5** | **PO6** | **PO7** | **PO8** | **PO9** | **PO10** | **PO11** |
|---|---|---|---|---|---|---|---|---|---|---|---|
| **CO1** | 3 | 2 | 1 | | | | | | | | |
| **CO2** | 3 | 3 | 3 | 2 | 2 | | | | | | 1 |
| **CO3** | 3 | 2 | 2 | 2 | 2 | | | | | | |
| **CO4** | 3 | 3 | 3 | 2 | 2 | | | | | | 1 |
| **CO5** | 3 | 3 | 2 | 2 | 3 | | | | | | 1 |

| **Semester: V** | | | | | |
|---|---|---|---|---|---|
| **Multimedia System Design** | | | | | |
| **Course Code** | **:** | BCG525C | **Credits** | **:** | 3 |
| **Hours/Week(L:T:P)** | **:** | 3:0:0 | **CIE** | **:** | 50 Marks |
| **Total Hours** | **:** | 40 Hrs | **SEE** | **:** | 50 Marks |
| **Course Type** | **:** | PEC | **SEE Duration** | **:** | 3 Hours |

| **Prerequisites:** | |
|---|---|
| **Courses** | Computer Organization, Operating Systems, Computer Networks, Database Management Systems |
| **Knowledge on Fundamental Concepts** | Computer Fundamentals, Digital Data and Signals, Operating Systems Basics, Networking Concepts |
| **Knowledge on Connected Tools (If any)** | Database, Virtualization Tools |

| **Course Learning Objectives: This course will enable the students to** | |
|---|---|
| **CLO1** | Understand the basic concepts of multimedia systems, multimedia elements, applications, system architecture, and data standards. |
| **CLO2** | Analyze various compression techniques for audio, image and video data used in multimedia systems. |
| **CLO3** | Explore storage, retrieval and telecommunication technologies relevant to multimedia applications. |
| **CLO4** | Design multimedia applications and user interfaces considering system components, workflow, and distribution. |
| **CLO5** | Apply system design methodologies to build scalable, high-performance, and extensible multimedia systems. |

| **Module – 1** | **08Hrs** |
|---|---|
| **Multimedia Systems Design: An Introduction –** Multimedia elements, Multimedia applications, Multimedia system architecture, Defining objects for multimedia systems, Multimedia data interface standard, Multimedia databases<br>**Compression and Decompression** – Types of compression, video image compression, audio compression<br><br>**Textbook:1, Ch. 1, 2** | |
| **Module – 2** | **08 Hrs** |
| **Storage and Retrieval Technologies –** magnetic media technology, optical media, cache management for storage systems.<br>**Architectural and Telecommunication Considerations –** Specialised computational processors, memory systems, multimedia board solutions, LAN/WAN connectivity, Distributed object models.<br><br>**Textbook 1, Ch. 5, 6** | |
| **Module – 3** | **08 Hrs** |
| **Multimedia Application design –** Multimedia application classes, types of Multimedia system, virtual reality design, components of Multimedia system, organizing Multimedia databases, Application workflow design issues, distributed application design issues<br>**Multimedia Authoring and User Interface –** Multimedia authoring systems, hypermedia application design considerations, user interface design<br><br>**Textbook 1, Ch. 7, 8** | |

| Module – 4 | 08 Hrs |
|---|---|
| **Hypermedia messaging –** Hypermedia message components, Hypermedia linking and embedding, creating Hypermedia messages, Integrated multimedia message standards. **Distributed Multimedia Systems** – components of a Distributed Multimedia Systems, distributed client-server operation, Multimedia object servers, multiserver network topologies, distributed Multimedia databases, managing distributed objects.<br><br>**Textbook 1, Ch 9, 10** | |
| **Module – 5** | **08 Hrs** |
| **System Design: Methodology and Considerations –** Fundamental design issues, determining enterprise requirements, examining current architecture and feasibility, performance analysis, designing for performance, multimedia system design, system extensibility.<br><br>**Textbook 1, Ch 11** | |

| **Course Outcomes: After completing the course, the students will be able to** | |
|---|---|
| **CO1** | Understand the key elements of multimedia systems, their applications, architectures and data standards. |
| **CO2** | Apply various multimedia compression techniques for video, audio and images. |
| **CO3** | Analyze storage and retrieval technologies, and assess architectural and network considerations in multimedia systems. |
| **CO4** | Design multimedia applications and authoring systems, including user interfaces and distributed design issues. |
| **CO5** | Implement end-to-end system design strategies to build high-performance multimedia solutions for enterprise environments. |

| **Text Books** | |
|---|---|
| **1** | "Multimedia Systems Design", Prabhat K. Andleigh and Kiran Thakrar, low price Edition, 2008, PHI Publisher, ISBN-10: 0130890952 |

| **Reference Books** | |
|---|---|
| **1** | "Fundamentals of Multimedia", Ze-Nian Li and Mark S. Drew, 2nd Edition, ISBN: 9783319052908 |
| **2** | "Multimedia: Making It Work", Tay Vaughan, 9th Edition,2014, McGraw-Hill Publisher, ISBN: 9780071832885 |

**CO – PO MAPPING**

| | **PO1** | **PO2** | **PO3** | **PO4** | **PO5** | **PO6** | **PO7** | **PO8** | **PO9** | **PO10** | **PO11** |
|---|---|---|---|---|---|---|---|---|---|---|---|
| **CO1** | 3 | 2 | 2 | | 2 | 1 | | 1 | 2 | | 2 |
| **CO2** | 2 | 3 | 2 | | 3 | | | 1 | 2 | | 2 |
| **CO3** | 3 | 3 | 3 | 2 | 3 | 2 | | 1 | 2 | | 2 |
| **CO4** | 2 | 2 | 3 | | 3 | | | 2 | 3 | | 2 |
| **CO5** | 3 | 2 | 3 | 2 | 3 | 1 | | 2 | 3 | 2 | 2 |

| Semester: V | | | | | |
|---|---|---|---|---|---|
| **Embedded Systems and Sensor Technology** | | | | | |
| **Course Code** | : | BIS525D | **Credits** | : | 3 |
| **Hours/Week(L:T:P)** | : | 3:0:0 | **CIE** | : | 50Marks |
| **Total Hours** | : | 40L | **SEE** | : | 50Marks |
| **Course Type** | : | PEC | **SEE Duration** | : | 3 Hours |

