

Third Year BE SCHEME & SYLLABUS

Autonomous Scheme 2021-22

Computer Science & Business Systems



ST JOSEPH ENGINEERING COLLEGE
AN AUTONOMOUS INSTITUTION
Vamanjoor, Mangaluru - 575028

MOTTO

Service and Excellence

VISION

To be a global premier Institution of professional education and research

MISSION

- Provide opportunities to deserving students of all communities, the Christian students in particular, for quality professional education
- Design and deliver curricula to meet the national and global changing needs through student-centric learning methodologies
- Attract, nurture and retain the best faculty and technical manpower
- Consolidate the state-of-art infrastructure and equipment for teaching and research activities
- Promote all-round personality development of the students through interaction with alumni, academia and industry
- Strengthen the Educational Social Responsibilities (ESR) of the Institution



ST JOSEPH ENGINEERING COLLEGE

An Autonomous Institution
Vamanjoor, Mangaluru - 575028

Affiliated to VTU – Belagavi & Recognized by AICTE New Delhi
NBA – Accredited: B.E.(CSE, ECE, EEE, ME and CIV) & MBA
NAAC – Accredited with A+

B.E. SCHEME & SYLLABUS (With effect from 2021-22)

Computer Science and Business Systems

**THIRD YEAR
(V and VI Semester)**

AUTONOMY AND ACCREDITATION

St Joseph Engineering College (SJEC) is an Autonomous Institute under Visvesvaraya Technological University (VTU), Belagavi, Karnataka State, and is recognized by the All-India Council for Technical Education (AICTE), New Delhi. SJEC is registered under the trust “Diocese of Mangalore, Social Action Department”.

The SJEC has been conferred Fresh Autonomous Status from the Academic Year 2021-22. The college was granted autonomy by the University Grants Commission (UGC) under the UGC Scheme for Autonomous Colleges 2018 and conferred by VTU. The UGC Expert Team had visited the college on 28-29 November 2021 and rigorously assessed the college on multiple parameters. The fact that only a handful of engineering colleges in the state have attained Autonomous Status adds to the college’s credibility that has been on a constant upswing. Autonomy will make it convenient for the college to design curricula by recognizing the needs of the industry, offering elective courses of choice and conducting the continuous assessment of its students.

At SJEC, the Outcome-Based Education (OBE) system has been implemented since 2011. Owing to OBE practised at the college, SJEC has already been accredited by the National Board of Accreditation (NBA). Five of the UG programs, namely Computer Science & Engineering, Mechanical Engineering, Electronics and Communication Engineering, Electrical & Electronics Engineering and Civil Engineering and MBA programs, have accreditation from the NBA.

Also, SJEC has been awarded the prestigious A+ grade by the National Assessment and Accreditation Council (NAAC) for five years. With a Cumulative Grade Point Average (CGPA) of 3.39 on a 4-point scale, SJEC has joined the elite list of colleges accredited with an A+ grade by NAAC in its first cycle. The fact that only a small percentage of the Higher Education Institutions in India have bagged A+ or higher grades by NAAC adds to the college’s credibility that has been on a constant upswing.

The college is committed to offering quality education to all its students, and the accreditation by NAAC and NBA reassures this fact. True to its motto of “Service and Excellence”, the college’s hard work has resulted in getting this recognition, which has endorsed the academic framework and policies that the college has been practicing since its inception. The college has been leveraging a flexible choice-based academic model that gives students the freedom to undergo learning in respective disciplines and a transparent and continuous evaluation process that helps in their holistic development.

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ABOUT THE DEPARTMENT

SJEC takes pride to launch in partnership with India's leading IT Service and Consulting Company – TCS, an industry ready BE Programme titled Computer Science and Business Systems (CSBS) to cater to the rising need of engineering talent with skills in Business Systems. This Four-Year undergraduate degree programme is offered with an intake of 60, Autonomous under VTU -Belagavi. This state-of-the-art programme aims to impart knowledge of cutting-edge technologies and business skills with hands-on exposure to help the students be industry-ready.

The Computer Science and Business Systems programme in collaboration with TCS aims to expose students not only to the core topics of Computer Science but also develop an equal understanding of humanities, human values and management sciences. This programme is an apt choice for students aspiring to be business leads in the IT industry. Students will also gain excellent industrial exposure on emerging topics such as Business Analytics, Machine Learning, Cloud Computing, Internet of Things etc.

DEPARTMENT VISION

To impart value-based quality education with the motive of transforming mankind with excellence and competing areas of engineering, technology and management.

DEPARTMENT MISSION

1. Focus on the practical aspects of the curriculum to make learning a meaningful and interesting experience.
2. Encourage active collaboration with industries, communities, and fellow institutions within the country and abroad.
3. Infuse strong moral and ethical principles in students in order to make them conscientious citizens and excellent human beings.
4. Cultivate the competitive spirit required for success.

PROGRAM EDUCATIONAL OBJECTIVES (PEOs)

1. To provide students with a solid foundation and the ability to use engineering concepts, mathematics, physics, and humanities required to develop, analyse, design, and implement solutions to the problems in intelligent computing and business systems.
2. To develop in students, the knowledge of computer science and engineering to work in domains such as artificial intelligence, machine learning and data science.
3. To foster in students, the capacity of teamwork through efficient communication in multidisciplinary projects.
4. To prepare students for building successful careers in artificial intelligence, data science and business systems to meet the needs of society while incorporating professional ethics.
5. To inspire learners to pursue higher education in their desired fields and engage in research.

PROGRAM OUTCOMES (POs)

Engineering Graduates will be able to:

- 1. Engineering knowledge:** Apply the knowledge of mathematics, science, engineering fundamentals, and engineering specialization to the solution of complex engineering problems.
- 2. 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.
- 3. 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.
- 4. Conduct investigations on complex problems:** Use research-based knowledge and research methods including design of experiments, analysis and interpretation of data, and the synthesis of information to provide valid conclusions.
- 5. Modern tool usage:** Create, select, and apply appropriate techniques, resources, and modern engineering and IT tools including prediction and modeling to complex engineering activities with an understanding of the limitations.
- 6. 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.
- 7. 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.
- 8. Ethics:** Apply ethical principles and commit to professional ethics and responsibilities and norms of the engineering practice.
- 9. 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 a 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)

- 1. Entrepreneurship and Freelancing:** Recognize the tenets of entrepreneurship, freelancing and the prerequisites for starting a business in the IT or related fields.
- 2. Competitive Exams:** Participate skillfully in competitive examinations for certification, professional advancement, and admission to higher studies.

V Semester (B.E. - CSBS)

SI. No.	Course and Course Code		Course Title	Teaching Department	Paper Setting Board	Teaching Hours/Week			Examination				Credits
						Theory Lecture	Tutorial	Practical/ Drawing	Duration in hours	CIE Marks	SEE Marks	Total	
						L	T	P					
1	HSMC	21CBS501	Fundamentals of Management	CBS	CBS	3	-	-	03	50	50	100	3
2	PCC	21CBS502	Database Management Systems (Integrated Course)	CBS	CBS	3	-	2	03	50	50	100	4
3	PCC	21CBS503	Software Design with UML	CBS	CBS	2	2	-	03	50	50	100	3
4	PCC	21CBS504	Compiler Design	CBS	CBS	2	2	-	03	50	50	100	3
5	PCC	21CBS505	Business Strategy	CBS	CBS	2	2	-	03	50	50	100	3
6	PCC	21CBL506	Application Development Using Python Lab	CBS	CBS	-	-	2	03	50	50	100	1
7	HSMC	21RMI507	Research Methodology and Intellectual Property Rights	CBS	CBS	3	-	-	03	50	50	100	3
8	INT	21INT508	Summer Internship - II	CBS	CBS	-	-	-	03	100	-	100	2
9	MNCC	21ETP509	Emerging Technologies: A Primer	COM	COM	-	-	2	02	50	-	50	-
						15	6	6	26	500	350	850	22

Note: BSC: Basic Science Courses; ESC: Engineering Science Courses; HSMC: Humanity, Social Science and Management Courses; MNCC = Mandatory Non-Credit Course. INT: Internship, PCC: Professional Core Course; PEC = Professional Elective Course; OEC = Open Elective Course; UHV: Universal Human Values SDC: Ability Enhancement (Skill Development) Course.

One-hour Lecture (L) per week per semester = 1 Credit; Two-hour Tutorial (T) per week per semester = 1 Credit; Two-hour Practical/Laboratory/Drawing (P) per week per semester = 1 Credit.

VI Semester (B.E. - CSBS)

SI. No.	Course and Course Code		Course Title	Teaching Department	Paper Setting Board	Teaching Hours/Week			Examination				Credits
						Theory Lecture	Tutorial	Practical/ Drawing	Duration in hours	CIE Marks	SEE Marks	Total	
						L	T	P					
1	PCC	21CBS601	Computer Networks and Security (Integrated Course)	CBS	CBS	3	-	2	03	50	50	100	4
2	PCC	21CBS602	Artificial Intelligence	CBS	CBS	2	2	-	03	50	50	100	3
3	PEC	21CBS603X	Professional Elective - 1	CBS	CBS	2	2	-	03	50	50	100	3
4	OEC	21XXX604X	Open Elective - 1	CBS	CBS	3	-	-	03	50	50	100	3
5	HSMC	21CIV605	Environmental Studies	CIV	CIV	1	-	-	02	50	50	100	1
6	PCC	21CBL606	Artificial Intelligence Lab	CBS	CBS	-	-	2	03	50	50	100	1
7	PCC	21CBS607	Operation Research	CBS	CBS	2	2	-	03	50	50	100	3
8	SDC	21CBS608	Mini-Project	CBS	CBS	-	-	2	03	100	-	100	2
9	MNCC	21IIP609	Innovation and Intellectual Property	COM	COM	-	-	2	02	50	-	50	-
10	INT	Summer Internship III: Research Internship / Industrial Internship: 24 weeks during the VI to VIII semesters On successful completion, 10 credits will be added in the VIII Semester marks card.											
						13	06	08	25	500	350	850	20

Professional Elective - I: Students can select any one of the Professional Electives offered by the Department.

Professional Elective – 1 21CBS603X			
21CBS6031	Financial and Cost Accounting	21CBS6033	Machine Learning
21CBS6032	Introduction to Innovation, Entrepreneurship and IPR Management	21CBS6034	Design Thinking

Open Elective I (21XXX604X)							
Course Code	CSE	AIM	CBS	ECE	EEE	MEC	CIV
21XXX6041	Introduction to Database Management System	Neural Networks	Neural Networks	Basics of Analog Circuits	Renewable Energy Sources	Automobile Engineering	Remote Sensing and Geographical Information System
21XXX6042	Introduction to Programming in Java	Introduction to AI and ML	Introduction to AI and ML	Fundamentals of Digital System Design	PLC & SCADA	3D modelling	Numerical Methods and Applications
21XXX6043	Dot Net Programming	Computer Vision	Computer Vision	Microcontroller	Control Systems	Entrepreneurship Development	Sustainability Concepts in Engineering
21XXX6044	Introduction to Python	Predictive Analytics	Predictive Analytics	Programming & Interfacing with Arduino	Electrical Safety Practices	Statistical Quality Control	Occupational Health and Safety
21XXX6045	-	Introduction to Data Science	Introduction to Data Science	Communication Theory	Energy Conservation and Audit	Non-Destructive Testing	-

Note: Open Elective – I: Students can select any one of the open electives offered by other Departments except those that are offered by the parent Department (Please refer to the list of open electives). Selection of an open elective shall not be allowed if, (i) the candidate has studied the same course during the previous semesters of the program. (ii) the syllabus content of open elective is similar to that of the Departmental core courses or professional electives. (iii). A similar course, under any category, is prescribed in the higher semesters of the program. Registration to electives shall be documented under the guidance of Programme Coordinator/ Advisor/Mentor.

Research/Industrial Internship - All the students admitted shall have to undergo a mandatory internship of minimum 24 weeks during the VI to VIII semesters. Viva-Voce examination shall be conducted during VIII semester and the prescribed credit shall be included. The internship shall be considered as a head of passing and shall be considered for the award of degree. Those, who do not take up/complete the internship shall be declared fail and shall have to complete during subsequent examination after satisfying the internship requirements.

Research Internship Students have to take up research internships at Centers of Excellence (CoE) / Study Centers established in the same institute and /or out of the institute at reputed research organizations / Institutes. A research internship is intended to give students the flavour of current research going on a particular topic/s. The internships serve this purpose. They help students to get familiarized with the field, the skill needed, the amount and kind of effort required for carrying out research in that field.

AICTE Activity Points to be earned by students admitted to BE/B.Tech/B. Plan day college programme (For more details refer to Chapter 6, AICTE Activity Point Programme, Model Internship Guidelines): Over and above the academic grades, every student admitted to the 4 years Degree programme and every student entering 4 years Degree programme through lateral entry, shall earn 100 and 75 Activity Points respectively for the award of degree through AICTE Activity Point Programme. Students transferred from other Universities to fifth semester are required to earn 50 Activity Points from the year of entry. The Activity Points earned shall be reflected on the student's eighth semester Grade Card. The activities can be spread over the years, anytime during the semester weekends and holidays, as per the liking and convenience of the student from the year of entry to the programme. However, minimum hours' requirement should be fulfilled. Activity Points (non-credit) have no effect on SGPA/CGPA and shall not be considered for vertical progression. In case students fail to earn the prescribed activity Points, Eighth semester Grade Card shall be issued only after earning the required activity Points. Students shall be admitted for the award of degree only after the release of the Eighth semester Grade Card.

V Semester

Fundamentals of Management			
Course Code	21CBS501	CIE Marks	50
Course Type (Theory/Practical/Integrated)	Theory	SEE Marks	50
		Total Marks	100
Teaching Hours/Week (L:T:P)	3:0:0	SEE	3 Hours
Total Hours	40 Hours	Credits	03
<p>Course Learning Objectives: The objective of the course is to</p> <ul style="list-style-type: none"> • Manage business organizations in the dynamic global environment • Understand and maintain competitive advantage in organizations • Take decisions using various tools and techniques to remain competitive in business • Develop strategies and critical thinking skills to solve real-life situations • Discuss different areas of the business (i.e., Manufacturing/Service, Marketing, Finance and Human Resource Management) . 			
Module-1 Introduction to Management			8 hours
<p>Introduction to Management: Definition, Nature and Scope, Functions, Managerial Roles, Levels of Management, Managerial Skills, Challenges of Management; Evolution of Management- Classical Approach- Scientific and Administrative Management; The Behavioral approach; The Quantitative approach; The Systems Approach; Contingency Approach, IT Approach.</p> <p>TB1, TB2</p>			
Module-2 Planning and Decision Making			8 hours
<p>Planning and Decision Making: General Framework for Planning - Planning Process, Types of Plans, Management by Objectives; Development of Business Strategy. Decision making and Problem Solving - Programmed and Non-Programmed Decisions, Steps in Problem Solving and Decision Making; Bounded Rationality and Influences on Decision Making; Group Problem Solving and Decision Making, Creativity and Innovation in Managerial Work.</p> <p>TB1, TB2</p>			
Module-3 Organization and HRM			8 hours
<p>Organization and HRM: Principles of Organization: Organizational Design & Organizational Structures; Departmentalization, Delegation; Empowerment, Centralization, Decentralization, Recentralization; Organizational Culture; Organizational Climate and Organizational Change. Human Resource Management & Business Strategy: Talent Management, Talent Management Models and Strategic Human Resource Planning; Recruitment and Selection; Training and Development; Performance Appraisal.</p> <p>TB1, TB2</p>			
Module-4 Leading and Motivation			8 hours
<p>Leading and Motivation: Leadership, Power and Authority, Leadership Styles; Behavioral Leadership, Situational Leadership, Leadership Skills, Leader as Mentor and Coach, Leadership during adversity and Crisis; Handling Employee and Customer Complaints, Team Motivation - Types of Motivation; Relationship between Motivation, Performance and Engagement, Content Motivational Theories - Needs Hierarchy Theory, Two Factor Theory, Theory X and Theory Y.</p> <p>TB1, TB2</p>			
Module-5 Controlling			8 hours
<p>Controlling: Control, Types and Strategies for Control, Steps in Control Process, Budgetary and Non- Budgetary Controls. Characteristics of Effective Controls, Establishing control systems, Control frequency, and Methods.</p> <p>TB1, TB2</p>			

Course Outcomes: At the end of the course the student will be able to:	
21CBS501.1	Apply the primary functions of management and the roles of managers, contributions to field of management.
21CBS501.2	Explain planning, decision-making, and problem-solving in managerial contexts.
21CBS501.3	Explain principles of organization design, HRM strategies, talent management, and organizational change in diverse contexts.
21CBS501.4	Build leadership competence, analyze styles, and apply crisis management, ensuring effective team leadership in various situations..
21CBS501.5	Illustrate the intricacies of motivation types, analyze their impact on performance, and apply motivational theories effectively.
21CBS501.6	Analyze control types, strategies, and apply effective control systems, fostering organizational performance and efficiency.