| **Prerequisites:** | |
|---|---|
| **Courses** | Digital Design and Computer Organization |
| **Knowledge on Fundamental Concepts** | Programming in C (Knowledge of variables and data types, control structures, functions, arrays, pointers, structures |
| **Knowledge on Connected Tools (If any)** | Arduino/STM32/PIC boards, Multisim /NI tools |

| **Course Learning Objectives: This course will enable the students to** | |
|---|---|
| **CLO1** | Analyze the architecture and operation of embedded systems. |
| **CLO2** | Gain knowledge of smart sensors and interfacing methods. |
| **CLO3** | Explore real-time operating systems (RTOS) and wireless sensing techniques. |
| **CLO4** | Learn to integrate sensors with microcontrollers for practical applications. |
| **CLO4** | Apply embedded and sensing technologies to real-world applications. |

| **Module – 1** | **08Hrs** |
|---|---|
| **Introduction to Embedded Systems:** Definition, Applications, Classification, Embedded hardware units, software components, **Smart Sensors Basics:** Sensor vs Transducer, Introduction, transitions, integration, output characteristics, sensing technologies, digital sensors, Output Characteristic, Sensing Technologies, Digital Output Sensors<br><br>**Text Book 1: Ch 1: 1.1–1.6**<br>**Text Book 2: Ch 1: 1.1, 1.6, Ch 3: 3.2–3.4** | |
| **Module – 2** | **08Hrs** |
| **Application-specific sensors:** Ultrasonic Sensors, Microwave Motion Detectors, Capacitive Sensors, Optical Sensors – Photodiode, Photoresistor, CCD/CMOS, Temperature Sensors – Thermoelectric, Motion & Ultrasonic Sensing.<br><br>**Embedded Firmware Development / Control Techniques:** Firmware Architecture, Languages, Hardware–Software Co-design, State Machines, Fuzzy Logic, Neural Networks, Adaptive Control, Impact of Artificial Intelligence.<br><br>**Text Book 1: Ch 7: 7.1–7.2; Ch 15, Ch 17.**<br>**Text Book 2: Ch 3.2.2–3.2.7, Ch 7.1.1, 7.3–7.5, 7.7** | |
| **Module – 3** | **08 Hrs** |

| |
|---|
| Basics of RTOS, Task Scheduling, Interrupts, Preemption, Sensor Interfacing with Microcontrollers, Signal Conditioning, Digital Conversion, Context Switching, Device Driver Programming<br><br>**Text Book 1: Ch 10: 10.1–10.3, 10.5.2, Ch 12:12.1–12.2**<br>**Text Book 2: Ch 4: 4.1–4.7, Ch 5: 5.2–5.7** |

| **Module – 4** | **08 Hrs** |
|---|---|
| **Wireless Data Communication:** RF Sensing, RF MEMS, Telemetry, Wireless Sensor Networks, Industrial Wireless Sensing, **Communication Protocols:** Serial, I2C, SPI, Wireless Standards (e.g., IEEE 802.15.4)<br><br>**Text Book 2: Ch 8: 8.1–8.9**<br>**Text Book 1: Ch 2: 2.3** | |

| **Module – 5** | **08 Hrs** |
|---|---|
| **Real-time Applications:** Automotive, Industrial, Smart Homes, Future sensor and semiconductor capabilities, Embedded System Tools, Development Environments, Trusted Sensing.<br><br>**Text Book 2: Ch 14: 14.3–14.5, Ch 16:16.2–16.6,**<br>**Text Book 1: Ch 9: 9.1–9.2** | |

| **Course Outcomes: After completing the course, the students will be able to** | |
|---|---|
| **CO1** | Interpret the architecture and components of embedded systems. |
| **CO2** | Analyze the behavior and interfacing mechanisms of smart sensors. |
| **CO3** | Develop embedded firmware and integrate it with sensors. |
| **CO4** | Implement real-time task scheduling and synchronization using RTOS. |
| **CO5** | Analyze and apply wireless and smart sensing in real-world embedded applications. |

| **Text Books** | |
|---|---|
| **1** | Introduction to Embedded Systems**,** Shibu K.V., 2nd Edition, 2017, McGraw-Hill Education, ISBN: 978-93-5260-401-2. |
| **2** | Understanding Smart Sensors, Randy Frank, 3rd Edition, 2013, Artech House, ISBN: 978-1608075072. |

| **Reference Books** | |
|---|---|
| **1** | Handbook of Modern Sensors**,** Jacob Fraden, 5th Edition, 2021, Springer, ISBN: 978-3-030-61108-0. |
| **2** | Embedded Systems: Architecture, Programming and Design**,** Raj Kamal, 3rd Edition, 2017, Tata McGraw-Hill Education, ISBN: 978-93-5260-311-4. |
| **3** | Internet of Things: Technologies and Applications**,** Vlasios Tsiatsis, Stamatis Karnouskos, Jean-Paul Vasseur, Marcus Bauer, and Serafim Nikoletseas, 1st Edition, 2014, Academic Press (Elsevier), ISBN: 978-0-12-416043-2. |
| **Web links and Video Lectures (e – Resources)** | |
| **1** | https://youtu.be/bvEDXDFbM_E |

| | |
|---|---|
| **2** | https://youtu.be/T9z0t_FWPRU |
| **3** | https://youtu.be/F321087yYy4 |
| **4** | https://youtu.be/BBvG7uzmOV0 |

**CO – PO MAPPING**

| | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 |
|---|---|---|---|---|---|---|---|---|---|---|---|
| **CO1** | 3 | 2 | 1 | | 2 | | | | | | 2 |
| **CO2** | 2 | 2 | 2 | 1 | 3 | | | | | | 2 |
| **CO3** | 2 | 2 | 3 | 2 | 3 | | | 1 | 1 | 2 | 2 |
| **CO4** | 2 | 3 | 3 | 3 | 3 | | | 1 | 1 | 2 | 2 |
| **CO5** | 3 | 3 | 3 | 2 | 3 | 2 | 1 | 1 | 2 | 2 | 2 |

| **Semester: V** | | | | | |
|---|---|---|---|---|---|
| **Mini Project** | | | | | |
| **Course Code** | : | BCG536 | **Credits** | : | 2 |
| **Hours/Week(L:T:P)** | : | 0:0:4 | **CIE** | : | 50 Marks |
| **Total Hours** | : | 10P | **SEE** | : | 50 Marks |
| **Course Type** | : | PROJ | **SEE Duration** | : | 03 Hours |

| **Prerequisites:** | |
|---|---|
| **Courses** | Programming concepts on C, DSA, JAVA, DBMS, PYTHON. |
| **Knowledge on Fundamental Concepts** | Web Programming, DBMS. |
| **Knowledge on Connected Tools (If any)** | Eclipse, Visual Studio,Google Colab |

| **Course Learning Objectives: This course will enable the students to** | |
|---|---|
| **CLO1** | Conceptualize, design, and implement solutions to specific engineering problems. |
| **CLO2** | Communicate project outcomes through effective presentations and technical reports. |
| **CLO3** | Apply project and resource management skills while considering professional ethics and societal concerns. |
| **CLO4** | Develop, test, and evaluate the solution using appropriate techniques. |
| **CLO5** | Demonstrate self-learning abilities, develop sustainable solutions, and exhibit lifelong learning skills. |

| **Course Outcomes: After completing the course, the students will be able to** | |
|---|---|
| **CO1** | Identify and define a real-world problem relevant to the domain |
| **CO2** | Apply appropriate tools, technologies, and methodologies to design a solution. |
| **CO3** | Develop a working prototype/model/software/system to address the identified problem. |
| **CO4** | Demonstrate teamwork, time management, and project planning skills effectively through reports and presentations |
| **CO5** | Evaluate the developed solution based on performance, functionality, and requirements. |

**CO-PO MAPPING**

| | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 |
|---|---|---|---|---|---|---|---|---|---|---|---|
| CO1 | 3 | 3 | | | | | 2 | | | | |
| CO2 | 3 | | | | 3 | 2 | 2 | 3 | | | 3 |
| CO3 | | 3 | 2 | 3 | 2 | | 2 | | | | 3 |
| CO4 | | | | | | | 2 | | 3 | 3 | |
| CO5 | | 3 | | 3 | 2 | | 2 | | | | |

**PROJECT WORK (**BCG536**):** The objective of the Project work is To :
(i) Encourage independent learning and the innovative attitude of the students.
(ii)Develop interactive attitude, communication skills, organization, time management, and presentation skills.
(iii)Impart flexibility and adaptability.
(iv)Inspire team working.
(v) Expand intellectual capacity, credibility, judgment and intuition.
(vi)Adhere to punctuality, setting and meeting deadlines.

(vii)Instil responsibilities to oneself and others.
(viii)Train students to present the topic of project work in a seminar without any fear, face the audience confidently, enhance communication skills, involve in group discussion to present and exchange ideas.

**CIE procedure for Project Work:**

(1) Single discipline: The CIE marks shall be awarded by a committee consisting of the Head of the concerned Department and two senior faculty members of the Department, one of whom shall be the Guide.The CIE marks awarded for the project work, shall be based on the evaluation of project work Report, project presentation skill, and question and answer session in the ratio 50:25:25. The marks awarded for the project report shall be the same for all the batch mates.

(2) Interdisciplinary: Continuous Internal Evaluation shall be group-wise at the college level with the participation of all guides of the college.

Participation of external guide/s, if any, is desirable. The CIE marks awarded for the project work, shall be based on the evaluation of project work Report, project presentation skill, and question and answer session in the ratio 50:25:25. The marks awarded for the project report shall be the same for all the batch mates.

***

| Semester: V | | | | | |
|---|---|---|---|---|---|
| **Research Methodology and IPR (Common to all Branches)** | | | | | |
| **Course Code** | **:** | BRM507 | **Credits** | **:** | 3 |
| **Hours/Week (L: T:P)** | **:** | 3:0:0 | **CIE** | **:** | 50 Marks |
| **Total Hours** | **:** | 40Hrs | **SEE** | **:** | 50 Marks |
| **Course Type** | **:** | AEC | **SEE Duration** | **:** | 3 Hours |

| **Prerequisites:** | |
|---|---|
| **Courses** | Engineering / Technical Communication |
| **Knowledge on Fundamental Concepts** | Fundamentals of engineering problem solving, technical report writing, information retrieval, analytical thinking, and professional ethics |
| **Knowledge on Connected Tools (If any)** | Familiarity with web search engines, digital libraries, scholarly databases (e.g., Google Scholar), reference management tools, and basic office productivity software |

| **Course Learning Objectives: This course will enable the students to** | |
|---|---|
| **CLO1** | Familiarize students with research methodologies, problem formulation, and research ethics. |
| **CLO2** | Equip students with techniques for literature search, review, and analysis using scholarly databases. |
| **CLO3** | Strengthen technical reading and interpretation skills for research documents, algorithms, and datasets. |
| **CLO4** | Introduce Intellectual Property Rights and innovation protection procedures. |
| **CLO5** | Enhance awareness of IP management, commercialization, and significant IPR case studies. |

| **Module – 1** | **08Hrs** |
|---|---|
| Introduction: Meaning of Research, Objectives of Engineering Research, and Motivation in Engineering Research, Types of Engineering Research, Finding and Solving a Worthwhile Problem. Ethics in Engineering Research, Ethics in Engineering Research Practice, Types of Research Misconduct, Ethical Issues Related to Authorship.<br>**Textbook 1**: **Ch. 1, Ch. 2** | |
| **Module – 2** | **08Hrs** |
| Literature Review and Technical Reading, New and Existing Knowledge, Analysis and Synthesis of Prior Art Bibliographic Databases, Web of Science, Google and Google Scholar, Effective Search: The Way Forward Introduction to Technical Reading Conceptualizing Research, Critical and Creative Reading, Taking Notes While Reading, Reading Mathematics and Algorithms, Reading a Datasheet. Attributions and Citations: Giving Credit Wherever Due, Citations: Functions and Attributes, Impact of Title and Keywords on Citations, Knowledge Flow through Citation, Citing Datasets, Styles for Citations, Acknowledgments and Attributions, What Should Be Acknowledged, Acknowledgments in, Books Dissertations, Dedication or Acknowledgments.<br>**Textbook 1**: **Ch. 3, Ch. 4** | |
| **Module – 3** | **08Hrs** |
| Introduction To Intellectual Property: Role of IP in the Economic and Cultural, Development of the Society, IP Governance, IP as a Global Indicator of Innovation, Origin of IP History of IP in India. Major Amendments in IP Laws and Acts in India. Patents: Conditions for Obtaining a Patent Protection. Rights Associated with Patents. Enforcement of Patent Rights. Inventions Eligible for Patenting. Non-Patentable Matters. Patent Infringements. Avoid Public | |