Sl. No.	Title of the Book	Name of the Author/s	Name of the Publisher	Edition and Year
Textbooks				
1	Management Fundamentals	Robert N Lussier	Cengage Learning,	5 th Edition, 2013
2	Fundamentals of Management,	Stephen P Robbins,	Pearson Education, 2009.	9 th Edition, 2016
Reference Books				
1	Essentials of Management	Koontz Kleihrich	Tata McGraw Hill	8 th Edition, 2009
2	Management Essentials	Andrew DuBrin	Cengage Learning	9 th Edition, 2012

Web links and Video Lectures (e-Resources):

- <http://nptel.ac.in/courses/109105121/>
- <http://nptel.ac.in/courses/122105021/>
- <https://en.wikipedia.org/wiki/Management>
- <https://iedunote.com/planning-decision-making-relation>
- <https://www.sciencedirect.com/science/article/pii/.../pdf?md5...pid=1-s2.0...1>
- smallbusiness.chron.com › Managing Employees › Employees
- [www.businessmanagementideas.com/advertisement/controlling...management.](http://www.businessmanagementideas.com/advertisement/controlling...management)

Course Articulation Matrix

Course Outcomes (COs)	Program Outcomes (POs)													
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
21CBS501.1		1								3	3	1	1	
21CBS501.2		1								2	2		1	
21CBS501.3								2			3			
21CBS501.4		2							3	2		1		
21CBS501.5		2							2	2		1	1	
21CBS501.6		1								2	1			

1: Low 2: Medium 3: High

Database Management Systems			
Course Code	21CBS502	CIE Marks	50
Course Type (Theory/Practical/Integrated)	Integrated	SEE Marks	50
		Total Marks	100
Teaching Hours/Week (L:T:P)	3:0:2	SEE	3 Hours
Total Hours	40 hours Theory + 10 Lab slots	Credits	04
<p>Course Learning Objectives: The objective of the course is to</p> <ol style="list-style-type: none"> 1. Provide a strong foundation in database concepts, technology, and practice. 2. Practice SQL programming through a variety of database problems. 3. Demonstrate the use of concurrency and transactions in the database. 4. Design and build database applications for real world problems. 5. Develop applications to interact with databases. 			
Module-1 Introduction to Databases			8 hours
<p>Introduction to Databases: Introduction, Simplified database system environment, Characteristics of database approach, Actors on the scene, Workers behind the scene, Advantages of using the DBMS approach.</p> <p>Database Concepts and Architectures: Data Models, Schemas and Instances. Three schema architecture and data independence, database languages and interfaces, Component modules of a DBMS and their Interactions.</p> <p>Data Model: Main phases of a Database Design Process, Entity Types, Entity Sets, Attributes, Keys, Relationship Types, Sets, Roles and Structural Constraints, ER diagram Notations and examples.</p> <p>TB 1</p>			
Module-2 Relational Model			8 hours
<p>Relational Model: Relational Model Concepts, Relational Model Constraints and schemas, Update Operations and Dealing with Constraint violations, Relational database design using ER to Relational Mapping</p> <p>SQL: SQL data definition and data types, Specifying Constraints in SQL, Basic Retrieval Queries in SQL, INSERT, DELETE, and UPDATE statements in SQL, More Complex SQL Retrieval Queries, Specifying Constraints as Assertions and Triggers, Views in SQL, Schema Change Statements in SQL.</p> <p>TB1</p>			
Module-3 SQL & JDBC			8 hours
<p>Relational Algebra & Design: Unary and Binary relational operations, Relational Algebra Operations, Additional Relational Operations, Examples of Queries in Relational Algebra.</p> <p>Database Application Development: Embedded SQL, Dynamic SQL, SQLJ, Database Programming with Function calls: SQL and JDBC, Database Stored Procedures.</p> <p>TB1, TB2</p>			
Module-4 Normalization			8 hours
<p>Normalization and its Algorithms: Informal design guidelines for relation schema, Functional Dependency (Inference Rules, Equivalence, and Minimal Cover) , Normal Forms based on Primary Keys, Second and Third Normal Forms, Boyce-Codd Normal Form, Multivalued Dependency and Fourth Normal Form, Join Dependencies and Fifth Normal Form, Properties of Relational Decompositions, Algorithms for Relational Database Schema Design, Dangling tuples.</p> <p>TB1</p>			
Module-5 Transaction Processing & database Recovery			8 hours
<p>Transaction Processing: Introduction to Transaction Processing, Transaction and System concepts, Desirable properties of Transactions, characterizing schedules based on recoverability, characterizing schedules based on Serializability, Two-phase locking techniques for Concurrency control.</p> <p>Database Recovery Protocols: Recovery Concepts, NO-UNDO/REDO algorithm, Recovery</p>			

techniques based on immediate update, Shadow paging, ARIES recovery algorithm.

Database Security: Database security issues-Types of security and control measures, SQL Injection, Challenges to Maintaining Database Security.

TB1

PRACTICAL MODULE

Design, develop, and implement the specified queries for the following problems using Oracle, MySQL, MS SQL Server, or any other DBMS under LINUX/Windows environment. Create Schema and insert at least 5 records for each table. Add appropriate database constraints.

1. Write Schema and ER Diagram for Bank Database/ College Database. Demonstrate mapping of ER- diagram to Relational Schema model.
(Drawing tool like “drawio” can be explored if required)
2. The Company database of an organization has a table with following attributes
EMPLOYEE (empid:int, empname:string, Doj:date, department:string, salary:decimal)
 - i. Create above tables using suitable constraints
 - ii. Enter 5 tuples into the table
 - iii. Display number of employee working in each department
 - iv. Find the sum and average of salaries of employees of a particular department
 - v. Find the empid and emp_name of all the employees who has salary not equal to 25000 or 30000
 - vi. Display all records who’s name starts with and ends with A and has atleast 4 characters.
3. The College Database has following tables
DEPARTMENT (DEPT_ID: int, DEPT_NAME: string)
STUDENT (STUD_ID:int, STUD_NAME:String,AGE: int, DOB: date,ADDRESS: String, DEPT_NO:int)
SUBJECT (SUBJECT_ID:int, SUBJECT_NAME:String,DEPT_NO:int)
TEACHER (TEACHER_ID:int,TEACHER_NAME:String,SUB_NO:int,DEPT_NO: int)
Create tables using suitable constraints, Insert 10 sample data into the table and perform following operations
 - i. List all the students’ details studying in Computer Science Department
 - ii. List all the teachers teaching in EEE Department
 - iii. List the subject offered by Computer Science Department
 - iv. Change the date type of STUD_ID from integer to string
 - v. Add new attribute STUD_Phno to the existing STUDENT table
 - vi. Combine each row of Student table with each row of Subject table
 - vii. Create a student table view
 - viii. Display the names of the students who opted DBMS subject
4. Consider the following schema for Order Database:
SALESMAN(Salesman_id, Name, City, Commission)
CUSTOMER(Customer_id, Cust_Name, City, Grade, Salesman_id)
ORDERS(Ord_No, Purchase_Amt, Ord_Date, Customer_id, Salesman_id)
Create tables using suitable constraints, Insert 10 sample data into the table and Write SQL queries to
 - i. Count the customers with grades above Bangalore’s average.
 - ii. Find the name and numbers of all salesman who had more than one customer.
 - iii. List all the salesman and indicate those who have and don’t have customers in

- iv. their cities (Use UNION operation.)
 - v. Create a view that finds the salesman who has the customer with the highest order
 - vi. of a day.
 - vii. Demonstrate the DELETE operation by removing salesman with id 1000. All
 - viii. his orders must also be deleted..
5. Consider the schema for Company Database:
 EMPLOYEE(SSN, Name, Address, Sex, Salary, SuperSSN, DNo)
 DEPARTMENT(DNo, DName, MgrSSN, MgrStartDate)
 DLOCATION(DNo,DLoc)
 PROJECT(PNo, PName, PLocation, DNo)
 WORKS_ON(SSN, PNo, Hours)
- Create tables using suitable constraints, Insert 10 sample data into the table and Write SQL queries to
- i. Find the sum of the salaries of all employees, the maximum salary, the minimum salary and the average salary.
 - ii. Select the total number of employees in the company and the number of employees in the 'Research' department
 - iii. Retrieve all employees whose address is in “Houston, Texas” (LIKE)
 - iv. Find all employees who were born during the 1970s (LIKE)
 - v. Retrieve all employees in department 5 whose salary is between \$30,000 and \$40,000 (BETWEEN)

Mini Project (Open Ended Problem)

Use Java, HTML, Python, or any other similar front-end tool. All applications must be demonstrated on desktop/laptop as a stand-alone or web-based application (Mobile apps on Android/IOS are not permitted)

Course Outcomes: At the end of the course the student will be able to:	
21CBS502.1	Identify attributes, entities and relationships of the given system and draw Entity Relationship Diagrams.
21CBS502.2	Apply relational database schema for the given application and develop queries in relational algebraic expressions.
21CBS502.3	Implement basic and complex queries using SQL to retrieve the required information from database
21CBS502.4	Apply normalization steps in database design using the design guidelines and functional dependencies
21CBS502.5	Analyze the issues associated with Transaction Processing and relate the concept of query optimization.
21CBS502.6	Design and develop a database application system using advanced SQL tools and interfaces with appropriate documentation by incorporating ethical standards

Sl. No.	Title of the Book	Name of the Author/s	Name of the Publisher	Edition and Year
Textbooks				
1	Fundamentals of Database Systems	Ramez Elmasri, Shamkant B. Navathe	Pearson	7 th Edition, 2017
2	Database management systems	Ramakrishnan, Gehrke	McGraw Hill	3 rd Edition, 2014

Reference Books				
1	Database System Concepts	Silberschatz Korth, Sudharshan	McGraw Hill	6 th Edition, 2013
2	Database Principles Fundamentals of Design, Implementation and Management	Coronel, Morris, and Rob	Cengage Learning	9 th Edition, 2012

Web links and Video Lectures (e-Resources):

- <https://nptel.ac.in/courses/106/106/106106095/>
- <https://nptel.ac.in/courses/106/106/106106220/>
- <https://www.youtube.com/watch?v=3EJlovevfcA>
- <https://www.youtube.com/watch?v=c5HAWKX-suM>
- <https://www.youtube.com/watch?v=mXc81thXi1E>
- <https://www.youtube.com/watch?v=3EJlovevfcA>

Course Articulation Matrix

Course Outcomes (COs)	Program Outcomes (POs)													
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
21CBS502.1	1	2												
21CBS502.2			2											
21CBS502.3			2		1									2
21CBS502.4	1				2									
21CBS502.5	2					1								
21CBS502.6			3		2			1			1			2

1: Low 2: Medium 3: High

Software Design with UML			
Course Code	21CBS503	CIE Marks	50
Course Type (Theory/Practical/Integrated)	Theory	SEE Marks	50
		Total Marks	100
Teaching Hours/Week (L: T:P)	2:2:0	SEE	3 Hours
Total Hours	40 hours Theory	Credits	03
<p>Course Objective: The objective of the course is to</p> <ul style="list-style-type: none"> • Provide an understanding of various software development models and software quality metrics. • Analyze requirements to represent logical design that is recognized by various object relationships. • Identify interaction among structural elements to translate an analysis model into a design model. • Apply dependencies among packages and package able element ownership • Implement dynamic behavior of the system and message flow from one object to other. 			
Module-1 Software Engineering and Object Oriented Techniques		8 hours	
<p>Introduction to Software Engineering: Software Crisis, Need for Software Engineering. Professional Software Development, Software Engineering Ethics.</p> <p>Introduction to Object-Oriented Technologies: Software development process: The Waterfall Model vs. The Spiral Model; The Software Crisis, description of the real world using the Objects Model; Classes, inheritance, and multiple configurations; Quality software characteristics; Description of the Object-Oriented Analysis process vs. the Structure Analysis Model.</p>			
Module-2 UML Design		8 hours	
<p>UML Language: Standards; Elements of the language; General description of various models; The process of Object-Oriented software development; Description of Design Patterns; Technological Description of Distributed Systems.</p> <p>Requirements Analysis Using Case Modeling AND The Logical View Design: Analysis of system requirements; Actor definitions; Writing a case goal; Use Case Diagrams; Use Case Relationships.</p>			
Module-3 Software Design Simplified		8 hours	
<p>The Static Structure Diagrams: The Class Diagram Model; Attributes descriptions; Operations descriptions; Connections descriptions in the Static Model; Association, Generalization, Aggregation, Dependency, Interfacing, Multiplicity.</p> <p>Transfer from Analysis to Design in the Characterization Stage: Interaction Diagrams: Description of goal; Defining UML Method, Operation, Object Interface, Class; Sequence Diagram; Finding objects from Flow of Events; Describing the process of finding objects using a Sequence Diagram; Describing the process of finding objects using a Collaboration Diagram</p>			
Module-4 Modeling		8 hours	
<p>Package Diagram Model: Description of the model; White box, black box; Connections between packages; Interfaces.; Create Package Diagram; Drill Down.</p> <p>Dynamic Model: State Diagram / Activity Diagram: Description of the State Diagram; Events Handling; Description of the Activity Diagram; Exercise in State Machines.</p>			
Module-5 UML Aspects		8 hours	
<p>Component Diagram Model: Physical Aspect; Logical Aspect; Connections and Dependencies; User face; Initial DB design in a UML environment.</p> <p>Deployment Model: Processors; Connections; Components; Tasks; Threads; Signals and Events.</p>			
Course Outcomes: At the end of the course the student will be able to:			
21CBS503.1	Identify different software process models along with proper ethical considerations to develop a quality software.		

21CBS503.2	Analyze requirements to represent a logical design that is recognized by various object relationships
21CBS503.3	Identify interaction among structural elements to translate analysis model into design model
21CBS503.4	Model dependencies among packages and package able element ownership
21CBS503.5	Model dynamic behavior of the system and message flow from one object to other
21CBS503.6	Envision the topology of the physical components of a system where the software components are utilized

Sl. No.	Title of the Book	Name of the Author/s	Name of the Publisher	Edition and Year
Textbooks				
1	Software Engineering	Ian Sommerville	Pearson	9 th Edition, 2010
2	The Unified Modelling Language User Guide.	Grady Booch, James Rumbaugh, War Jacobson	Pearson	2 rd Edition, 2005
Reference Books				
1	Design Patterns: Elements of Reusable Object-Oriented Software	Erich Gamma, Richard Helm, Ralph Johnson, and John M. Vlissides.	Pearson	1 st Edition, 2008
2	Object Oriented Modeling and Design with UML	Rumbaugh & Blaha	Pearson	2 nd Edition, 2007

Course Articulation Matrix

Course Outcomes (COs)	Program Outcomes (POs)													
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
21 CBS503.1	3				2								2	
21 CBS503.2		2											3	
21 CBS503.3	3			2	1								1	
21 CBS503.4		2											2	
21 CBS503.5	3				1									
21 CBS503.6		2			2									1

1: Low 2: Medium 3: High

Compiler Design			
Course Code	21CBS504	CIE Marks	50
Course Type (Theory/Practical/Integrated)	Theory	SEE Marks	50
		Total Marks	100
Teaching Hours/Week (L:T:P)	2:2:0	SEE	3 Hours
Total Hours	40 Hours	Credits	03
<p>Course Learning Objectives: The objective of the course is to</p> <ul style="list-style-type: none"> • Understand the front end and back-end phases of Compiler. • Learn the concepts using LEX and YACC tools. • Understand different types of parsing mechanisms. • Get an insight into the compiler's role in managing the runtime environment. • Know the significance of optimization techniques in code generation. 			
Module-1: Introduction, Symbol Tables and Lexical Analysis			8 hours
<p>Introduction: Language Processors, The structure of a compiler, The evolution of programming languages, The science of building compilers, Applications of compiler technology. Symbol Tables, Lexical Analysis: The role of lexical analyzer, Input buffering, Specifications of token, recognition of tokens.</p> <p>TB1</p>			
Module-2: Syntax Analysis-I & LEX			8 hours
<p>LEX: The Lexical Analyzer Generator Lex -uses, structure, conflict resolution, Look-Ahead Operators, Programming Examples.</p> <p>Syntax Analysis-I: Introduction, Context-free Grammars, Writing a Grammar, Top-down Parsing.</p> <p>TB1</p>			
Module-3: Syntax Analysis-II & YACC			8 hours
<p>Syntax Analysis-II: Bottom-up Parsing-Reduction, Handle Pruning, Shift Reduce Parsing, Conflicts; Simple LR – Why LR Parsers, Items & LR(0) Automaton, LR Parsing Algorithm, SLR Parsing Table, Viable Prefixes</p> <p>YACC: The Parser Generator YACC, Using YACC with ambiguous Grammar, YACC with Lex, Error recovery, Programming Examples</p> <p>TB1</p>			
Module-4: Syntax Directed Translation and Intermediate Code Generation			8 hours
<p>Syntax Directed Translation: Syntax Directed Definitions, Evaluation Orders for SDD's, Applications of SDT- Construction of Syntax Trees</p> <p>Intermediate Code Generation: Variants of Syntax Trees, Three Address Code,</p> <p>TB1</p>			
Module-5: Run Time Environment and Code Generation			8 hours
<p>Run Time Environments: Storage Organization, Stack Allocation of Space</p> <p>Code Generation: Issues in the design of Code generator, The Target Language, The addresses in the Target Code, Basic Blocks and Flow Graphs, Optimization in Basic Blocks, A simple Code Generator</p> <p>TB1</p>			

Course Outcomes: At the end of the course, the student will be able to:	
21CBS504.1	Describe the different phases of compilation.
21CBS504.2	Apply the necessary techniques to make grammar suitable for parsing.
21CBS504.3	Construct Parsing Table using appropriate parsing algorithms.
21CBS504.4	Develop Syntax Tree and Three Address code for a given problem.

21CBS504.5	Make use of Basic Blocks, Flow Graphs, and optimization techniques to generate target code.
21CBS504.6	Implement Programs using LEX and YACC tools

Sl. No.	Title of the Book	Name of the Author/s	Name of the Publisher	Edition and Year
Textbooks				
1	Compilers-Principles, Techniques and Tools	Alfred V Aho, Monica S. Lam, Ravi Sethi, Jeffrey D. Ullman	Pearson Publishers	2 nd Edition, 2007
Reference Books				
1	Lex & Yacc	Doug Brown, John Levine, Tony Mason	O'Reilly Media	2 nd Edition, October 2012
2	Compiler Design 2013	K Muneeswaran	Oxford University Press	2 nd Edition, 2013
3	Modern Compiler Design	Dick Grune, Kees Van, Henri, Koen L	Springer	2 nd Edition, 2012

Web links and Video Lectures (e-Resources):

- https://onlinecourses.nptel.ac.in/noc20_cs13/
- <https://www.youtube.com/watch?v=5ZmFlxNaN8&list=PLBlnK6fEyqRjT3oJxFXRgjPNzeS-LFY-q>
- https://www.youtube.com/watch?v=Qkwj65l_96l&list=PLEbnTDJUr_IcPtUXFy2b1sGRPsLFMghhS
- <https://www.youtube.com/playlist?list=PLXj4XH7LcRfC9pGMWuM6UWE3V4YZ9TZzM>
- <https://www.youtube.com/playlist?list=PLBlnK6fEyqRjT3oJxFXRgjPNzeS-LFY-q>

Course Articulation Matrix

Course Outcomes (COs)	Program Outcomes (POs)													
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
21CBS504.1	2												1	
21CBS504.2		2											1	
21CBS504.3			2										1	
21CBS504.4		2											1	
21CBS504.5			2			2								1
21CBS504.6		2			2					2				1

1: Low 2: Medium 3: High

Business Strategy			
Course Code	21CBS505	CIE Marks	50
Course Type (Theory/Practical/Integrated)	Theory	SEE Marks	50
		Total Marks	100
Teaching Hours/Week (L:T:P)	2:2:0	SEE	3 Hours
Total Hours	40 Hours	Credits	03
<p>Course Learning Objectives: The objective of the course is to</p> <ul style="list-style-type: none"> • Understand strategic management, analyzing and evaluating its application in business world. • Analyze vision, mission, objectives for strategic planning • Understand the fundamental principles of interrelationships among business functions such as: R&D, production, marketing, finance, HR and information technology. • Discuss on different strategic implementation • Analyze complex, unstructured qualitative and quantitative problems. 			
Module-1: Introduction			8 hours
<p>Introduction : Concept and importance of strategic management, importance of strategic decisions, elements of strategic management, Need for strategy, company values, levels of strategy, strategic management process, changes in the approach to strategic management, different perspectives on strategy formulation, concept and features of strategic planning. TB1</p>			
Module-2: Vision and Mission, Objectives and Strategy			8 hours
<p>Developing strategic vision, communicating the strategic vision, crafting a mission statement, linking vision and mission with company values, levels of objectives, crafting objectives. Sources of Sustained Competitive Advantage: Introduction and Objectives, How Competitive Advantage Emerges and Is Sustained, Types of Competitive Advantage: Cost and Differentiation TB1, TB2</p>			
Module-3: Strategic Analysis			8 hours
<p>Concept, the general environment; scanning, monitoring and forecasting the environment, Scenario planning, PEST analysis; The competitive environment- Porter's Five Forces Framework, the value net, strategic groups hyper competition, Internal environment analysis-value-chain-analysis, evaluating Value chain, SWOT analysis; concept of internal environment, the resource-based view of strategy- resources, competencies, core competencies and distinctive capabilities; identifying sustainable competitive advantage, criticism of resource-based view, knowledge management. TB1</p>			
Module-4: Strategy Formulation			8 hours
<p>Concept, Business level strategy- Generic competitive strategies, a resource-based view to strategy formulation, the industry life-cycle; corporate level strategies- Growth strategies, related and unrelated diversification, implementing growth strategies, External Growth Strategies: Mergers, Acquisitions, and Alliances, Introduction and Objectives Mergers and Acquisitions: Causes and Consequences Strategic Alliances. TB1, TB2</p>			
Module-5: Strategy Implementation			8 hours
<p>Concept, organizational structures- the entrepreneurial, functional, divisional, matrix and network, strategic leadership, leadership and management, the learning organization, emotional intelligence and leadership performance, leadership capabilities, impact of leadership on vision, values and culture, corporate culture and leadership, leading strategic change. TB1 , TB3</p>			

Course Outcomes: At the end of the course the student will be able to:	
21CBS505.1	Explain the nature of competition and industries at an advanced level
21CBS505.2	Discuss how external forces such as social, political/legal, economic, and technological influence strategic decision-making and firm performance.
21CBS505.3	Describe the sophisticated relationships among the functional areas of an

	organization and strategic planning.
21CBS505.4	Interpret strategy research, including extensive use of internet as a research tool.
21CBS505.5	Analyze higher order linear differential equations as linear homogeneous, linear non-homogeneous, with constant & variable coefficients and solve them.
21CBS505.6	Choose appropriate strategic management concepts to apply in the business world.

Sl. No.	Title of the Book	Name of the Author/s	Name of the Publisher	Edition and Year
Textbooks				
1	Strategic Management: Formulation, Implementation and Control	Pearce II, J.A., Robinson R.B and Mittal, A	McGraw Hill.	12 th Edition, 2017
2	Contemporary Strategic Management	Robert M. Grant	Blackwell	7 th Edition, 2012
3	Crafting and Executing Strategy	Thompson, A. Peteraf, M.A., Gamble, J.E., Strickland, A.J., and Jain A.K,	McGraw Hill	18 th Edition, 2011
Reference Books				
1	Business Policy and Strategic management	Kajmi, A.	Tata McGraw Hil	3 rd Edition, 2008
2	Strategic Management and Business Policy	Wheelan, T.L. and Hunger J.D	Pearson	13 th Edition, 2012
3	Understanding Strategic Management,	Henry, E.A.	Oxford	3 rd Edition, 2018
4	Business Policy and Strategic Management	Jauch, L.R. and Glueck	McGraw-Hill.	5 th Edition, 1988

Web links and Video Lectures (e-Resources):
<ul style="list-style-type: none"> • https://www.mindtools.com/aqa3q37/pest-analysis • https://thinkinsights.net/strategy/ge-mckinsey-matrix • https://www.managementstudyguide.com/swot-analysis.htm

Course Articulation Matrix

Course Outcomes (COs)	Program Outcomes (POs)													
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
21CBS505.1									2		2			1
21CBS505.2									2		3			1
21CBS505.3											2			
21CBS505.4									2		3			
21CBS505.5											2			1
21CBS505.6									2		3			1

1: Low 2: Medium 3: High

Application Development Using Python Lab			
Course Code	21CBL506	CIE Marks	50
Course Type (Theory/Practical/Integrated)	Practical	SEE Marks	50
		Total Marks	100
Teaching Hours/Week (L:T:P)	0:0:2	SEE	3 Hours
Total Hours	10 Lab Slots	Credits	01
Course Learning Objectives:			
<ul style="list-style-type: none"> • Learn the syntax and semantics of Python programming language. • Illustrate the process of structuring the data using lists, tuples and dictionaries. • Understand the String manipulation methods and operators • Demonstrate the use of built-in functions to read/write files. • Interpret the concepts of Object-Oriented Programming used in Python. 			
Laboratory Programs:			
PART- A			
1.	a) Write a program for checking the given number is even or odd. b) Write a program for comparing two numbers. c) Write a program using a while loop that asks the user for a number, and prints a countdown from that number to zero		
2.	a) Write a program using a for loop to print factorial of a given number b) Write a python program to find area of square, rectangle and circle using user defined functions. Take input from the user and print the results.		
3.	a) Guess the Number: Write a program that tells the player that it has come up with a secret number and will give the player six chances to guess it. The code that lets the player enter a guess and checks that guess is in a for loop that will loop at most six times. b) Collatz Sequence: Write a function named collatz() that has one parameter named number. If number is even, then collatz() should print number // 2 and return this value. If number is odd, then collatz() should print and return 3 * number + 1. Then write a program that lets the user type in an integer and that keeps calling collatz() on that number until the function returns the value 1.		
4.	a) Write a python program to accept N numbers from the user. Find and display sum of all even numbers and product of all odd numbers in entered list. b) For a given list num=[45,22,14,65,97,72], write a python program to replace all the integers divisible by 3 with “ppp” and all integers divisible by 5 with “qqq” and replace all the integers divisible by both 3 and 5 with “pppqqq” and display the output.		
5.	a) Write a program to calculate the total number of an item being brought by all the guests given in the below list. <pre>allGuests = {'Alice': {'apples': 5, 'pretzels': 12}, 'Bob': {'ham sandwiches': 3, 'apples': 2}, 'Carol': {'cups': 3, 'apple pies': 1}}</pre> Output: <hr/> <pre>Number of things being brought: - Apples 7 - Cups 3 - Cakes 0 - Ham Sandwiches 3 - Apple Pies 1</pre> <hr/>		

	<p>b) Write a function named <code>displayInventory(inventory)</code> that would take any possible “inventory” (for example, <code>{'rope': 1, 'torch': 6, 'gold coin': 42, 'dagger': 1, 'arrow': 12}</code>) and display it like the following:</p> <pre>Inventory: 12 arrow 42 gold coin 1 rope 6 torch 1 dagger Total number of items: 62</pre> <p>Write a function named <code>addToInventory(inventory, addedItems)</code> that receives inventory (ex: <code>{'rope': 1, 'torch': 6, 'gold coin': 42, 'dagger': 1, 'arrow': 12}</code>) and addedItems (ex: <code>['gold coin', 'dagger', 'gold coin', 'gold coin', 'ruby']</code>) and return a dictionary that represents the updated inventory.</p> <pre>Inventory: 45 gold coin 1 rope 1 ruby 1 dagger Total number of items: 48</pre>
6.	Write a program to play tic-tac-toe board game.
7.	<p>a) Write a Python program that accepts a sentence and finds the number of words, digits, uppercase letters and lowercase letters.</p> <p>b) Write a program that repeatedly asks users for their phone number (10 digits) and a password (letters and numbers only, at least 8 characters long) until they provide valid input.</p>
8.	<p>a) Write a program that take the account’s name—for instance, email or blog from the command line arguments and copies the account’s password to the clipboard so that the user can paste it into a Password field.</p> <p>b) Write a program that will get the text from the clipboard, add a star and space to the beginning of each line, and then paste this new text to the clipboard.</p>
9.	Write a python program to create 3 files <code>file1.txt</code> , <code>file2.txt</code> and <code>file3.txt</code> in a folder. Write the content in <code>file1.txt</code> as “VTU” and in <code>file2.txt</code> as “UNIVERSITY”. Open and merge contents of <code>file1.txt</code> and <code>file2.txt</code> and write the merged content in <code>file3.txt</code> .
10.	Write a python program to demonstrate <code>__init__</code> , <code>__str__</code> and <code>__add__</code> methods
PART- B-Problem based learning	
<p>Case Study:</p> <p>Generating Random Quiz Files:</p> <p>Say you’re a geography teacher with 35 students in your class and you want to give a pop quiz on US state capitals. Alas, your class has a few bad eggs in it, and you can’t trust the students not to cheat. You’d like to randomize the order of questions so that each quiz is unique, making it impossible for anyone to crib answers from anyone else. Of course, doing this by hand would be a lengthy and boring affair and hence we need a python program to automate the task.</p> <p>Here is what the program does:</p> <ul style="list-style-type: none"> • Creates 35 different quizzes. 	

- Creates 50 multiple-choice questions for each quiz, in random order.
- Provides the correct answer and three random wrong answers for each question, in random order.
- Writes the quizzes to 35 text files.
- Writes the answer keys to 35 text files.

After you run the program, this is how your capitalsquiz1.txt file will look, though of course your questions and answer options may be different from those shown here, depending on the outcome of your random.shuffle() calls:

Name:

Date:

Period:

State Capitals Quiz (Form 1)

1. What is the capital of West Virginia?

- A. Hartford
- B. Santa Fe
- C. Harrisburg
- D. Charleston

2. What is the capital of Colorado?

- A. Raleigh
- B. Harrisburg
- C. Denver
- D. Lincoln

--snip--

Course Outcomes: At the end of the course the student will be able to:

21CBL506.1	Write in handling of conditions, loops and creation of functions.
21CBL506.2	Apply the methods to create and manipulate lists and tuples using python.
21CBL506.3	Apply the methods to create and manipulate dictionaries using python.
21CBL506.4	Apply the methods to create and manipulate Strings using python.
21CBL506.5	Apply file handling constructs to perform file oriented operations in python.
21CBL506.6	Apply object-oriented concepts and other constructs of python for application development and demonstrate it.

Web links/Video Lectures/MOOCs/papers

1. Al Sweigart, "Automate the Boring Stuff with Python", 1st Edition, No Starch Press, 2015. (Available under CC-BY-NC-SA license at <https://automatetheboringstuff.com/>)
2. <https://www.youtube.com/watch?v=kWEbNBXc2-Y>
3. <https://www.youtube.com/watch?v=8124kv-632k>
4. <https://www.youtube.com/watch?v=eWRfhZUzrAc&list=PLWKjhJtqVAbnqBxcdjVGgT3uVR10bzTEB>
5. https://www.youtube.com/watch?v=Ej_02ICoIgs&list=PLWKjhJtqVAbnqBxcdjVGgT3uVR10bzTEB&index=4

Course Articulation Matrix

Course Outcomes (COs)	Program Outcomes (POs)													
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
21CBL506.1	2										2		2	
21CBL506.2	2										2		2	
21CBL506.3	2										2		2	
21CBL506.4	2										2		2	
21CBL506.5	2										2		2	
21CBL506.6	2	2			3	2				2	2		2	

1: Low 2: Medium 3: High

Research Methodology and Intellectual Property Rights			
Course Code	21RMI507	CIE Marks	50
Course Type (Theory/Practical/Integrated)	Theory	SEE Marks	50
		Total Marks	100
Teaching Hours/Week (L:T:P)	(3:0:0)	SEE	3 Hours
Total Hours	40 hours	Credits	03
Course Learning Objectives:			
<ol style="list-style-type: none"> 1. To understand the basic concepts related to research 2. To learn the concept of literature survey, review and technical writing 3. To discuss the basics of intellectual property 4. To explain the patents, copyrights, trademarks, industrial designs and geographical indications. 			
Module-1 Research Methodology and Literature Survey (8 hours)			
<p>Research Methodology: Meaning, objectives, types, significance of research. Research approaches, method versus methodology, research process, Criteria of good research. Defining the research problem: conditions, components, selection, necessity, techniques and illustrations.</p> <p>Literature Survey, Literature Review: Introduction, process, databases (Google Scholar, Web of Science, Scopus, Science Direct etc) and management tools. Author Metrics and Journal Metrics, Identifying gap areas from literature review. Ethics in research and publications. Plagiarism: Introduction, tools for detection, avoiding plagiarism. Illustrations. Textbook 1: Ch 1 and 2, Textbook 2: Ch 7-17.</p>			
Module-2 Technical Writing and Presentations (8 hours)			
<p>Research Paper Writing: Importance, steps of writing research papers, Contents of a research article, referencing and citations, submission and post-submission. Illustrations.</p> <p>Thesis Writing: Synopsis, Introduction, Literature review, Aim and objectives, Methodology, Time frame, Results and discussions, Conclusions.</p> <p>Research Proposal Writing: Types of research projects, Major funding agencies in India, Preliminary requirements for proposal writing, Standard heads in research proposal. Illustrations. Textbook 2: Ch 20-28, 35.</p>			
Module-3 Introduction to IPR and Patents (8 hours)			
<p>Introduction to Intellectual Property: Meaning, relevance, Types of IP, Role of International Institutions: The Patent Cooperation Treaty (PCT), TRIPS Agreement, WIPO, IP system in India and National IPR Policy in India.</p> <p>Patents: Concept, Patents Act 1970 and its amendments, Patentable Subject Matter and Patentability Criteria, Non- Patentable Subject Matter, Procedure for Filing of Patent Application and types of Applications, Patent Search and Databases, Patent Granting Procedure, Rights of Patentee, Patent Infringement, Recent Developments: Patenting of Softwares, Inventions in Biotechnology. Illustrations. Textbook 3: Lesson 1-10.</p>			
Module-4 Copyright and Trademarks (8 hours)			
<p>Copyright: Introduction, meaning, nature of copyright protection, Indian copyright law: Classes of work, copyright pertaining to software, Authorship and ownership and rights, Terms of copyright, Assignment, transmission and licensing, Infringement of copyrights: Exceptions and remedies, Copyright societies, Office, board, Registration of copyrights and appeals, Illustrations.</p> <p>Trademark: Introduction, The Trade Marks Act 1999, Important Definitions, Trade Mark Rules 2017, Procedure of registration of trade mark in India. Duration and renewal, Opposition to registration, Grounds for refusal to registration, Rights conferred by registration, Infringement of registered Trade Mark and Remedies. Illustrations. Textbook 3: Lesson 11 and 12.</p>			