Disclosure of an Invention before Patenting. Process of Patenting. Process of Patenting. Prior Art Search. Choice of Application to be Filed. Patent Application Forms. Jurisdiction of Filing Patent Application. Publication. Pre-grant Opposition. Examination. Grant of a Patent. Validity of Patent Protection. Post-grant Opposition. Commercialization of a Patent. Need for a Patent Attorney/Agent. Patent Related Forms. Fee Structure. Types of Patent Applications. Commonly Used Terms in Patenting. National Bodies Dealing with Patent Affairs. Utility Models**.**

**Textbook 2: Ch. 2**

| **Module – 4** | **08Hrs** |
|---|---|

Copyrights and Related Rights: Classes of Copyrights. Criteria for Copyright. Ownership of Copyright. Copyrights of the Author. Copyright Infringements. Copyright Infringement is a Criminal Offence. Copyright Infringement is a Cognizable Offence. Fair Use Doctrine. Copyrights and Internet. Non-Copyright Work. Copyright Registration. Judicial Powers of the Registrar of Copyrights. Fee Structure. Copyright Symbol. @#@26092024 Validity of Copyright. Copyright Profile of India. Copyright and the word 'Publish'. Transfer of Copyrights to a Publisher. Copyrights and the Word 'Adaptation'. Copyrights and the Word 'Indian Work'. Joint Authorship. Copyright Society. Copyright Board. Copyright Enforcement Advisory Council (CEAC). International Copyright Agreements, Conventions and Treaties. Interesting Copyrights Cases. Trademarks: Eligibility Criteria. Acts and Laws. Classification of Trademarks. Validity of Trademark. Types of Trademark Registered in India. Trademark Registry. Process for Trademarks Registration. Prior Art Search. Famous Case Law: Coca-Cola Company vs. Bisleri International Pvt. Ltd.

**Textbook 2: Ch. 3**

| **Module – 5** | **08Hrs** |
|---|---|

Industrial Designs: Eligibility Criteria. Acts and Laws to Govern Industrial Designs. Design Rights. Enforcement of Design Rights. Non-Protectable Industrial Designs India. Protection Term. Procedure for Registration of Industrial Designs. Prior Art Search. Application for Registration. Duration of the Registration of a Design. Importance of Design Registration. Cancellation of the Registered Design. Application Forms. Classification of Industrial Designs. Designs Registration Trend in India. International Treaties. Famous Case Law: Apple Inc. vs. Samsung Electronics Co. Geographical Indications: Acts, Laws and Rules Pertaining to GI. Ownership of GI. Rights Granted to the Holders. Registered GI in India. Identification of Registered GI. Classes of GI. Non-Registerable GI. Protection of GI. Collective or Certification Marks. Enforcement of GI Rights. Procedure for GI Registration Documents Required for GI Registration. GI Ecosystem in India. Case Studies on Patents. Case study of Curcuma (Turmeric) Patent, Case study of Neem Patent, Case study of Basmati patent. IP Organizations in India. Schemes and Programmes.

**Textbook 2**: **Ch. 4, Ch. 7**

| **Course Outcomes: After completing the course, the students will be able to** | |
|---|---|
| **CO1** | Apply research methodologies and ethical practices to address engineering research problems. |
| **CO2** | Analyze technical literature and synthesize research findings using appropriate citation practices. |
| **CO3** | Interpret research articles, algorithms, datasets, and technical documents in computing domains. |
| **CO4** | Implement intellectual property rights procedures for protecting technological innovations |
| **CO5** | Evaluate intellectual property case studies and determine suitable protection strategies for research outcomes |

| **Textbooks** | |
|---|---|
| **1** | "Research Methodology: Methods and Techniques", C.R. Kothari and Gaurav Garg, 5th Edition, New Age International Publishers, 2024. ISBN: 9389802555 |

| | |
|---|---|
| **2** | "Intellectual property rights under WTO", T Ramappa, 2nd revised edition, Asia Law House Publisher, 2016, ISBN: 9385556819 |

| **Reference Books** | |
|---|---|
| **1** | "Research Methodology: A Step-by-Step Guide for Beginners", Ranjit Kumar, SAGE Publications 2018, ISBN: 9781526457080 |
| **2** | "Principles of Intellectual Property", Dr. N. S. Gopalakrishnan and T. G. Agitha, Eastern Book Company Publisher, 3rd edition, 2023. ISBN: 9788170121572 |

| **Web links and Video Lectures ( e – Resources )** | |
|---|---|
| **1** | https://online.vtu.ac.in/course/1-research-methodologies-and-ipr |
| **2** | https://onlinecourses.swayam2.ac.in/e-learning/preview/ntr24_ed08 |

**CO – PO MAPPING**

| | **PO1** | **PO2** | **PO3** | **PO4** | **PO5** | **PO6** | **PO7** | **PO8** | **PO9** | **PO10** | **PO11** |
|---|---|---|---|---|---|---|---|---|---|---|---|
| **CO1** | 2 | 3 | | 3 | | | 3 | | | | 2 |
| **CO2** | 2 | 3 | | 3 | 1 | | 2 | | 2 | | 3 |
| **CO3** | 2 | 3 | | 2 | 2 | | | | 2 | | 3 |
| **CO4** | 1 | 1 | 2 | | | 2 | 3 | | | 2 | 2 |
| **CO5** | 1 | 3 | 2 | 2 | | 2 | 3 | | 1 | 2 | 2 |

| **Semester: V** | | | | | |
|---|---|---|---|---|---|
| **Competency Enhancement Course-3**<br>**Stream: CSE/ECE/ME/CV** | | | | | |
| **Course Code** | **:** | BCE508 | **Credits** | **:** | 0 |
| **Hours/Week( L:T:P)** | **:** | 2:0:0 | **CIE** | **:** | 100 Marks |
| **Total Hours** | **:** | 40 | **SEE** | **:** | - |
| **Course Type** | **:** | NCMC | **SEE Duration** | **:** | - |

| **Prerequisites:** | |
|---|---|
| **Courses** | Fundamentals of C Programing |
| **Knowledge on Fundamental Concepts** | Programming fundamentals, including variables, data types, control structures (if, loops), and syntax |
| **Knowledge on Connected Tools** | NA |