Module-5 Industrial Designs and Geographical Indications (8 hours)
<p>Industrial Designs: Introduction, Need for protection of industrial designs, Registrable and non-registrable designs, Registration of designs, Infringement of Industrial Designs—and Remedies, Illustrations.</p> <p>Geographical Indications (GIs): Introduction, Geographical Indications of Goods (Registration & Protection) Act, 1999, Procedure for registration of geographical indications, Infringement of GIs.</p> <p>Layout – Designs of Integrated Circuits: Introduction, Procedure for Registration of Layout design under the Semi-Conductor Integrated Circuits Layout-Design Act, 2000, Conditions and Procedures for registration. Infringement and Penalty.</p> <p>Miscellaneous Topics: The Protection of Plant Varieties and Farmers' Rights, Protection of Traditional Knowledge and Bio-diversity Act.</p> <p>Textbook 3: Lesson 13-16, Textbook 4: Ch 70.</p>

Course Outcomes: At the end of the course the student will be able :	
21RMI507.1	To conduct literature survey, review and define a research problem.
21RMI507.2	To follow research ethics and develop the art of writing technical papers and reports.
21RMI507.3	To discuss the importance of Intellectual Property Rights in India.
21RMI507.4	To explain the various forms of Intellectual Property and its relevance in Indian context.
21RMI507.5	To explain the legal aspects of patents, copyrights and trademarks in India.
21RMI507.6	To explain the legal aspects of industrial designs, geographical indications and semi-conductor integrated circuits layout-designs in India.

Sl. No.	Title of the Book	Name of the Author/s	Name of the Publisher	Edition and Year
Textbooks				
1	Research Methodology: Methods and Techniques	C R Kothari and Gaurav Garg	New International Publishers	4 th Edition 2019
2	Academic Writing	Ajay Semalty	B S Publications	2021
3	Intellectual Property Rights – Laws and Practice	The Institute of Company Secretaries of India, New Delhi	Delhi Computer Services, New Delhi	2018
4	Law Relating to Intellectual Property Rights	V K Ahuja	LexisNexis, India	3 rd Edition 2017
Reference Books				
1	Research Methodology: A Step-by-Step Guide for Beginners	Ranjit Kumar	Sage Publications India Pvt Ld New Delhi	4 th Edition 2014
2	Intellectual Property: A Primer for Academia	Prof. Rupinder Tewari and Ms. Mamta Bhardwaj	Publication Bureau, Panjab University, India	2021
Additional Resources: Web links/NPTEL Courses				
https://ipindia.gov.in/ (Official website of Intellectual Property India) https://dpiit.gov.in/policies-rules-and-acts/policies/national-ipr-policy https://www.icsi.edu/media/webmodules/FINAL_IPR&LP_BOOK_10022020.pdf				

<https://corpbiz.io/learning/design-infringement-in-india/>
<https://nptel.ac.in/courses/121106007> (Introduction to Research (Research Methodology))
<https://nptel.ac.in/courses/109105112> (Introduction on Intellectual Property to Engineers and Technologists)

Course Articulation Matrix

Course Outcomes (COs)	Program Outcomes (POs)													
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
21RMI507.1	-	2	-	-	1	-	-	-	-	-	-	2	-	-
21RMI507.2	-	-	-	-	1	-	-	3	-	2	-	-	-	-
21RMI507.3	-	-	-	-	-	2	-	-	-	2	-	-	-	-
21RMI507.4	-	-	-	-	-	2	-	-	-	2	-	-	-	-
21RMI507.5	-	-	-	-	-	2	-	-	-	2	-	-	-	-
21RMI507.6	-	-	-	-	-	2	-	-	-	2	-	-	-	-

1: Low 2: Medium 3: High

Emerging Technologies: A Primer			
Course Code	21ETP509	CIE Marks	50
Teaching Hours/Week (L:T:P)	(0:0:2)	SEE Marks	-
Credits	0	Exam Hours	02
Course Learning Objectives:			
<ol style="list-style-type: none"> To develop a strong awareness of the ethical and societal implications associated with emerging technologies. To instil practical skills related to AI (Artificial Intelligence), Blockchain, Digital Twins, RPA (Robotic Process Automation), and Cybersecurity. To enable experiences of working on a team project, allowing students to apply their knowledge and skills to a real-world problem and present their findings effectively. 			
Module-1: AI and Web 3.0 (06 Hours)			
<p>Introduction to Emerging Technologies: Overview of the course, Importance of staying updated with emerging technologies, Ethical and societal considerations.</p> <p>Artificial Intelligence (AI): Definition and history of AI, Machine learning and deep learning, Applications of AI in various industries, In-Class Assignment: AI in Everyday Life, Homework Assignment: Building a Simple Chatbot.</p> <p>Web 3.0: Blockchain and Metaverse - Introduction to Blockchain technology, Metaverse and its potential, In-Class Assignment: Creating a Simple Smart Contract, Homework Assignment: Exploring a Metaverse Platform.</p>			
Module-2: Smart Manufacturing and Robotic Process Automation (06 Hours)			
<p>Smart Manufacturing and Digital Twins: The concept of Smart Manufacturing, Role of IoT and sensors, Digital Twins and their applications, In-Class Assignment: Explore the designs of Digital Twins, Homework Assignment: Analysing a Smart Manufacturing Case Study.</p> <p>Robotic Process Automation: Understanding Robotic Process Automation (RPA), Types of robots and their applications, Human-robot collaboration, In-Class Assignment: Automating a Task with RPA, Homework Assignment: Researching Advances in Robotics.</p>			
Module-3: Cybersecurity and Quantum Computing (06 Hours)			
<p>Cybersecurity: Importance of cybersecurity in the digital age, Threats and vulnerabilities, Security best practices, In-Class Assignment: Ethical Hacking Simulation, Homework Assignment: Creating a Cybersecurity Plan.</p> <p>Quantum Computing: Introduction to Quantum Mechanics, Quantum bits (qubits) and quantum gates, Quantum supremacy and real-world applications. Homework Assignment: Exploring Quantum Computing Research.</p>			
Module-4: Project Work (06 Hours)			
Team Formation, Synopsis submission, Mid-Term Progress Review, Final Project Presentation.			
Course Outcomes: At the end of the course the student will be able to:			
21ETP509.1	Assess the ethical and societal impacts of emerging technologies, demonstrating critical thinking skills.		
21ETP509.2	Apply AI and Web 3.0 concepts to develop practical solutions and explore real-world applications.		
21ETP509.3	Apply RPA principles and tools to automate common tasks to boost productivity.		
21ETP509.4	Explain common cybersecurity threats and recommend best practices to safeguard digital assets.		
21ETP509.5	Explain the fundamentals of quantum computing and its real-world applications.		
21ETP509.6	Develop a solution using emerging technologies for a real-world problem in teams.		

Sl. No.	Title of the Book	Name of the Author/s	Name of the Publisher	Edition and Year
Textbooks				
1	Artificial Intelligence: A Modern Approach	Stuart Russell, Peter Norvig	Pearson	Fourth Edition, 2020
2	Blockchain Technology	Chandramouli Subramanian, Asha A George, Abhilash K A and Meena Karthikeyan	Universities Press (India) Pvt. Ltd.	First Edition 2020
3	Metaverse and Web 3: A Beginner's Guide: A Beginner's Guide: A Digital Space Powered with Decentralized Technology	Utpal Chakraborty	BPB Publications	First Edition, 2022
4	Learning Robotic Process Automation: Create Software robots and automate business processes with the leading RPA tool - UiPath	Alok Mani Tripathi	Packt Publishing	First Edition 2018
5	Cybersecurity: The Beginner's Guide: A comprehensive guide to getting started in cybersecurity	Dr. Erdal Ozkaya	Packt Publishing Limited	First Edition 2019
6	Quantum Computing: A Gentle Introduction	Eleanor G. Rieffel, Wolfgang H. Polak.	MIT Press	First Edition 2014
Reference Books				
1	Smart Manufacturing Technologies for Industry 4.0: Integration, Benefits, and Operational Activities	Edited By: Jayakrishna Kandasamy, Kamalakanta Muduli, V. P. Kommula, Purushottam L. Meena	CRC Press	First Edition 2022
2	The Robotic Process Automation Handbook: A Guide to Implementing RPA Systems	Tom Taulli	Apress Berkeley, CA	2020
3	The Cyber Security Handbook: Prepare for, respond to and recover from cyber-attacks with the IT Governance Cyber Resilience Framework (CRF)	Alan Calder	IT Governance Publishing	First Edition 2020

Web links/Video Lectures:

Introduction to Emerging Technologies:

1. <https://aiethics.princeton.edu/case-studies/case-study-pdfs/>
2. <https://research.aimultiple.com/ai-ethics/>
3. <https://news.harvard.edu/gazette/story/2020/10/ethical-concerns-mount-as-ai-takes-bigger-decision-making-role/>
4. <https://www.sciencedirect.com/science/article/pii/S0268401223000816>
5. <https://www.youtube.com/watch?v=G2fqAlmoPo>
6. <https://www.youtube.com/watch?v=zizonToFXDs>

Web 3.0: Blockchain and Metaverse

1. [What is Ethereum? | ethereum.org](https://www.ethereum.org/)
2. [Navigating Remix — Remix - Ethereum IDE 1 documentation \(remix-ide.readthedocs.io\)](https://remix-ide.readthedocs.io/)

3. [Solidity — Solidity 0.6.8 documentation \(soliditylang.org\)](https://soliditylang.org)
4. https://www.youtube.com/watch?v=nalMdCI_pv8&t=765s
5. [The Decentralized Autonomous Organization and Governance Issues by Usman W. Chohan :: SSRN](#)
6. [Ethereum Smart Contract Best Practices \(consensys.github.io\)](https://consensys.github.io)
7. <https://hackernoon.com/hack-solidity-reentrancy-attack>

Smart Manufacturing and Digital Twins:

1. https://www.youtube.com/watch?v=nwFed03fS_s
2. <https://www.youtube.com/watch?v=ScmK-bKJ4MI>

RPA and Robotics:

1. <https://www.youtube.com/watch?v=9URSbTOE4YI>
2. <https://www.youtube.com/watch?v=UEbw7dIOg0g>
3. <https://www.uipath.com/resources/automation-case-studies>
4. <https://www.ibm.com/products/robotic-process-automation/case-studies>

Cybersecurity:

1. <https://www.getastra.com/blog/security-audit/what-is-vapt/>
2. <https://owasp.org/www-project-top-ten/>
3. <https://owasp.org/www-project-mutillidae-ii/>
4. <https://www.youtube.com/watch?v=JAtwZoW76-I>
5. Threat modelling (STRIDE framework): <https://learn.microsoft.com/en-us/azure/security/develop/threat-modeling-tool-threats>
6. Cyber Kill Chain: <https://www.lockheedmartin.com/en-us/capabilities/cyber/cyber-kill-chain.html>

Quantum Computing:

1. <https://www.youtube.com/watch?v=e3fz3dqhN44>
2. <https://quantumai.google/>

Course Articulation Matrix

Course Outcomes (COs)	Program Outcomes (POs)											
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
21ETP509.1	-	-	-	-		3	-	2	-	-	-	-
21ETP509.2	-	2	-	-	3	-	-	-		-	-	1
21ETP509.3	-	-	-	3	2	-	-	-	-	-	-	-
21ETP509.4	-	-	-	-	3	-		-	-	-	-	1
21ETP509.5	2	-	-	-	3	-	-	-	-	-	-	-
21ETP509.6	-	-	2	-	3	-	-	-	2	-	-	1

1: Low 2: Medium 3: High

VI Semester

Computer Networks and Security			
Course Code	21CBS601	CIE Marks	50
Course Type (Theory/Practical/Integrated)	Integrated	SEE Marks	50
		Total Marks	100
Teaching Hours/Week (L:T:P)	3:0:2	SEE	3 Hours
Total Hours	40 hours Theory + 10 Lab slots	Credits	04
<p>Course Learning Objectives: The objective of the course is to</p> <ul style="list-style-type: none"> • Comprehend the transmission technique of digital data between multiple computers and understand the fundamentals of data communication networks. • Analyze the applications of various network core devices and protocols in data communication. • Explain routers, IP and Routing Algorithms in network layer • Implement different protocols and analyze the network performance. • Discuss the different issues related to computer security. 			
Module-1 Introduction & Physical Layer			8 hours
<p>Introduction: Data Communications, Networks, Network Types, Internet History, Standards and Administration, Protocol Layering, TCP/IP Protocol suite, The OSI model. Physical Layer: Data and Signals, Digital Signals, Transmission Impairment, Data Rate limits, Performance, Digital to digital conversion (Only Line coding: Polar, Bipolar and Manchester coding), Analog to digital conversion (only PCM), Transmission Modes, Digital to analog conversion. TB1</p>			
Module-2 Data Link Layer			8 hours
<p>Introduction to Data-Link Layer: Introduction, DLC services, Data link layer protocols, Point to Point protocol (Framing, Transition phases only), Link-Layer Addressing, ARP, Multiplexing and Spread Spectrum, Switching: Introduction, Circuit Switched Networks and Packet switching. Error Detection and Correction: Introduction, Block coding, Cyclic codes, Checksum, Media Access control: Random Access, Controlled Access and Channelization. TB1</p>			
Module-3 Network & Transport Layer			8 hours
<p>What's Inside a Router? Input Processing, Switching, Output Processing, Where Does Queuing Occur?, Classful and CIDR addressing, IPv6, Routing Algorithms: The Link-State (LS) Routing Algorithm, The Distance-Vector (DV) Routing Algorithm Transport Layer: Introduction and Transport-Layer Services: Relationship Between Transport and Network Layers, Connectionless Transport: UDP, UDP Segment Structure, UDP Checksum, Go-Back-N, Selective repeat. TB2</p>			
Module-4 Transport & Application Layer			8 hours
<p>Transport Layer: Connection-Oriented Transport TCP: The TCP Connection, TCP Segment Structure, Round-Trip Time Estimation and Timeout, Flow Control, TCP Connection Management, Principles of Congestion Control, Approaches to Congestion Control, Network-assisted congestion-control example, ATM ABR Congestion control. Application Layer: Principles of Network Applications: Network Application Architectures, Processes Communicating, Application-Layer Protocols. The Web and HTTP: Overview of HTTP, Non-persistent and Persistent Connections, HTTP Message Format, FTP, SMTP, Mail Message Format, Mail Access Protocols, DNS, Overview of How DNS Works, DNS Records and Messages. TB2</p>			
Module-5 Security in Computer Networks			8 hours
<p>What is network security?, Principles of Cryptography, Message Integrity and digital signatures, End point authentication, Securing Email, Securing TCP connection: SSL, Network layer security: IPSec & VPNs, Securing wireless LAN, Firewalls, Intrusion Detection Systems. TB2</p>			

PRACTICAL MODULE

1. Network System Administration: Understanding the basic network configuration and installation.
2. Implement a TCP based client server program in python using TCP sockets where Server displays the following:
 - a) Host Name, IP address and Port Number on which it is hosted
 - b) IP address and port number of a client requesting connection. Server sends the message “Thanks for Connecting!” back to client. Client displays this message on screen.
3. Implement a UDP based client server program in python using UDP sockets where Server displays the following:
 - a) Host Name, IP address and Port Number on which it is hosted
 - b) IP address and port number of a client sending some dummy message. Server displays the dummy message on screen. Server sends the message “Thanks for Message!” back to client. Client displays this message on screen.
4. Write a program in Java/Python to find the shortest path between vertices using Distance-Vector (DV) Routing Algorithm.
5. Implement an ftp client using ftplib which connects to an ftp server, takes login/ password from user, and displays directory list and permits upload and download of files.
6. Write a program in Java/Python to perform encryption and decryption using the following algorithms
 - I. Ceaser cipher
 - II. Substitution cipher
 - III. Hill Cipher
7. Write a program in Java/Python to implement RSA algorithm
8. Perform Network Analysis using Wireshark tool.

Course Outcomes: At the end of the course the student will be able to:

21CBS601.1	Explain the fundamental principles involved in data communication
21CBS601.2	Describe the different switching mechanisms and data link layer protocols for digital communication
21CBS601.3	Discuss the working of routing protocols, the entities involved in the day to day running of the cellular networks and the process involved with development of policy and protocols of these networks.
21CBS601.4	Identify the essential principles of a transport layer and application layer protocol and explain how they are used to solve computer networking problems.
21CBS601.5	Apply the basic concepts of cryptography to identify the security attacks and services and to select appropriate security protocols for a particular scenario
21CBS601.6	Analyze the current architecture of the internet and the entities involved in the day to day running of the internet using several applications.

Sl. No.	Title of the Book	Name of the Author/s	Name of the Publisher	Edition and Year
Textbooks				
1	Data Communications and Networking	Behrouz A. Forouzan	Tata McGraw-Hill	5 th Edition, 2013
2	Computer Networking, A Top-Down Approach	James F Kurose and Keith W Ross	Pearson Education	6 th Edition, 2017

Reference Books				
1	Computer-Networks	Andrew S. Tanenbaum and David J. Wetherall	Pearson Education,	5 th Edition, 2010
2	Computer Networks	Larry L Peterson and Bruce S Davie,	ELSEVIER	5 th Edition, 2020
3	Computer Networks	Mayank Dave	Cengage Learning	2 nd Edition, 2012

Web links and Video Lectures (e-Resources):

- <https://www.digimat.in/nptel/courses/video/106105183/L01.html>
- <http://www.digimat.in/nptel/courses/video/106105081/L25.html>
- <https://nptel.ac.in/courses/106105081>
- <https://docs.python.org/3/howto/sockets.html>
- <https://docs.python.org/3/library/socket.html>

Course Articulation Matrix

Course Outcomes (COs)	Program Outcomes (POs)													
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
21CBS601.1	3		1											1
21CBS601.2	3													
21CBS601.3		1	2											
21CBS601.4	2		1											
21CBS601.5	1		2		2									
21CBS601.6					3						1		1	2

1: Low 2: Medium 3: High

Artificial Intelligence			
Course Code	21CBS602	CIE Marks	50
Course Type (Theory/Practical/Integrated)	Theory	SEE Marks	50
		Total Marks	100
Teaching Hours/Week (L:T:P)	2:2:0	SEE	3 Hours
Total Hours	40 Hours	Credits	03
<p>Course Learning Objectives: The objective of the course is to</p> <ul style="list-style-type: none"> • Gain a historical perspective of AI and its foundations. • Become familiar with basic principles of AI toward problem solving. • Understand different search techniques and to make optimal decisions in game playing. • Know approaches of inference, perception, knowledge representation, and learning. • Apply and develop the knowledge of advanced problem-solving strategies. 			
Module-1: Introduction to Artificial Intelligence			8 hours
<p>Introduction to Artificial Intelligence: Brief on The Foundations of Artificial Intelligence, Brief on The History of Artificial Intelligence, and the State of the Art. Intelligent Agents: Agents and Environments, The Structure of Agents (4Types). TB1</p>			
Module-2: Problem Solving and Game Playing			8 hours
<p>Problem Solving, Problem Space & Search and Game Playing Problem-Solving: Problem-Solving Agents, Example Problems, Informed (Heuristic) Search Strategies, State space search and control strategies, Bounded look-ahead strategy, alpha-beta pruning, Two player perfect information games. TB1, TB2</p>			
Module-3: Search Techniques			8 hours
<p>Search Techniques. Hill-climbing search, AND-OR search trees, The minimax search algorithm, Optimal decisions in multiplayer games, A* search, AO* search, block world problem, Linear planning using a goal stack. TB1, TB2</p>			
Module-4: Constraint satisfaction and Knowledge Representation			8 hours
<p>Constraint satisfaction problems and Knowledge Representation. Defining Constraint Satisfaction Problems, Constraint Propagation: Inference in CSPs, Backtracking Search for CSPs, Approaches to knowledge representation, Knowledge representation using semantic network. TB1, TB2</p>			
Module-5: ML and DL			8 hours
<p>Machine Learning and Deep Learning. Introduction to ML, DL and AI and their relationship, Forms of Learning, Supervised Learning, Unsupervised Learning, Reinforcement learning, Deep Learning and Transfer Learning, Model Selection and Optimization, Nonparametric Models: Nearest-neighbor models, Ensemble Learning: Random forests, Classification v/s Clustering. TB1</p>			

Course Outcomes: At the end of the course the student will be able to:	
21CBS602.1	Describe the foundation, areas, applications, trends and development of Artificial Intelligence (AI) to solve problem on search algorithm.
21CBS602.2	Apply the knowledge to write simple algorithm for problem reduction strategies and game playing.
21CBS602.3	Make use of the advanced problem solving strategies to solve Linear and Non-Linear planning.

21CBS602.4	Identify different Constraint Satisfaction Problems and solving approaches for knowledge representation.
21CBS602.5	Develop a machine or deep learning models for a given problem.
21CBS602.6	Design and Develop two player perfect information games and AI applications.

Sl. No.	Title of the Book	Name of the Author/s	Name of the Publisher	Edition and Year
Textbooks				
1	Artificial Intelligence: A Modern Approach	Stuart Russell and Peter Norvig	Pearson Education	3rd / 4th Edition 2015
2	Artificial Intelligence	Saroj Kaushik	Cengage Learning	1st Edition 2014
Reference Books				
1	Introduction to Artificial Intelligence & Expert Systems	Dan W. Patterson	Prentice-Hall	1st Edition 2015
2	Artificial Intelligence	Kevin Knight, Elaine Rich, Shivashankar B. Nair	McGraw Hill Education	3 rd Edition, 2017

Web links and Video Lectures (e-Resources):

- <https://www.udemy.com/topic/artificial-intelligence/>
- <https://www.coursera.org/learn/ai-for-everyone>
- <https://www.coursera.org/professional-certificates/ai-engineer>
- <https://intellipaat.com/artificial-intelligence-deep-learning-course-with-tensorflow/>
- <https://www.youtube.com/watch?v=ITzHIU3OrXs>
- <https://www.youtube.com/watch?v=VOaoabf3LPM>
- <https://www.youtube.com/watch?v=yUjpGMdrWK0>

Course Articulation Matrix

Course Outcomes (COs)	Program Outcomes (POs)													
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
21CBS602.1	2			2										
21CBS602.2									2		2			
21CBS602.3		2					2						2	
21CBS602.4												2	2	
21CBS602.5			2		2							2	2	
21CBS602.6			2		2							2		

1: Low 2: Medium 3: High

Financial & Cost Accounting			
Course Code	21CBS6031	CIE Marks	50
Course Type (Theory/Practical/Integrated)	Theory	SEE Marks	50
		Total Marks	100
Teaching Hours/Week (L:T:P)	2:2:0	SEE	3 Hours
Total Hours	40 hours	Credits	03
<p>Course Learning Objectives: The objective of the course is to</p> <ul style="list-style-type: none"> • To create an awareness about the importance and usefulness of the accounting concepts and their managerial implications • To develop an understanding of the financial statements and the underlying principles and learn to interpret financial statements • To create an awareness about cost accounting, different types of costing and cost management 			
Module-1 Financial Accounting		8 hours	
<p>Financial Accounting: Basic Concept – Definitions of Book Keeping and Accounting – Objectives and Functions of Accounting – Types of Accounts – Rules of Debit and Credit, Journal – Ledger – Trial Balance. Preparation of Final Accounts – Adjusting Entry – Trading, Profit and Loss Account and Balance Sheet.</p>			
Module-2 Capital Budgeting		8 hours	
<p>Budget - Meaning and definitions – Preparation of Functional Budgets – Cash Budget - Sales Budget – Purchases and Production Budget – Flexible Budget. Capital Budgeting – Nature, Importance and Objectives – Process involved in Capital Budgeting – Kinds of Capital Budgeting Decision.</p>			
Module-3 Investment Proposals		8 hours	
<p>Methods of Evaluating Investment Proposals – Payback method – Payback profitability method – Discounted Cash Flow method – Net present – Value method.</p>			
Module-4 Costing		8 hours	
<p>Costing concepts – Meaning and Definition – Objectives – Difference between Cost of Financial Accounting Cost Classification Statement of Cost and Estimation – Methods of Costing – Job Costing and Process Costing.</p>			
Module-5 Project Accounts		8 hours	
<p>Project Accounts – Preparation of Contract Accounts for each project – Methods of Recording and Reporting Site Accounts to Project Office and from Project Office to Head Office.</p>			

Course Outcomes: At the end of the course the student will be able to:	
21CBS6031.1	Describe the basic principles and concepts of Accounting.
21CBS6031.2	Comprehend the different financial statements and process involved in budgeting.
21CBS6031.3	Describe the different elements of costing system and perform analysis on different types of costing system.
21CBS6031.4	Describe the method of evaluating investment proposals
21CBS6031.5	Apply the knowledge of concepts of finance and cost accounting in construction.
21CBS6031.6	Apply the Accounting concepts learnt in solving real world business problems.

Sl. No.	Title of the Book	Name of the Author/s	Name of the Publisher	Edition and Year
Textbooks				
1	Accounting for Management - 2	Bhattacharya S.K. and Dearden John Vani	Vikas Publishing House,	3th Edition 1997
2	Management Accounting	Khan, M.Y;Jain, P.K	McGraw Hill	8 th Edition, 2021
3	A Textbook of Cost and Management Accounting	Arora M N	Himalaya Publishing House	3 rd Edition, 2016
Reference Books				
1	Financial Accounting	Tulsian P C	Pearson Education Pvt. Ltd..	4 th Edition, 2009
2	Financial Management	Prasanna Chandra	- Tata McGraw Hill	10th Edition, 2019

Course Articulation Matrix

Course Outcomes (COs)	Program Outcomes (POs)													
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
21CBS6031.1	2					1								2
21CBS6031.2		2								1				
21CBS6031.3												2	1	
21CBS6031.4						1						1		
21CBS6031.5		2				2							1	
21CBS6031.6										2				

1: Low 2: Medium 3: High

Introduction to Innovation, Entrepreneurship and IPR Management			
Course Code	21CBS6032	CIE Marks	50
Course Type (Theory/Practical/Integrated)	Theory	SEE Marks	50
		Total Marks	100
Teaching Hours/Week (L: T:P)	2:2:0	SEE	3 Hours
Total Hours	40 hours Theory	Credits	03
<p>Course Learning Objectives: The objective of the course is to</p> <ul style="list-style-type: none"> • Develop and strengthen entrepreneurial quality and motivation in students. • Impart basic entrepreneurial skills and understanding to run a business efficiently and effectively. • Provide insights to students on entrepreneurship opportunities, sources of funding, and institutions supporting entrepreneurs. • Make students understand the ways of starting a company of their own. • Evaluate their decision-making skills. 			
Module – 1 Innovation and Creativity			8 hours
<p>Innovation: What and Why? Creating new products and services, exploiting open innovation and collaboration, Use of innovation for starting a new venture Creativity and Innovation: The Role of Creativity - The Innovation Process - Sources of New Ideas - Methods of Generating Ideas - Creative Problem Solving - Entrepreneurial Process.</p>			
Module – 2 Building an Innovative Organization			8 hours
<p>Importance of Business Model-Starting a small-scale industry -Components of an Effective Business Model, Osterwalder Business Model Canvas. Business Planning Process: Meaning of business plan - Business plan process - Advantages of business planning - Final Project Report with Feasibility Study - preparing a model project report for starting a new venture. Business Continuity Management-Definition and scope, Drivers of BCM, Developing effective BCM capabilities.</p>			
Module – 3 Introduction to Entrepreneur & Entrepreneurship			8 hours
<p>Meaning of entrepreneur - Evolution of the concept - Functions of an Entrepreneur Types of Entrepreneurs Intrapreneur- an emerging class Concept of Entrepreneurship -Entrepreneurial Culture - Stages in the entrepreneurial process. Entrepreneurship as a Style of Management.</p>			
Module-4 Entrepreneurial Finance			8 hours
<p>Entrepreneurial finance- Estimating the financial needs of a new venture, internal sources of finance, external sources of finance, components of financial plan. Institutions supporting Entrepreneurs: Small industry financing developing countries - A brief overview of financial institutions in India - Central level and state level institutions - SIDBI - NABARD - IDBI - SIDCO - Indian Institute of Entrepreneurship - DIC - Single Window Latest Industrial Policy of Government of India.</p>			
Module-5 IPR			8 hours
<p>Introduction to Intellectual Property-Intellectual property and physical property-importance of Intellectual property- Intellectual Property Rights (IPR)- Classification of IPR: Patents-Copyright- Trademark-Geographical Indications-Industrial Designs- Intellectual Property System in India- Development of TRIPS Complied Regime in India-National IPR policy of India-Objectives and provisions. Class Discussion- Major Court battles regarding violation of patents between corporate companies.</p>			

Course Outcomes: At the end of the course the student will be able to:	
21CBS6032.1	Explain the role of creativity and innovations in solving any real Entrepreneurial problems.

21CBS6032.2	Describe the importance of business model and business planning process to maintain continuity in business management.
21CBS6032.3	Discuss different functions of an entrepreneur and stages in Entrepreneurship
21CBS6032.4	Demonstrate the need for entrepreneurial finance by taking real world business examples.
21CBS6032.5	Interpret the importance of intellectual property rights in India.
21CBS6032.6	Compare the different entrepreneurship opportunities, sources of funding, and institutions supporting entrepreneurs to discover a entrepreneur.

Sl. No.	Title of the Book	Name of the Author/s	Name of the Publisher	Edition and Year
Textbooks				
1	Entrepreneurship Development	T.N. Chhabra	Pearson	1 st Edition, 2019
2	Intellectual Property Rights	Neeraj Pandey and Khushdeep Dharni	PHI Learning	1 st Edition, 2014
Reference Books				
1	Entrepreneurship Development	Gupta S.L., Arun Mittal	International Book House	1 st Edition, 2011
2	B. Ramakrishna and H.S Anil Kumar	Fundamentals of Intellectual Property Rights	Notion Press	1 st Edition, 2017

Course Articulation Matrix

Course Outcomes (COs)	Program Outcomes (POs)													
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
21CBS6032.1	1	1		3										3
21CBS6032.2				3										3
21CBS6032.3				3										
21CBS6032.4					2	2								
21CBS6032.5						2		1						
21CBS6032.6							2							3

1: Low 2: Medium 3: High

Machine Learning			
Course Code	21CBS6033	CIE Marks	50
Course Type (Theory/Practical/Integrated)	Theory	SEE Marks	50
		Total Marks	100
Teaching Hours/Week (L:T:P)	2:2:0	SEE	3 Hours
Total Hours	40 Hours	Credits	03
<p>Course Learning Objectives: The objective of the course is to</p> <ul style="list-style-type: none"> • Understand the need for machine learning algorithms. • Choose various learning techniques with basic knowledge. • Distinguish between various classification algorithms. • Discuss the training models used in machine learning. • Apply machine learning algorithms for a given dataset. 			
Module-1: Concept Learning			8 hours
<p>Introduction to Machine learning Landscape: what is ML? Types of ML, main challenges of ML, Correlation-Karl Pearson's coefficient of correlation-problems</p> <p>Concept learning and Learning Problems: Designing Learning systems, Perspectives and Issues, Concept Learning, Find S, Version Spaces and Candidate Elimination Algorithm, Remarks on VS, Inductive bias</p> <p>TB2, TB1</p>			
Module-2: Evaluation Measures and Preprocessing			8 hours
<p>End to end Machine learning Project: Working with real data, Look at the big picture, Get the data, Discover and visualize the data, Prepare the data, select and train the model, Fine tune your model</p> <p>Evaluating hypothesis: Estimating hypothesis Accuracy, Basics of Sampling Theory, difference in error of two hypothesis, Comparing learning algorithms</p> <p>TB2, TB1</p>			
Module-3: Classification			8 hours
<p>Decision Trees: Training and Visualizing DT, making prediction, estimating class, the CART training, computational complexity, GINI impurity, Entropy, regularization Hyper parameters, Regression, instability</p> <p>Ensemble learning and Random Forest: Voting classifiers, Bagging and pasting, Random patches, Random forests, Boosting, stacking</p> <p>TB2</p>			
Module-4: Training Models			8 hours
<p>Regression: Linear regression, gradient descent, polynomial regression, learning curves, regularized linear models, logistic regression</p> <p>Support Vector Machine: linear, Nonlinear , SVM regression and under the hood</p> <p>TB 2</p>			
Module-5: Bayesian Learning			8 hours
<p>Bayes Theorem, Concept Learning, Maximum Likelihood, Minimum Description Length Principle, Bayes Optimal Classifier, Gibbs Algorithm, Naïve Bayes Classifier, example- Bayesian Belief Network, EM Algorithm</p> <p>TB1</p>			

Course Outcomes: At the end of the course the student will be able to:	
21CBS6033.1	Explain machine learning and relate the basic theory underlying machine learning.
21CBS6033.2	Describe the supervised, unsupervised and reinforcement learning.
21CBS6033.3	Implement new situations using basic concepts of learning and decision trees.