| **Course Learning Objectives: This course will enable the students to** | |
|---|---|
| **CLO1** | Understand and apply fundamental programming concepts using C |
| **CLO2** | Develop object-oriented programs in C++ |
| **CLO3** | Write and debug multi-file programs in C and C++ |
| **CLO4** | Design and manage databases using SQL in Oracle and MySQL |
| **CLO5** | Compare and analyze different database models (RDBMS vs NoSQL) |

| **Module – 1** | **8 Hrs** |
|---|---|
| **C programming (A)**<br>Data Types, Operators and Expressions Input and output Operations Control Flow – Branching, Control Flow – Looping, Statements and Blocks, If Else, Switch, Nesting of If Else, GOTO statement, The while statement, The For statement, The Do statement, Jumps in loops<br>**C programming (B)**<br>Arrays, Strings, One-dimensional arrays, Initialization of one-dimensional arrays, Two-dimensional Arrays, Initializing Two-dimensional arrays, Multi-dimensional arrays, Dynamic arrays, Declaring and Initializing string variables, Reading Strings from Terminal, Writing Strings to screen, String handling functions, Operations on strings<br>**C programming (C)**<br>User-defined Functions, Structures, Basics of Functions, Functions Returning Non-integers, External Variables, Scope Rules, Header Files, Static Variables, Register Variables, Block Structure, Initialization, Recursion, Category of functions, Functions that return multiple values, Nesting functions, Multi-file programs, Structures and Functions, Arrays of Structures, Pointers to Structures, Self-referential structures<br>**Textbook 1, Ch1-11** | |
| **Module – 2** | **8 Hrs** |
| **C Programming (D)**<br>Unions, Pointers, Difference between Structures and Unions, Accessing the address of a variable, Declaring and Initializing pointer variables, Accessing a variable through its | |

pointers, Chain of pointers, Pointer Expressions, Pointer Increments and Scale Factors, Pointers and character strings, Array of pointers, Pointers as function arguments, Functions returning pointers, Pointers to functions, Drawback of Pointers

**File Management in C**

The Preprocessor, Defining and Opening a File, Closing a File, Input / Output Operations on Files, Random Access to Files, Command Line Arguments. Macro Substitution, File Inclusion, Compiler Control Directives, ANSI Additions

**Textbook 1- Ch2-16**

| **Module-3** | **8 Hrs** |
|---|---|

**C++**

Object oriented Programming, Class and Objects, Dynamic Memory Management POP,OOPs in C++, Console Input / Output in C++, Comment lines in C++, Importance of function prototyping in C++, Function overloading, Inline functions and default arguments

**Textbook 2 –Ch1-6**

| **Module-4** | **8 Hrs** |
|---|---|

**C++**

Scope Resolution Operator, Structures, Defining function outside the class , Friend functions, Friend class, Array of class objects, Passing class objects to and returning class objects from functions, Nested classes, Namespaces, Dynamic memory allocation using new and deallocation, new handler function

**Textbook 2- Ch7-11**

| **Module-5** | **8 Hrs** |
|---|---|

Database Management System : Types of DBMS – Merits and Demerits Oracle and MySQL, SDLC, Architecture (Oracle 10g) - Instance, User Accounts, Client Applications IP, Port Number, SQL Introduction Tables, DDL and DML, Pluggable Databases – Oracle 19c, Architecture Undo and Redo, Operators Constraints Sequences Triggers, Functions – Conversion, String, Math, Aggregate Clauses, Joins, Views, Synonyms, Indexes Stored Procedures, Normalization, Triggers and stored procedures, NoSQL Db, normalisation – tables

**Textbook 3 – Ch1-8**

| **Course Outcomes: After completing the course, the students will be able to** | |
|---|---|
| **CO1** | Demonstrate basic C programming skills in data types, control flow, arrays and strings to solve problems. |
| **CO2** | Apply advanced C features like functions, structures, pointers, unions and file handling for modular coding |
| **CO3** | Apply C++ OOP concepts, including classes, function overloading, friend functions and dynamic memory management. |
| **CO4** | Design and manage databases with Oracle/MySQL, write SQL queries, normalize data and use stored procedures. |
| **CO5** | Combine C/C++ programming with database operations to build applications for data storage and retrieval. |

| **Text Books** | |
|---|---|
| **1** | **Let Us C** by Yashavant Kanetkar (ISBN- 978-8183331630), 15th Edition, BPB Publications- 2016 |

| | |
|---|---|
| 2 | **Object-Oriented Programming with C++** by E. Balagurusamy (ISBN- 978-9389949186), 8th Edition, Tata McGraw-Hill - 2020 |
| 3 | **Database System Concepts** by Abraham Silberschatz, Henry Korth, S. Sudarshan(ISBN- 978-9332901384),6th Edition, McGraw Hill Education- 2013 |

| **Reference Books** | |
|---|---|
| 1 | **Programming in ANSI C,** by E. Balaguruswamy, (ISBN- 978-9339219666), 7th Edition, Tata McGraw-Hill - 2017 |
| 2 | **C PROGRAMMING LANGUAGE** by Brian W. Kernighan / Dennis Ritchie(ISBN-978-9332549449), 2nd Edition, Pearson Education India - 2015 |

| **Web links and Video Lectures ( e – Resources )** | |
|---|---|
| 1 | https://www.softprayog.in/programming/c-programming-tutorial-data-types-and-expressions |
| 2 | https://www.geeksforgeeks.org/array-of-strings-in-c/ |
| 3 | https://www.programiz.com/c-programming/c-structures-pointers |
| 4 | https://www.w3schools.com/cpp/cpp_oop.asp |
| 5 | https://www.geeksforgeeks.org/dbms/ |