21CBS6033.4	Infer functioning of Regression, Support Vector Models and analyze its abilities.
21CBS6033.5	Examine Bayesian techniques for problems in machine learning.
21CBS6033.6	Create statistical analysis of various machine learning techniques.

Sl. No.	Title of the Book	Name of the Author/s	Name of the Publisher	Edition and Year
Textbooks				
1	Machine Learning	Tom M. Mitchell	McGraw-Hill Education	1 st Edition, 2017
2	Hands-on Machine Learning with Scikit-Learn & TensorFlow	Aurelien Geron,	O'Reilly, Shroff Publishers and Distributors Pvt.Ltd	2 nd Edition 2019
Reference Books				
1	Higher Engineering Mathematics	B.V.Ramana	Tata McGraw-Hill	11 th Edition 2010
2	Engineering Mathematics	Srimanta Pal and Subodh C. Bhunia	Oxford University Press	3 rd Edition, 2016
3	A textbook of Engineering Mathematics	N.P Bali and Manish Goyal	Laxmi Publications	10 th Edition, 2022
4	Advanced Engineering Mathematics	C. Ray Wylie, Louis C. Barrett	McGraw – Hill Book Co., New York	6 th Edition, 2017

Web links and Video Lectures (e-Resources):

- https://onlinecourses.nptel.ac.in/noc23_cs18/preview
- <https://nptel.ac.in/courses/106105152>
- <https://intellipaat.com/blog/tutorial/machine-learning-tutorial/>
- <https://www.coursera.org/professional-certificates/ibm-machine-learning#courses>

Course Articulation Matrix

Course Outcomes (COs)	Program Outcomes (POs)													
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
21CBS6033.1		2								2				
21CBS6033.2				2										1
21CBS6033.3							2			2				1
21CBS6033.4				2	2									1
21CBS6033.5		2			2		1							1
21CBS6033.6						2			2	2				

1: Low 2: Medium 3: High

Design Thinking			
Course Code	21CBS6034	CIE Marks	50
Course Type (Theory/Practical/Integrated)	Theory	SEE Marks	50
		Total Marks	100
Teaching Hours/Week (L:T:P)	2:2:0	SEE	3 Hours
Total Hours	40 Hours	Credits	03
<p>Course Learning Objectives: The objective of the course is to</p> <ul style="list-style-type: none"> • Provide an understanding of the need of design thinking • Explore the students for the design thinking process • Make students understand process of converting an idea to innovation as per business demands • Provide a platform to discover need of design thinking and modelling for the product design. • Develop students' professional skills in client management and communication while marketing their products. 			
Module-1 Design Thinking for Innovation			8 hours
<p>Design Thinking for Innovation: What is of Design Thinking, Really? Is design Thinking a science or an art? Design thinking oversimplified, Building to Think, or The Power of Prototyping Converting Need into Demand, or Putting People First.</p> <p>Text Book: TB1, TB2</p>			
Module-2 Design Thinking Process			8 hours
<p>Design Thinking Process: Applied Design thinking in business and strategy, Design Thinking to the Rescue, Every Future Business Leader Needs to Be a Good Design Thinker, The 10 Design Thinking Principles That Redefine Business Management. Design Activism, or Inspiring Solutions with Global Potential.</p> <p>Text Book: TB1, TB2</p>			
Module-3 Innovation			8 hours
<p>Innovation: Art of innovation, Business Challenge: Growth, Predictability, change, Maintaining Relevance, extreme competition, Standardization, creative culture, strategy and organization.</p> <p>Activity: Debate on innovation and creativity, Flow and planning from idea to innovation, Debate on value-based innovation. Design Thinking Meets the Corporation or Teaching to Fish.</p> <p>Text Book: TB1, TB2</p>			
Module-4 Product Design			8 hours
<p>Product Design: Hiring Design Thinkers Is Not Enough; We Need to Create Design Thinking Companies, The New Social Contract, or We're All in This Together.</p> <p>Activity: Importance of modelling, how to set specifications, Explaining their own product design.</p> <p>Text Book: TB1, TB2</p>			
Module-5 Design Thinking in Business Processes			8 hours
<p>Design Thinking in Business Processes: Design Activism, or Inspiring Solutions with Global Potential. Changing Management Paradigms, Designing Tomorrow—Today</p> <p>Activity: How to market our own product, About maintenance, Reliability and plan for startup.</p> <p>Text Book: TB1, TB2</p>			

Course Outcomes: At the end of the course the student will be able to:	
21CBS6034.1	Develop an understanding of the design thinking process and its significance.
21CBS6034.2	Identify the implication of design thinking in business processes for better performance.
21CBS6034.3	Model innovative ideas by considering unique needs of a company around specific challenges
21CBS6034.4	Discover the need of design thinking and modelling as per the specifications for a product design.

21CBS6034.5	Develop an ability to market a product by considering maintenance and change management factors to make it reliable.
21CBS6034.6	Create physical prototypes / visual representation of an innovative idea by highlighting its business benefits.

Sl. No.	Title of the Book	Name of the Author/s	Name of the Publisher	Edition and Year
Textbooks				
1	Change by design: How Design Thinking Transforms Organizations and Inspires Innovation	Tim Brown	Harper Collins Publishers Ltd	2009
2	Design Thinking for Strategic Innovation	Idris Mootee	John Wiley & Sons Inc.	2013
Reference Books				
1	Design Thinking in the Classroom	David Lee	Ulysses Press	2018
2	Design the Future	Shrrutin N Shetty	Norton Press	1 st Edition 2018
3	Universal Principles of Design	William Lidwell, Kritina Holden, Jill Butter	Rockport Publishers	2 nd Edition 2010

Web links and Video Lectures (e-Resources):

- <https://online.hbs.edu/courses/design-thinking-innovation/>
- <https://www.roitraining.com/course-315-introduction-to-design-thinking/>
- <https://www.amrita.edu/course/design-thinking/>
- <https://www.coursera.org/learn/uva-darden-design-thinking-innovation>
- <https://dschool.stanford.edu/resources/design-thinking-bootleg>
- Stanford Webinar - Design Thinking = Method, Not Magic
- <https://www.youtube.com/watch?v=vSuK2C89yjA>
- Rise of Design Thinking in India | Ankur Grover Kunal Gupta | TEDxTISS
- <https://www.youtube.com/watch?v=VuedtXtyCjs>
- <http://quicksand.co.in/>

Course Articulation Matrix

Course Outcomes (COs)	Program Outcomes (POs)													
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
21CBS6034.1	2	2	2											
21CBS6034.2	2	2	1											
21CBS6034.3		3	2				1			1	1	1	2	
21CBS6034.4		2	1				1			1	1	1	2	
21CBS6034.5	2		2				1			1	1	1	2	
21CBS6034.6			2		2		1			1	1	1	2	

1: Low 2: Medium 3: High

Neural Networks			
Course Code	21CBS6041	CIE Marks	50
Course Type (Theory/Practical/Integrated)	Theory	SEE Marks	50
		Total Marks	100
Teaching Hours/Week (L:T:P)	3:0:0	SEE	3 Hours
Total Hours	40 Hours	Credits	03
<p>Course Learning Objectives: The objective of the course is to</p> <ul style="list-style-type: none"> • Understand the basics of ANN. • Provide knowledge on Generalization and function approximation. • Know various architectures of building an ANN. • Gain knowledge of reinforcement learning using neural networks • Learn unsupervised learning using neural networks. 			
Module-1: Introduction to Learning			8 hours
<p>Biological Neuron- Artificial Neural Model-Types of activation functions- Architecture: Feedforward and Feedback, Convex Sets, Convex Hull and Linear Separability, Non-Linear Separable Problem. XOR Problem, Multilayer Networks. Learning: Learning Algorithms, Error correction and Gradient Descent Rules, Learning objective of TLNs, Perceptron Learning Algorithm, Perceptron Convergence Theorem.</p> <p>TB1: Ch 2 to 5</p>			
Module-2: Perceptron and LMS			8 hours
<p>Perceptron learning and Non Separable sets, a-Least Mean Square Learning, MSE Error surface, Steepest Descent Search, μ-LMS approximate to gradient descent, Application of LMS to Noise Cancelling, Multi-layered Network Architecture, Backpropagation Learning Algorithm, Practical consideration of BP algorithm.</p> <p>TB1: Ch 5 to 6</p>			
Module-3: Support Vector Machines and Radial Basis Function			8 hours
<p>Learning from Examples, Statistical Learning Theory, Support Vector Machines, SVM application to Image Classification, Radial Basis Function Regularization theory, Generalized RBF Networks, Learning in RBFNs, RBF application to face recognition.</p> <p>TB1: Ch 8</p>			
Module-4: Recurrent Neural Network			8 hours
<p>Attractor Neural Networks: Associative Learning Attractor Associative Memory, Linear Associative memory, Hopfield Network, application of Hopfield Network, Brain State in aBox neural Network, Simulated Annealing, Boltzmann Machine, Bidirectional Associative Memory.</p> <p>TB1: Ch 10</p>			
Module-5: Autoencoders			8 hours
<p>Self-organization Feature Map: Maximal Eigenvector Filtering, Extracting Principal Components, Generalized Learning Laws, Vector Quantization, Self-organization Feature Maps, Application of SOM, Growing Neural Gas.</p> <p>TB1: Ch 12</p>			

Course Outcomes: At the end of the course the student will be able to:	
21CBS6041.1	Describe the basics of ANN.
21CBS6041.2	Understand the role of neural networks in engineering, artificial intelligence, and cognitive modeling.
21CBS6041.3	Understand the concepts and techniques of neural networks through models.
21CBS6041.4	Identify the need for neural networks to a particular application.
21CBS6041.5	Make use of matrix theory for solving systems of linear equations and compute eigenvalues and eigenvectors.

21CBS6041.6	Design neural networks for suitable applications and propose steps to improve performance.
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Sl. No.	Title of the Book	Name of the Author/s	Name of the Publisher	Edition and Year
Textbooks				
1	Neural Networks A Classroom Approach	Satish Kumar	McGraw Hill Education (India) Pvt. Ltd	2 nd Edition
Reference Books				
1	Introduction to Artificial Neural Systems	J.M. Zurada	Jaico Publications	1994
2	Artificial Neural Networks	B. Yegnanarayana	Pill, New Delhi.	2005

Web links and Video Lectures (e-Resources):

- <https://www.cs.toronto.edu/~hinton/csc321/notes/lec18.pdf>
- <https://www.youtube.com/watch?v=r5dsCkyD1eU>
- <https://archive.nptel.ac.in/courses/106/106/106106184/>
- <http://deeplearning.stanford.edu/tutorial/supervised/MultiLayerNeuralNetworks/>

Course Articulation Matrix

Course Outcomes (COs)	Program Outcomes (POs)													
	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2
21CBS6041.1		2		2										
21CBS6041.2				2			2							
21CBS6041.3				2			2							
21CBS6041.4							2			2				
21CBS6041.5		2								2				
21CBS6041.6										2				

1: Low 2: Medium 3: High

Introduction to AI & ML			
Course Code	21CBS6042	CIE Marks	50
Course Type (Theory/Practical/Integrated)	Theory	SEE Marks	50
		Total Marks	100
Teaching Hours/Week (L: T:P)	3:0:0	SEE	3 Hours
Total Hours	40 hours	Credits	03
<p>Course Objective: The objective of the course is to</p> <ul style="list-style-type: none"> ● Gain a historical perspective of AI and its foundations. ● Become familiar with basic principles of AI toward problem solving. ● Familiarize with the basics of Machine Learning & Machine Learning process. ● Understand the basics of Decision Tree and probability learning. ● Understand the working of Artificial Neural Networks and basic concepts of clustering algorithms 			
Module-1: What is AI?			8 hours
<p>What is AI, The foundation of Artificial Intelligence, The history of Artificial Intelligence, Intelligent Agents: Agents and Environments, Good Behavior: The concept of rationality, the nature of Environments, the structure of Agents.</p> <p>TB1: Ch-1, 2</p>			
Module-2: Searching and Solving			8 hours
<p>Problem solving agents, Example problems, Searching for solutions, Uninformed search strategies, Informed search strategies, Heuristic functions</p> <p>TB 1: Ch- 3</p>			
Module-3: Why do we need ML?			8 hours
<p>Introduction to Machine Learning: Need for Machine Learning, Machine Learning Explained, and Machine Learning in relation to other fields, Types of Machine Learning. Challenges of Machine Learning, Machine Learning process, Machine Learning applications.</p> <p>Basics of Learning Theory: Introduction to learning and its types, Introduction computational learning theory, Design of learning system, Introduction concept learning.</p> <p>Similarity-based learning: Introduction to Similarity or instance based learning, Nearest-neighbor learning, weighted k- Nearest - Neighbour algorithm</p> <p>TB 2: Ch-1, 2</p>			
Module-4: Understanding Data			8 hours
<p>Understanding Data-I: What is data, types of data, Big data analytics and types of analytics, Big data analytics framework, Descriptive statistics, univariate data analysis and visualization</p> <p>Understanding Data-II: Bivariate and Multivariate data, Multivariate statistics , Essential mathematics for Multivariate data, Overview hypothesis, Feature engineering and dimensionality reduction techniques,</p> <p>TB 2: Ch-2, 3 and 4</p>			
Module-5: Neural Networks			8 hours
<p>Artificial Neural Network: Introduction, Biological neurons, Artificial neurons, Perceptron and learning theory, types of Artificial neural Network, learning in multilayer Perceptron, Radial basis function neural network, self-organizing feature map,</p> <p>TB 2: Ch-10</p>			
Course Outcomes: At the end of the course the student will be able to:			
21CBS6042.1	Apply the knowledge of searching and reasoning techniques for different applications		
21CBS6042.2	Comprehend basic understanding of machine learning in relation to other fields and fundamental issues and challenges of machine learning.		

21CBS6042.3	Apply the knowledge of classification algorithms on various dataset and compare results
21CBS6042.4	Examine the neuron and Neural Network, and to analyze ANN learning and its applications
21CBS6042.5	Identify the suitable clustering algorithm for different pattern.
21CBS6042.6	Compare the techniques of AI & ML for specific applications.

Sl. No.	Title of the Book	Name of the Author/s	Name of the Publisher	Edition and Year
Textbooks				
1	Artificial Intelligence	Stuart J. Russell and Peter Norvig	Pearson Education	3 rd Edition, 2015
2	Machine Learning	S. Sridhar, M Vijayalakshmi	Oxford	2021
3	Artificial Intelligence	Elaine Rich, Kevin K and S B Nair	McGraw Hill Education	3 rd Edition, 2017
Reference Books				
1	Artificial Intelligence Structure and Strategies	George F Luger	Pearson Education	3 rd Edition, 2000
2	Machine Learning	Tom Mitchell	McGrawHill Publication	2013

Web links and Video Lectures (e-Resources):

- [Artificial Intelligence - Overview \(tutorialspoint.com\)](#)
- [Problem-solving in Artificial Intelligence - TAE \(tutorialandexample.com\)](#)
- [Decision Tree Tutorials & Notes | Machine Learning | HackerEarth](#)
- [History of Artificial Intelligence - Javatpoint](#)
- [Heuristic Search Techniques in Artificial Intelligence - TechVidvan](#)

Course Articulation Matrix

Course Outcomes (COs)	Program Outcomes (POs)													
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
21CBS6042.1			1	2	3									3
21CBS6042.2				2		3								3
21CBS6042.3				2		1								
21CBS6042.4				2	3	2								3
21CBS6042.5			2	2										
21CBS6042.6			2	2		1								3

1: Low 2: Medium 3: High

Computer Vision			
Course Code	21CBS6043	CIE Marks	50
Course Type (Theory/Practical/Integrated)	Theory	SEE Marks	50
		Total Marks	100
Teaching Hours/Week (L:T:P)	3:0:0	SEE	3 Hours
Total Hours	40 Hours	Credits	03
<p>Course Learning Objectives: The objective of the course is to</p> <ul style="list-style-type: none"> • Learn basic principles of image formation, image processing algorithms. • Understand different algorithms for recognition from single or multiple images/videos. • Understand the core vision tasks of scene understanding and recognition. • Choose the appropriate segmentation and clustering techniques for vision modeling. • Apply different vision levels for image/video analysis, object recognition in building a computer vision model. 			
Module-1: Introduction and Image Formation			8 hours
<p>Introduction and Image Formation: What is computer vision? A brief history, Geometric primitives and transformations, Photometric image formation, The digital camera. Pinhole Perspective, Weak Perspective, Cameras with Lenses, The Human Eye, Intrinsic Parameters and Extrinsic Parameters, Geometric Camera Calibration. TB1: Ch -1.1 & 1.2, Ch -2.1 to 2.3. TB2: Ch -1.1 to 1.3</p>			
Module-2: Early Vision – One Image			8 hours
<p>Linear Filters: Linear Filters and Convolution, Shift Invariant Linear Systems, Spatial Frequency and Fourier Transforms, Sampling and Aliasing, Filters as Templates. Local Image Features: Computing the Image Gradient, Representing the Image Gradient, Finding Corners and Building Neighborhoods, Describing Neighborhoods with SIFT and HOG Features. Texture: Local Texture Representations Using Filters, K-means Clustering for Vector Quantization, Synthesizing Textures and Filling Holes in Images, Shape from Texture. TB2:Ch -4.1 to 4.5, Ch -5.1 to 5.4, Ch -6.1, 6.2.2, 6.3, 6.5</p>			
Module-3: Early Vision – Multiple Images			8 hours
<p>Stereopsis: Binocular Camera Geometry and the Epipolar Constraint, Binocular Reconstruction, Local Methods for Binocular Fusion, Application - Robot Navigation. Structure from Motion: Internally Calibrated Perspective, Uncalibrated Weak-Perspective and Uncalibrated Perspective Cameras. TB2:Ch -7.1, 7.2, 7.4, 7.7, Ch 8-8.1 to 8.3</p>			
Module-4: Mid-level Vision			8 hours
<p>Segmentation by Clustering: Important Applications, Image Segmentation by Clustering Pixels Image Segmentation in Practice. Grouping and Model fitting: The Hough Transform, Fitting Lines and Planes, Fitting Curve Structures, Fitting Using Probabilistic Models, Model Selection: Which Model Is the Best Fit? Tracking: Simple Tracking Strategies, Tracking Using Matching, Tracking Linear Dynamical Model with Kalman Filters, Data Association. TB2:Ch -9.2, 9.4, 9.5 Ch 10-10.1 to 10.3, 10.5, 10.7, Ch 11-11.1 to 11.4</p>			
Module-5: High-level Vision			8 hours
<p>Registration: Registering Rigid Objects, with Projection, Registering Deformable Objects. Smooth Surface and their Outlines: Elements of Differential Geometry, Contour Geometry. Range Data Detecting Objects in Images: Active Range Sensors, Range Data Segmentation, Range Image Registration and Model Acquisition, Object Recognition, Detecting Objects in Images. TB2:Ch -12.1 to 12.3, Ch -13.1 & 13.2, Ch -14.1 to 14.4, Ch - 17.1</p>			

Course Outcomes: At the end of the course the student will be able to:	
21CBS6043.1	Describe the fundamental image processing techniques required for computer vision.
21CBS6043.2	Explain Image formation process.

21CBS6043.3	Choose appropriate shape analysis techniques.
21CBS6043.4	Make use of video processing and motion computations.
21CBS6043.5	Analyze mid-level and high-level vision techniques.
21CBS6043.6	Design applications using computer vision techniques.

Sl. No.	Title of the Book	Name of the Author/s	Name of the Publisher	Edition and Year
Textbooks				
1	Computer Vision: Algorithms and Applications	Richard Szeliski	Springer	2 nd Edition, 2020
2	Computer Vision – A modern approach	D. Forsyth and J. Ponce	Prentice Hall	2 nd Edition, 2012
Reference Books				
1	Computer Vision: Models, Learning, and Inference	Simon J. D. Prince	Cambridge University Press	1 st Edition 2012
2	Building Computer Vision Applications Using Artificial Neural Networks - With Step-by-step Examples in Opencv And Tensorflow With Python	Shamshad Ansari	Apress	1 st Edition, 2020

Web links and Video Lectures (e-Resources):

- <https://www.udacity.com/course/introduction-to-computer-vision--ud810>
- <https://www.mygreatlearning.com/academy/learn-for-free/courses/computer-vision-essentials>
- <https://www.mltut.com/best-free-computer-vision-courses/>
- <https://www.youtube.com/watch?v=D5hmApvpLH4>
- https://www.youtube.com/watch?v=01sAkU_NvOY

Course Articulation Matrix

Course Outcomes (COs)	Program Outcomes (POs)													
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
21CBS6043.1		2		1										2
21CBS6043.2			2	1							2			
21CBS6043.3				2		2								
21CBS6043.4			2	2							2			
21CBS6043.5				2		1					1			
21CBS6043.6		2		2										2

1: Low 2: Medium 3: High

Predictive Analytics			
Course Code	21CBS6044	CIE Marks	50
Course Type (Theory/Practical/Integrated)	Theory	SEE Marks	50
		Total Marks	100
Teaching Hours/Week (L:T:P)	3:0:0	SEE	3 Hours
Total Hours	40 Hours	Credits	03
<p>Course Learning Objectives: The objective of the course is to</p> <ul style="list-style-type: none"> • Gain knowledge of the modelling methods that may be used to predict both categorical and continuous outcomes. • know the use of the binary classifier and numeric predictor nodes to automate model selection. • learn how to combine two or more models to improve prediction. • Understand how analytics provided a solution to industries using real case studies. • Implement appropriate performance measures for predictive models. 			
Module-1: Linear Regression and Classification			8 hours
<p>Overview of supervised learning, what is statistical learning, Linear Methods for Regression, Simple Linear regression, Multiple Linear Regression, Multiple outputs, Other Considerations in the Regression Model, Logistic Regression, Linear Discriminant Analysis, A Comparison of Classification Methods.</p> <p>TB1: Ch 2,3 TB2: Ch 1,3,4</p>			
Module-2: Model Assessment and Selection			8 hours
<p>Bias, Variance, and model complexity, Bias-variance trade off, Optimism of the training error rate Estimate of In-sample prediction error, Effective number of parameters, Bayesian approach and BIC, Cross- validation, Bootstrap methods, conditional or expected test error. Resampling Methods: Cross-Validation, The Bootstrap, Subset Selection, Shrinkage Methods</p> <p>TB1:Ch 7, TB2:Ch 6</p>			
Module-3: Additive Models, Trees and Boosting			8 hours
<p>Generalized additive models, Tree-Based Methods, MARS: Multivariate Adaptive Regression Splines, Hierarchical Mixtures of Experts, Boosting Methods, The Basics of Decision Trees, Boosting Trees, Numerical Optimization via Gradient Boosting, Regularization, Right-Sized Trees for Boosting, Bagging, Random Forests, Boosting</p> <p>TB1: Ch 9, TB2: Ch 8</p>			
Module-4: Neural Networks (NN), SVM, and K-nearest Neighbor			8 hours
<p>Fitting neural networks, Back propagation, Issues in training NN, The Support Vector Classifiers, SVM and kernels, Support Vector Machines, SVMs with More than Two Classes, Relationship to Logistic Regression, Flexible Discriminant Analysis, Penalized Discriminant Analysis, Mixture Discriminant Analysis. TB1: Ch 11, 12 TB2 Ch:9</p>			
Module-5: Unsupervised Learning and Random forests			8 hours
<p>Association rules, Cluster analysis, Principal Components, Definition of Random Forests, Random forests and analysis. Clustering Methods, NCI60 Data Example, Independent Component Analysis, Learning Ensembles. Markov Graphs and Their Properties</p> <p>TB1:Ch 14,15,16 TB2: Ch 10</p>			

Course Outcomes: At the end of the course the student will be able to:

21CBS6044.1	Demonstrate the process of building predictive models for a various business application.
21CBS6044.2	Compare the underlying predictive modeling techniques.
21CBS6044.3	Select appropriate predictive modeling approaches to identify cases to progress with.
21CBS6044.4	Apply predictive modeling approaches using a suitable package such as SPSS Modeler

21CBS6044.5	Make use of Visualization techniques and explore data to understand relationships among variables
21CBS6044.6	Assess the performance of the models and generate predictions for new data

Sl. No.	Title of the Book	Name of the Author/s	Name of the Publisher	Edition and Year
Textbooks				
1	The Elements of Statistical Learning- Data Mining, Inference, and Prediction	Trevor Hastie, Robert Tibshirani, Jerome Friedman	Springer Verlag,	2 nd Edition, 2009
2	An introduction to statistical learning with applications in R	G.James,D.Witten, T.Hastie,R.Tibshirani	Springer	2013
3	Predictive & Advanced Analytics		(IBM ICE Publication)	
Reference Books				
1	Pattern Recognition and Machine Learning	C.M.Bishop	Springer	2006
2	All of statistics	L.Wasserman	Springer	4 th Edition , 2000
3	Introduction to Machine Learning	E.Alpaydin	Prentice Hall Of India	2010
3	Predictive & Advanced Analytics		(IBM ICE Publication)	

Web links and Video Lectures (e-Resources):

- <https://www.techtarget.com/searchbusinessanalytics/definition/predictive-analytics>
- <https://www.youtube.com/watch?v=Kd0C-8q0HkI>
- <https://www.cio.com/article/228901/what-is-predictive-analytics-transforming-data-into-future-insights.html>
- <https://www.conestogac.on.ca/fulltime/predictive-analytics>
- <https://www.youtube.com/watch?v=Cx8Xie5042M>
- <https://www.youtube.com/watch?v=1xw915rbyG4>

Course Articulation Matrix

Course Outcomes (COs)	Program Outcomes (POs)													
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
21CBS6044.1	1												1	
21CBS6044.2	2	1		1										
21CBS6044.3	1	2		1									2	
21CBS6044.4			2										2	
21CBS6044.5	1	3			2								1	
21CBS6044.6		1	1											

1: Low 2: Medium 3: High

Introduction to Data Science			
Course Code	21CBS6045	CIE Marks	50
Course Type (Theory/Practical/Integrated)	Theory	SEE Marks	50
		Total Marks	100
Teaching Hours/Week (L:T:P)	3:0:0	SEE	3 Hours
Total Hours	40 hours	Credits	03
<p>Course Objective: The objective of the course is to</p> <ul style="list-style-type: none"> ● Introduce data collection and pre-processing techniques for data science. ● Explore analytical methods for solving real life problems through data exploration techniques. ● Illustrate different types of data and its visualization. ● Find different data visualization techniques and tools. ● Design and map elements of visualization well to perceive information. 			
Module-1:Preparing and Gathering Data			8 hours
Philosophies of data science - Data science in a big data world - Benefits and uses of data science and big data - facts of data: Structured data, Unstructured data, Natural Language, Machine generated data, Audio, Image and video streaming data.			
TB 1: Ch-1			
Module-2:The Data Science Process			8 hours
Overview of the data science process- defining research goals and creating project charter, retrieving data, cleansing, integrating and transforming data, exploratory data analysis, Build the models, presenting findings and building application on top of them.			
TB 1: Ch-2			
Module-3:Machine Learning			8 hours
Application for machine learning in data science- Tools used in machine learning Modeling Process – Training model – Validating model – Predicting new observations –Types of machine learning Algorithm : Supervised learning algorithms, Unsupervised learning algorithms.			
TB 1: Ch-3			
Module-4:Visualization			8 hours
Introduction to data visualization – Data visualization options – Filters – MapReduce – Dashboar development tools.			
TB 1: Ch-9			
Module-5:Big Data			8 hours
<p>The Big data Ecosystem: Distributed file system, Distributed Programming framework, Data Integration framework, Machine learning Framework, NoSQL Databases, Scheduling tools, Benchmarking Tools, System Deployment, Service programming and Security.</p> <p>Distributing data storage and processing with frameworks - Case study: e.g, Assessing risk when lending money</p>			
TB 1: Ch-5			

Course Outcomes: At the end of the course the student will be able to:	
21CBS6045.1	Explain the data science terminologies.
21CBS6045.2	Describe the Data Science process on real time scenario
21CBS6045.3	Make use of data visualization tools
21CBS6045.4	Apply Data storage and processing with frameworks.
21CBS6045.5	Identify various branches in Data Science.
21CBS6045.6	Apply Data Science tools for real-life applications.

Sl. No.	Title of the Book	Name of the Author/s	Name of the Publisher	Edition and Year
Textbooks				
1	Introducing Data Science	Dav Cielen, Arno D. B. Meysman and Mohamed Ali	Manning Publications	2016
Reference Books				
1	Doing Data Science	Cathy O'Neil, Rachel Schutt, O' Reilly,	O'Reilly Media	1 st Edition, 2013
2	Think Like a Data Scientist	Brian Godsey	Manning Publications	2017
3	Mining of Massive Datasets	Jure Leskovec, Anand Rajaraman, Jeffrey David Ullman	Cambridge University Press	2 nd Edition, 2014

Web links and Video Lectures (e-Resources):

- <https://www.simplilearn.com/tutorials/data-science-tutorial/what-is-data-science>
- <https://www.simplilearn.com/tutorials/data-science-tutorial/what-is-data-science>
- <https://www.coursera.org/lecture/what-is-datascience/fundamentals-of-data-science-tPgFU>
- [Learn Data Science Tutorial - Full Course for Beginners - YouTube](#)
- <https://www.simplilearn.com/tutorials/data-science-tutorial/what-is-data-science>

Course Articulation Matrix

Course Outcomes (COs)	Program Outcomes (POs)													
	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO1	PSO2
21CBS6045.1	2			2	3									3
21CBS6045.2				2		3								3
21CBS6045.3				3										1
21CBS6045.4				3		1								
21CBS6045.5				2	2							2		3
21CBS6045.6				2	2							3		3

1: Low 2: Medium 3: High

Environmental Studies			
Course Code	21CIV605	CIE Marks	50
Course Type (Theory/Practical/Integrated)	Theory	SEE Marks	50
		Total Marks	100
Teaching Hours/Week (L:T:P)	1:0:0	SEE Hours	02
Total Hours	15 hours Theory	Credits	01
<p>Course Learning Objectives: This course will enable</p> <ul style="list-style-type: none"> • To create environmental awareness among the students. • To gain knowledge on different types of pollution in the environment. 			
Module-1 Introduction to Ecology			3 hours
Ecosystems (Structure and Function): Forest, Desert, Wetlands, River, Oceanic and Lake. Biodiversity: Types, Value; Hot-spots; Threats and Conservation of biodiversity, Forest Wealth, and Deforestation.			
Module-2 Energy Systems and Natural Resources			3 hours
Advances in Energy Systems (Merits, Demerits, Global Status and Applications): Hydrogen, Solar, OTEC, Tidal and Wind. Natural Resource Management (Concept and case-studies): Disaster Management, Sustainable Mining, case studies, and Carbon Trading.			
Module-3 Environmental Pollution and Public Health			3 hours
Environmental Pollution (Sources, Impacts, Corrective and Preventive measures, Relevant Environmental Acts, Case-studies): Surface and Ground Water Pollution; Noise pollution; Soil Pollution and Air Pollution. Waste Management & Public Health Aspects: Bio-medical Wastes; Solid waste; Hazardous wastes; E-wastes; Industrial and Municipal Sludge.			
Module-4 Environmental Concerns			3 hours
Global Environmental Concerns (Concept, policies and case-studies): Ground water depletion/recharging, Climate Change; Acid Rain; Ozone Depletion; Radon and Fluoride problem in drinking water; Resettlement and rehabilitation of people, Environmental Toxicology.			
Module-5 Environmental Management			3 hours
Latest Developments in Environmental Pollution Mitigation Tools (Concept and Applications): G.I.S. & Remote Sensing, Environment Impact Assessment, Environmental Management Systems, ISO14001; Environmental Stewardship- NGOs. Field work: Visit to an Environmental Engineering Laboratory or Green Building or Water Treatment Plant or Waste water treatment Plant; ought to be Followed by understanding of process and its brief documentation.			

Course Outcomes: At the end of the course the student will be able to:	
21CIV605.1	Understand the principles of ecology and environmental issues that apply to air, land, and water issues on a global scale
21CIV605.2	Develop critical thinking and/or observation skills and apply them to the analysis of a problem or question related to the environment.
21CIV605.3	Demonstrate ecology knowledge of a complex relationship between biotic and abiotic component.
21CIV605.4	Apply their ecological knowledge to illustrate and graph a problem and describe the realities that managers face when dealing with complex issues.
21CIV605.5	Address problems related to waste management and public health aspects
21CIV605.6	Understand about the Standards and latest tools to mitigate pollution.