**CO – PO MAPPING**

| | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 |
|---|---|---|---|---|---|---|---|---|---|---|---|
| **CO1** | 3 | 3 | | | 2 | | | | | | 2 |
| **CO2** | 3 | 3 | | | 2 | | | | | | 2 |
| **CO3** | 3 | 2 | | | 2 | | | | | | 2 |
| **CO4** | 3 | 2 | 3 | | 2 | | | | | | 2 |
| **CO5** | 3 | 2 | 3 | 2 | 2 | | | | | | 2 |

| **Semester: V** | | | | | |
|---|---|---|---|---|---|
| **NATIONAL SERVICE SCHEME**<br>**Stream: CSE/ECE/ME/CV** | | | | | |
| **Course Code** | **:** | BNS509 | **Credits** | **:** | 0 |
| **Hours/Week( L:T:P)** | **:** | 0:0:2 | **CIE** | **:** | **100 Marks** |
| **Total Hours** | **:** | 24 | **SEE** | **:** | - |
| **Course Type** | **:** | NCMC | **SEE Duration** | **:** | - |

| **Course Learning Objectives: This course will enable the students to** | |
|---|---|
| **CLO1** | Understand the community in general in which they work |
| **CLO2** | Identify the needs and problems of the community and involve them in problem – solving |
| **CLO3** | Develop among themselves a sense of social & civic responsibility & utilize their knowledge in finding practical solutions t |
| **CLO4** | Develop competence required for group-living and sharing of responsibilities & gain skills in mobilizing community participation to acquire leadership qualities and democratic attitudes. |
| **CLO5** | Appraise the importance of ethical issues and team working abilities pertaining to the social services. |

| **Activity– 1** | **06Hrs** |
|---|---|
| Developing Sustainable Water management system for rural areas and implementation approaches. | |
| **Activity – 2** | **06 Hrs** |
| Contribution to any national level initiative of Government of India. Foreg. Digital India, Skill India, Swachh Bharat, Atmanirbhar Bharath, Make in India, Mudra scheme, Skill development programs etc. | |
| **Activity – 3** | **06 Hrs** |
| Spreading public awareness under rural outreach programs.(Minimum 3 programs). | |
| **Activity – 4** | **06 Hrs** |
| Social connect and responsibilities. | |

**Pedagogy – Guidelines, it may differ depending on local resources available for the study as well as environment and climatic differences, location and time of execution**

| **Sl.** | **Topic** | **Group Size** | **Location** | **Activity Execution** | **Reporting** | **Evaluation of the Topic** |
|---|---|---|---|---|---|---|
| **1.** | Developing Sustainable Water management system for rural areas and implementation approaches. | May be individual or team | Villages/ City Areas / Grama panchayat/ public associations/Government Schemes officers/ campus etc. | Site selection /proper consultation/ Continuous monitoring/ Information board | Report should be submitted by individual to the concerned evaluation authority | Evaluation as per the rubrics Of scheme and syllabus by NSS officer |

| | | | | | | |
|---|---|---|---|---|---|---|
| **2.** | Contribution to any national level initiative of Government of India. For eg. Digital India, Skill India, Swachh Bharat, Atmanirbhar Bharath, Make in India, Mudra scheme, Skill development programs etc. | May be individual or team | Villages/ City Areas / Grama panchayat/ public associations/Government Schemes officers/ campus etc. | Group selection /proper consultation/ Continuous monitoring/ Information board | Report should be submitted by individual to the concerned evaluation authority | Evaluation as per the rubrics Of scheme and syllabus by NSS officer |
| **3.** | Spreading public awareness under rural outreach programs. (minimum5 programs). | May be individual or team | Villages/ City Areas / Grama panchayat/ public associations/Government Schemes officers/ campus etc. | Group selection/proper consultation/ Continuous monitoring / Information board | Report should be submitted by individual to the concerned evaluation authority | Evaluation as per the rubrics Of scheme and syllabus by NSS officer |
| **4.** | Social connect and responsibilities. | May be individual or team | Villages/ City Areas / Grama panchayat/ public associations/Government Schemes officers/ campus etc. | Group selection/proper consultation/ Continuous monitoring / Information board | Report should be submitted by individual to the concerned evaluation authority | Evaluation as per the rubrics Of scheme and syllabus by NSS officer |

**Plan of Action (Execution of Activities for 5th Semester)**

| Sl. No. | Practice Session Description |
|---|---|
| **1.** | Lecture session by NSS Officer |
| **2.** | Selection of topic, Commencement of activity and its progress |
| **3.** | Execution of Activity |
| **4.** | Case study based Assessment, Individual performance |
| **5.** | Sector wise study and its consolidation |
| **6.** | Video based seminar for 10 minutes by each student At the end of semester with Report. |

- In the 5th semester, each student should do activities according to the scheme and syllabus.
- At the end of the semester student performance has to be evaluated by the NSS Officer for the assigned activity progress and its completion.
- At the end of the 5th semester, consolidated report of all activities compiled report should be submitted as per the instructions.

| **Course Outcomes: After completing the course, the students will be able to** | |
|---|---|
| **CO1** | Exploit the importance of his / her responsibilities towards society. |
| **CO2** | Analyze the environmental and societal problems/issues and will be able to design solutions for the same. |
| **CO3** | Evaluate the existing system and to propose practical solutions for the same for sustainable development. |
| **CO4** | Implement government or self-driven projects effectively in the field of societal problems. |
| **CO5** | Appraise the importance of ethical issues and team working abilities pertaining to the social services. |

**Assessment Details for CIE (100 Marks)**

| **Weightage** | **CIE- 100 Marks** |
|---|---|
| Selection of Topic, Commencement of activity and its progress | **40 Marks** |
| Case study based Assessment | **20 Marks** |
| Sector wise study and its consolidation | **20 Marks** |
| Video based seminar for 10 minutes by each student at the end of semester with Report | **20 Marks** |
| Total Marks for the course in the semester | **100 Marks** |

| **Suggested Learning Resources:** | |
|---|---|
| **Books:** | |
| **1** | NSS Course Manual, Published by NSS Cell, VTU Belagavi. |
| **2** | Government of Karnataka, NSS cell, activities reports and its manual. |
| **3** | Government of India, NSS cell, Activities reports and its manual. |