Sl. No.	Title of the Book	Name of the Author/s	Name of the Publisher	Edition and Year
Textbooks				
1	Environmental studies	Benny Joseph	Tata McGraw-Hill	Edition 3, 2018
2	Environmental Studies –From Crisis to Cure	R Rajagopalan	Oxford Uni-Press	Edition 3, 2020
Reference Books				
1	A Basic Course in Environmental Studies	Surinder Deswal, Anupama Deswal	DhanpatRai Publishing Co. (P) Ltd	2017
2	Text book of Environmental Studies for Undergraduate Courses	Bharucha Erach	Universities Press	Edition 2, 2017
3	Environmental Studies	Ranjit R. J Daniels, Jagdish Krishnaswamy	John Wiley & Sons Inc.	2010
4	Perspective in Environmental Studies	Anubha Kaushik, C P Kaushik	New Age International Pvt. Ltd	Edition 3, 2009

Web links and Video Lectures (e-Resources):

- Coursera Course: Introduction to Environmental Science Specialization - <https://coursera.org/share/e6c3c98f7215fd49f688e7ede71a0dfc>
- NPTEL: Environmental Studies - https://onlinecourses.swayam2.ac.in/cec22_ge22/preview
- Directory of Open Access Books (DOAB) -Environmental Leadership Capacity Building in Higher Education: Experience and Lessons from Asian Program for Incubation of Environmental Leaders : <http://link.springer.com/openurl?genre=book&isbn=978-4-431-54339-8>
- Lec 31: Environmental Management Systems (EMS) - <https://youtu.be/BYqLRGawoH0>
- ISO 14001:2015 Training - Environmental Management - <https://youtu.be/2f4pBIvXkBs>

Course Articulation Matrix

Course Outcomes (COs)	Program Outcomes (POs)													
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
21CIV605.1	0	0	0	0	0	1	3	0	0	0	0	0	0	0
21CIV605.2	0	0	0	0	0	0	3	0	0	0	0	0	0	0
21CIV605.3	0	0	0	0	0	0	3	0	0	0	0	0	0	0
21CIV605.4	0	0	0	0	0	0	3	0	0	0	0	0	0	0
21CIV605.5	0	0	0	0	0	2	3	1	0	0	0	0	0	0
21CIV605.6	0	0	0	0	1	0	0	2	0	0	0	0	0	0

1: Low 2: Medium 3: High

Artificial Intelligence Lab			
Course Code	21CBL606	CIE Marks	50
Course Type (Theory/Practical/Integrated)	Practical	SEE Marks	50
		Total Marks	100
Teaching Hours/Week (L:T:P)	0:0:2	Exam Hours	03
Total Hours	10 Lab Slots	Credits	01
Course Learning Objectives:			
<ul style="list-style-type: none"> • To build software development skills using python programming for real-world applications. • To understand and apply the concepts of AI algorithms in programming language. • To develop applications using Artificial Intelligence. 			
Descriptions (if any):			
Installation procedure of the required software must be demonstrated.			
PART- A (For Practice)			
1.	(a) Write a python program to print the multiplication table for the given number. (b) Write a python program to implement a function that counts the number of times a String (s1) occurs in another String (s2). (c) Write a python program to Illustrate Different Set Operations. -- Any other relevant programs can be given.		
2.	(a) Write a python program to implement List operations (Nested List, Length, Concatenation, Membership, Iteration, Indexing and Slicing) (b) Write a python program to implement List methods (Add, Append, Extend and Delete). (c) Write a program to illustrate Dictionary operations([],in, traversal)and methods: keys(),values(),items()		
PART B – AI Problems.			
1.	Write a Program to Implement simple Chatbot with minimum 10 conversations		
2.	Write a Program to Implement and Demonstrate Water Jug Problem.		
3.	Write a Program to Implement Tic-Tac-Toe game using Python.		
4.	Write a Program to Solve 8-Queens Problem with suitable assumptions.		
5.	Write a Program to Implement Missionaries-Cannibals Problems using Python.		
6.	Write a program to Implement any Game and demonstrate the Game playing strategies.		
PART C – Value Added Programs			
1.	Write a program in prolog to implement simple facts and Queries.		
2.	Write a program in prolog to implement simple arithmetic.		
3.	Write a program in prolog to solve Monkey banana problem.		
4.	Write a program in prolog to solve Tower of Hanoi.		

Sl. No.	Title of the Book	Name of the Author/s	Name of the Publisher	Edition and Year
Textbooks				
1	Artificial Intelligence: A Modern Approach	Stuart Russell and Peter Norvig	Pearson Education	3rd / 4th Edition 2015

2	Artificial Intelligence	Saroj Kaushik	Cengage Learning	1st Edition 2014
Reference Books				
1	Introduction to Artificial Intelligence & Expert Systems	Dan W. Patterson	Prentice-Hall	1st Edition 2015
2	Artificial Intelligence	Kevin Knight, Elaine Rich, Shivashankar B. Nair	McGraw Hill Education	3 rd Edition, 2017

Course Articulation Matrix

Course Outcomes (COs)	Program Outcomes (POs)													
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
21CBL606.1	2			2										
21CBL606.2										2		2		
21CBL606.3		2					2						2	
21CBL606.4												2	2	
21CBL606.5			2		2							2	2	
21CBL606.6			2		2							2		

1: Low 2: Medium 3: High

Operation Research			
Course Code	21CBS607	CIE Marks	50
Course Type (Theory/Practical/Integrated)	Theory	SEE Marks	50
		Total Marks	100
Teaching Hours/Week (L:T:P)	2:2:0	SEE	3 Hours
Total Hours	40 Hours	Credits	03
<p>Course Learning Objectives: The objective of the course is to</p> <ul style="list-style-type: none"> • Formulate optimization problem as a linear programming problem. • Solve optimization problems using simplex method. • Devise and solve transportation problems. • Find solution for assignment Problems. • Make use of game theory for decision making problems. 			
Module-1:Introduction, Linear Programming			8 hours
<p>Introduction: Development of Operations Research, Definition of Operations Research, Characteristics of Operations Research, Scientific Method in Operations' Research, Necessity of Operations research in Industry, Scope of OR, OR and Decision Making, Phases and Models in OR, classification schemes of Model, Characteristics of a Good Model, Advantages of a Model, Limitations of Model, Constructing the Model, Approximations in OR Models, Types of Mathematical Models, Role of Computers in OR, Difficulties in OR, Limitations of OR.</p> <p>Linear Programming Problem (LPP): Requirements for a LPP, Assumptions of LPP, Formulation of LPP and Graphical method of solution with various examples. TB1</p>			
Module-2:Simplex Method			8 hours
<p>Simplex Method – 1: Theory of Simplex method, Some important definitions, Analytical method or trial and error method, The simplex method, Artificial variable Techniques, Big M method, Two phase method, Solutions of Simultaneous Equations by Simplex Method, Computational Efficiency of the Simplex Techniques. TB1</p>			
Module-3:The Transportation Model			8 hours
<p>The Transportation Model: Introduction to the Model, Assumption in the Transportation Model, Definition of the Transportation Model, Matrix Terminology, Formulation and solution of Transportation Models, Variants in Transportation Problems, Additional Problems, Least Time Transportation Problems, Post Optimality Analysis in Transportation, The Trans-shipment Problem, Dual of the Transportation Problem.</p> <p>TB1</p>			
Module-4:Assignment Problems			8 hours
<p>Assignment Problems: Definition of the Assignment Model, Mathematical representation of the assignment Model, Comparison with the Transportation, Solution of the Assignment Models, The Hungarian Method for solution of the assignment Problems, Formulation and solution of the Assignment Models, variations of the Assignment Problems, Additional problems, Sensitivity Analysis in the Assignment Problems</p> <p>TB1</p>			
Module-5:Decision Theory and Game Theory			8 hours
<p>Decision Theory: Steps in decision Theory Approach, Decision Making Environments, Decision Making under Conduction of Certainty, Decision Making under Conditions of Uncertainty, Decision making under Condition of Risk, Maximum Likelihood Criterion, Expected Value Criteria for Continuously Distributed random variables. Additional Examples.</p> <p>Game Theory: The Theory of games, Characteristics of Games, game models, Definitions, Rules for Game Theory, Rule1: Look for a Pure Strategy, Rule2: Reduce Game by Dominance, Rule 3: Solve for a Mixed Strategy, Mixed Strategies (2x2 games), Limitations of Game theory.</p> <p>TB1</p>			

Course Outcomes: At the end of the course the student will be able to:	
21CBS607.1	Devise the problem as Linear Programming Problem
21CBS607.2	Apply Big-M Method and Two-phase method for a given problem.
21CBS607.3	Represent and solve Transportation problem.
21CBS607.4	Solve Assignment Problem.
21CBS607.5	Apply Game theory for decision making problems.
21CBS607.6	Analyze the Optimality of the Problem' Solution.

Sl. No.	Title of the Book	Name of the Author/s	Name of the Publisher	Edition and Year
Textbooks				
1	Operations Research	D.S. Hira and Prem Kumar Gupta	S. Chand & Company Pvt. Ltd	7 th Edition, 2014
Reference Books				
1	Operation Research	S Kalavathy	Vikas Publishing House Pvt Limited	4 th Edition, 2013
2	Operation Research	S D Sharma	Kedar Nath, Ram Nath Publishers.	2020 th Edition (1 January 2014)

Web links and Video Lectures (e-Resources):
<ul style="list-style-type: none"> • https://www.youtube.com/watch?v=OwNPKGQ3UDY • https://onlinecourses.nptel.ac.in/noc20_ma23/preview • https://www.coursera.org/learn/operations-research-modeling • https://www.youtube.com/playlist?list=PLabr9RWfBcnoLyXr4Y7MzmHSu3bDjLvhu • https://www.youtube.com/watch?v=SsSFk_tYa8w

Course Articulation Matrix

Course Outcomes (COs)	Program Outcomes (POs)													
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
21CBS607.1	2												2	
21CBS607.2		2	2										2	
21CBS607.3	2		2										2	
21CBS607.4		2	2										2	
21CBS607.5	2		2										1	
21CBS607.6				2									1	

1: Low 2: Medium 3: High

Innovation and Intellectual Property			
Course Code	21IIP609	CIE Marks	50
Course Type (Theory/Practical/Integrated)	Practical	SEE Marks	-
		Total Marks	50
Teaching Hours/Week (L:T:P)	0:0:2	SEE	2 Hours
Total Hours	20 Hrs	Credits	-
Course Learning Objectives:			
<ol style="list-style-type: none"> 1. Learn how to use online databases and search tools for conducting patent searches. 2. Develop skills in analyzing patent documents and identifying relevant prior art. 3. Gain proficiency in evaluating the patentability criteria for engineering inventions. 4. Understand the principles of technology gap analysis and patentability search. 5. Understand the patent drafting and patent prosecution. 			
Module-1 Basics of Intellectual Property Rights (4 Hours)			
Creativity, Invention, and Innovation – Introduction to Intellectual Property Rights-types and Importance – Overview of Patent Law – Intellectual Property Management and Commercialization – Emerging Issues in Intellectual Property – Case Studies and Practical Examples – Ethical and Social Considerations.			
Activity: Trademark Design Challenge – IP Case Study Analysis			
Module-2 Patent Landscape Analysis – Technology Gap Analysis (4 Hours)			
Overview of Patent Databases and Search Tools – Keyword Searching, Classification Searching, and Citation Searching – Methods for Analyzing Patent Data: Patent Counts, Citation Analysis, and Patent Mapping – Technology Gap Analysis – Patent Portfolios – Portfolio Strength Assessment – Identification of Key Players – Competitive Intelligence and Market Analysis.			
Activity: Conduct Patent Landscape Analysis for the Proposed Capstone Project.			
Module-3 Patentability Assessment (6 Hours)			
Significance of Patentability Assessment – Patentability Criteria: Novelty, Non-obviousness (Inventive Step), and Industrial Applicability/Utility – Prior Art Searching and Analysis (Keyword Searching, Classification Searching, and Citation Searching) – Non-Patent Literature Search and Other sources of Prior Art – Patentability Reports and Assessments – Case Studies and Practical Examples.			
Activity: Conduct a Patentability Search for the Proposed Capstone Project.			
Module-4 Patent Drafting and Prosecution (6 Hours)			
Significance of Patent Drafting and Prosecution – Structure and Components of a Patent Application – Drafting of Patent Specifications, Claims, and Drawings – Overview of Patent Prosecution Process			
Activity: Prepare a Patent Draft for the Proposed Capstone Project.			

Course Outcomes: At the end of the course, the student will be able to:	
21IIP609.1	Demonstrate proficiency in utilizing various online databases and search tools for conducting patent searches.
21IIP609.2	Develop advanced skills in analyzing patent documents to identify relevant prior art, including patents, patent applications, and non-patent literature.
21IIP609.3	Demonstrate a comprehensive understanding of the patentability criteria, including novelty, non-obviousness, and utility.

21IIP609.4	Explain the principles and methodologies of technology gap analysis and its relevance to patentability searches.
21IIP609.5	Gain insight into the patent drafting process, including the structure and components of patent applications, and patent prosecution.
21IIP609.6	Apply the acquired knowledge and skills in conducting practical activities, such as conducting patent landscape analysis, patentability searches, and drafting patent applications, to solve real-world problems and challenges in the field of intellectual property rights.

Sl. No.	Title of the Book	Name of the Author/s	Name of the Publisher	Edition and Year
Reference Books/Sources				
1	Intellectual Property- A Primer for Academia (For Module 1)	Rupinder Tewari Mamtha Bhardway	Publication Bureau, Panjab University Chandigarh India	2021
2	Patent Landscape Reports (For Module 2)	WIPO - World Intellectual Property Organization		https://www.wipo.int/patentscope/en/programs/patent_landscape/s/
3	Guidelines for Preparing Patent Landscape Reports (For Module 2)	Anthony Trippe, Patinformatics, LLC	World Intellectual Property Organization (WIPO)	2015
4	Patent Searching - Tools and Techniques (For Module 3)	David Hunt	John Wiley & Sons Inc	First edition 2007
5	The Complete Patent Book_ Everything You Need to Obtain Your Patent (For Module 4)	James L. Rogers	Sphinx Publishing	First Edition 2003

Additional Resources:

1. WIPO Patent Drafting Manual - Second Edition 2023, <https://www.wipo.int/edocs/pubdocs/en/wipo-pub-867-23-en-wipo-patent-drafting-manual.pdf>
2. Patent Drafting for Beginners - <https://elearn.nptel.ac.in/shop/nptel/patent-drafting-for-beginners/?v=c86ee0d9d7ed>
3. The Office of the Controller General of Patents, Designs and Trade Marks, Government of India - <https://www.ipindia.gov.in/>
4. Copyright Office, Government of India - <https://copyright.gov.in/>
5. United States Patent and Trademark Office - <https://www.uspto.gov/>
6. Espacenet – patent search - <https://worldwide.espacenet.com/>
7. The Lens - Free & Open Patent and Scholarly Search - <https://www.lens.org/>
8. WIPO PATENTSCOPE - <https://patentscope.wipo.int/search/en/search.jsf>

Course Articulation Matrix

Course Outcomes (Cos)	Program Outcomes (POs)													
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
21IIP609.1	2	-	-	-	3	-	-	-	-	-	-	1	-	-
21IIP609.2	2	-	-	3	-	-	-	-	-	-	-	1	-	-
21IIP609.3	3	-	-	-	-	-	-	-	-	-	1	-	-	-
21IIP609.4	2	-	3	-	-	-	-	-	-	-	-	-	-	-
21IIP609.5	1	3	-	-	-	-	-	-	-	-	-	2	-	-
21IIP609.6	-	-	-	-	2	-	-	-	-	-	-	3	-	-

1: Low 2: Medium 3: High

Core Values of the Institution

SERVICE

A Josephite will keep service as the prime goal in everything that is undertaken. Meeting the needs of the stakeholders will be the prime focus of all our endeavors.

EXCELLENCE

A Josephite will not only endeavor to serve, but serve with excellence. Preparing rigorously to excel in whatever we do will be our hallmark.

ACCOUNTABILITY

Every member of the SJEC Family will be guided to deliver on assurances given within the constraints set. A Josephite will always keep budgets and deadlines in mind when delivering a service.

CONTINUOUS ADAPTATION

Every member of the SJEC Family will strive to provide reliable and continuous service by adapting to the changing environment.

COLLABORATION

A Josephite will always seek to collaborate with others and be a team-player in the service of the stakeholders.

Objectives

- Provide Quality Technical Education facilities to every student admitted to the College and facilitate the development of all round personality of the students.
- Provide most competent staff and excellent support facilities like laboratory, library and internet required for good education on a continuous basis.
- Encourage organizing and participation of staff and students in in-house and outside Training programmes, seminars, conferences and workshops on continuous basis.
- Provide incentives and encouragement to motivate staff and students to actively involve in research-innovative projects in collaboration with industry and R & D centres on continuous basis
- Invite more and more number of persons from industry from India and abroad for collaboration and promote Industry-Institute Partnership.
- Encourage consultancy and testing and respond to the needs of the immediate neighbourhood.



St Joseph Engineering College

AN AUTONOMOUS INSTITUTION

Affiliated to VTU, Belagavi | Recognised by AICTE, New Delhi

Accredited by NAAC with A+ Grade

B.E. (CSE, ECE, EEE, ME, CIV), MBA & MCA Accredited by NBA, New Delhi

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