**CO-PO Matrix**

| **COs** | **PO1** | **PO2** | **PO3** | **PO4** | **PO5** | **PO6** | **PO7** | **PO8** | **PO9** | **PO10** | **PO11** | **PSO1** | **PSO2** |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **CO1** | | | | | | 3 | | | | | 3 | | |
| **CO2** | | | | | | 3 | | | | | 3 | | |
| **CO3** | | | | | | 3 | | | | | 3 | | |
| **CO4** | | | | | | 3 | | | | | 3 | | |
| **CO5** | | | | | | 2 | 3 | 3 | | | 3 | | |

| **Semester: V** | | | | | |
|---|---|---|---|---|---|
| **Physical Education (PE) (Sports & Athletics)**<br>**Stream: CSE/ECE/ME/CV** | | | | | |
| **Course Code** | **:** | BPE509 | **Credits** | **:** | 0 |
| **Hours/Week( L:T:P)** | **:** | 0:0:1 | **CIE** | **:** | 100 Marks |
| **Total Hours** | **:** | 24 | **SEE** | **:** | - |
| **Course Type** | **:** | NCMC | **SEE Duration** | **:** | - |

| **Course Learning Objectives: This course will enable the students to** | |
|---|---|
| **CLO1** | Impart foundational knowledge on the importance of physical fitness, food, and nutrition for a healthy lifestyle and personal well-being. |
| **CLO2** | Develop awareness and proficiency in general fitness components such as agility, flexibility, and cardiovascular endurance through standardized physical fitness tests. |
| **CLO3** | Enhance motor skills and techniques in a selected sport (Badminton, Basketball, or Athletics) through structured practice and application of fundamental game-specific skills. |

| **Module – 1** | **4 Hrs** |
|---|---|
| **Orientation**<br>A. Fitness<br>B. Food & Nutrition | |
| **Module – 2** | **4 Hrs** |
| **General Fitness & Components of Fitness**<br>A. Agility – Shuttle Run<br>B. Flexibility – Sit and Reach<br>C. Cardiovascular Endurance – Harvard step Test | |
| **Module-3** | **16 Hours** |
| **Specific games (Any one to be selected by the student)**<br>A. Badminton (Fore hand low/high service, back hand service, smash, drop)<br>B. Basketball (Dribbling, passing, shooting etc.)<br>C. Athletics (Field events – Throws) | |

| **Course Outcomes: After completing the course, the students will be able to** | |
|---|---|
| **CO1** | Understand the fundamentals of fitness, food and nutrition and their role in a healthy lifestyle. |
| **CO2** | Demonstrate understanding of general fitness components such as agility, flexibility and cardiovascular endurance through standard fitness tests |
| **CO3** | Apply basic techniques, rules and strategies in the chosen sport (Badminton, Basketball, or Athletics) |
| **CO4** | Develop sport-specific skills to enhance performance in both practice and competitive situations |
| **CO5** | Exhibit teamwork, discipline and sportsmanship during training and game play |

**Scheme and Assessment for auditing the course and Grades:**

| **Sl. No.** | **Activity** | **Marks** |
|---|---|---|
| 1. | Participation of student in all the modules | 20 |
| 2. | Quizzes – 2, each of 15 marks | 30 |
| 3. | Final presentation / exhibition / Participation in competitions/ practical on specific tasks assigned to the students | 50 |
| | **Total** | **100** |

**CO – PO MAPPING**

| | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 |
|---|---|---|---|---|---|---|---|---|---|---|---|
| **CO1** | 3 | 2 | | | | 3 | | | | | |
| **CO2** | 3 | 3 | | | | 3 | | | 2 | | |
| **CO3** | 2 | 3 | | | | 3 | 2 | 3 | 3 | | |
| **CO4** | 2 | 3 | | | | 3 | 2 | 3 | 3 | | |
| **CO5** | 2 | 2 | | | | | 3 | 3 | 3 | | |

| Semester: V | | | | | |
|---|---|---|---|---|---|
| **Yoga**<br>**Stream: CSE/ECE/ME/CV** | | | | | |
| **Course Code** | **:** | BYO509 | **Credits** | **:** | 0 |
| **Hours/Week( L:T:P:S)** | **:** | 0:0:2 | **CIE** | **:** | 100 Marks |
| **Total Hours** | **:** | 15P | **SEE** | **:** | - |
| **Course Type** | **:** | NCMC | **SEE Duration** | **:** | - |

| **Course Learning Objectives: This course will enable the students to** | |
|---|---|
| **CLO1** | **Adopt** healthy lifestyle practices and maintain mental hygiene to promote physical and mental well-being |
| **CLO2** | **Develop** emotional intelligence and foster emotional stability through self-awareness and mindfulness practices. |
| **CLO3** | **Impart** moral values and enhance self-awareness to facilitate personal growth and attain higher levels of consciousness. |

| **Module - 1** | **03 Hrs** |
|---|---|
| **Ashtanga Yoga Basics:** Patanjali's Ashtanga Yoga – definition, need & importance, Introduction to 3 limbs: Asana, Pranayama, Pratyahara | |
| **Module - 2** | **03 Hrs** |
| **Asana Overview:** Meaning, need & benefits of Asanas, Classification: Sitting, Standing, Prone , Supine | |
| **Module - 3** | **03 Hrs** |
| **Sitting & Standing Asanas:** *Sitting Asanas*: Ardha Ushtrasana, Vakrasana, Yogamudra in Padmasana, *Standing Asanas*: Urdhva Hastothanasana, Hastapadasana, Parivritta Trikonasana Utkatasana, Technique, precautions & benefits | |
| **Module - 4** | **03 Hrs** |
| **Prone & Supine Asanas:** Prone Asanas: Padangushtha Dhanurasana, Poorna Bhujangasana / Rajakapotasana, Supine Asanas: Sarvangasana, Chakrasana, Navasana / Noukasana, Pavanamuktasana Technique, precautions & benefits | |
| **Module - 5** | **03 Hrs** |
| **Pranayama Practice:** Meaning, need & benefits of Pranayama, Breathing practice: 60 strokes/min, 3 rounds, Types of Pranayama:Ujjayi, Sheetali, Sheektari, Technique, precautions & benefits | |

| **Course Outcomes: After completing the course, the students will be able to** | |
|---|---|
| **CO1** | Describe the origin, history, objectives, and fundamental concepts of Yoga and its various schools. |
| **CO2** | **Demonstrate** Suryanamaskara and various types of Asanas with correct techniques, precautions, and benefits. |
| **CO3** | **Differentiate** between yogic and non-yogic practices |
| **CO4** | **Apply** yogic principles to promote physical and mental well-being. |

| **Text Books** | |
|---|---|
| **1.** | Light on Yoga, BKS Iyengar, Thorsons Publishers, ISBN-10 : 8172235011. |
| **2.** | Teaching Methods for Yogic practices, Dr. M L Gharote & Dr. S K Ganguly, 4th Edition, Kaivalyadhama Publishers, ISBN-10 : 9788189485245. |

| | |
|---|---|
| **3.** | Yoga Instructor Course hand book published, SVYASA University, Bengaluru. |

| **Reference Books** | |
|---|---|
| **1** | Yogapravesha in Kannada, Ajitkumar |
| **2** | Yoga for Children –step by step, Yamini Muthanna |

| **Web links and Video Lectures ( e – Resources )** | |
|---|---|
| **1** | https://www.youtube.com/watch?v=KB-TYlgd1wE |
| **2** | https://www.youtube.com/watch?v=aa-TG0Wg1Ls |

| Semester: III-VI | | | | | |
|---|---|---|---|---|---|
| **Music** | | | | | |
| **Course Code** | **:** | BMU310/410/509/610 | **Credits** | **:** | 0 |
| **Hours/Week( L:T:P)** | **:** | 0:0:2 | **CIE** | **:** | 100 Marks |
| **Total Hours** | **:** | 26P | **SEE** | **:** | - |
| **Course Type** | **:** | NCMC | **SEE Duration** | **:** | - |

| **Course Objectives: This course will enable the students to** | |
|---|---|
| **1** | Understand the foundational concepts of Indian classical music, including the evolution and structure of Shruthi, Nada, Swara, Laya, Raga, Tala and Mela systems. |
| **2** | Recognize and describe various types of Carnatic compositions such as Geethe, Jathi, Swara, Swarajathi, Varna, Krithi and Thillana, along with the basics of the notation system. |
| **3** | Appreciate the contributions of key composers like Purandaradasa, Thyagaraja and Mysore Vasudevacharya to Indian music and understand their musical legacy. |
| **4** | Identify and explain the classification and basic construction of traditional Indian musical instruments, including string, wind, percussion and idiophones, with appropriate examples. |
| **5** | Demonstrate basic vocal proficiency through the practice of Sarale Varase exercises, notations for Suladi Sapta Tala in Mayamalavagowla raga and performance of selected compositions such as Geethe, Jathi Swara and Krithi. |

| **Module -I** | **03 Hrs** |
|---|---|
| **Preamble**<br>Contents of the curriculum intended to promote music as language to develop an analytical, creative and intuitive understanding. For this the student must experience music through study and direct participation in improvisation and composition.<br>Origin of the Indian Music: Evolution of the Indian music system, understanding of Shruthi, Nada, Swara, Laya, Raga, Tala, Mela<br>**Textbook 1: V-1 Ch. 1-4** | |
| **Module – II** | **03 Hrs** |
| **Compositions**<br>Introduction to the types of composition in Carnatic Music – Geethe, Jathi, Swara, Swarajathi, Varna, Krithi and Thillana, Notation System.<br>**Textbook 2: Ch. 4-7** | |
| **Module –III** | **03 Hrs** |
| **Composers**<br>Biography and contributions of Purandaradasa, Thyagaraja, Mysoro asudevacharya, Kanakadasa<br>**Textbook 3: Ch. 2-5** | |
| **Module –IV** | **03 Hrs** |
| **Music Instruments**<br>Classification and construction of string instruments, wind instruments, percussion Instruments, Idiophones (Ghana Vaadya), Examples of each class of instruments.<br>**Textbook 1: V-4 – Ch. 2-6** | |
| **Module –V** | **14 Hrs** |
| **Abhyasa Gana**<br>Singing the swara exercises (Sarale Varase Only), Botatio writing for sarale varase and sulafi sapta tala (Only in mayamalavagowla raga), singing 4 geethe in malahari and one jathi swara, oe krithi in a mela raga<br>**Textbook 1: V-1&2** | |

| **Course Outcomes: After completing the course, the students will be able to** | |
|---|---|
| **CO1** | Outline the evolution of Indian music and key concepts like Shruthi, Swara, Raga and Tala. |
| **CO2** | Identify and interpret basic Carnatic compositions using standard notation. |
| **CO3** | Summarize the contributions of composers. |
| **CO4** | Classify Indian musical instruments and describe their construction and use. |
| **CO5** | Demonstrate basic Carnatic vocal skills through selected exercises and compositions. |

| **Text Books** | |
|---|---|
| **1** | South Indian Music – Vol. I to VI, Prof. P. Sambamoorthy, The Indian Music Publishing House, Chennai. |
| **2** | A Textbook of Carnatic Music, Dr. S. Bhagyalekshmy, CBH Publications |
| **3** | Karnataka Sangeetha Charitre, Dr. V. S. Sampathkumaracharya, Kannada University, Hampi. |

| **Reference Books** | |
|---|---|
| **1** | Music of India, B. Chaitanya Deva, Munshiram Manoharlal Publishers |
| **2** | Essentials of Musicology in South Indian Music, Prof. S. R. Janakiraman, Asian Educational Services |

**CO – PO MAPPING**

| | **PO1** | **PO2** | **PO3** | **PO4** | **PO5** | **PO6** | **PO7** | **PO8** | **PO9** | **PO10** | **PO11** |
|---|---|---|---|---|---|---|---|---|---|---|---|
| **CO1** | 3 | | 1 | | 1 | | 1 | 1 | 1 | | 1 |
| **CO2** | 3 | | 3 | 1 | 2 | 1 | 2 | 1 | 1 | | 1 |
| **CO3** | 1 | | | | 1 | 1 | 1 | | 1 | | |
| **CO4** | 2 | | 2 | | 3 | 1 | 1 | 1 | 1 | | 1 |
| **CO5** | 3 | | | 1 | 2 | 1 | 1 | 1 | 1 | | 1 |

## INSTITUTE VISION

Preparing Competent Engineering and Management Professionals to Serve the Society.

## INSTITUTE MISSION

- Providing Students with a Sound Knowledge in Fundamentals of their branch of Study.
- Promoting Excellence in Teaching, Training, Research and Consultancy.
- Exposing Students to Emerging Frontiers in various domains enabling Continuous Learning.
- Developing Entrepreneurial acumen to venture into Innovative areas.
- Imparting Value based Professional Education with a sense of Social Responsibility.

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Building up-skilled Computer Professionals, enriched with interactive design skills as to serve the dynamic needs of the Industry and Society.

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- Nurture competence as well as Applied Research activities to solve concrete problems.
- . Aspire for constant up-gradation of engineering skills to cater the needs of the Corporate and Society.
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- Inculcate Research culture to design and develop smart computing solutions for Humanity and Nation.

# SJC INSTITUTE OF TECHNOLOGY

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