

Fourth 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) & PG (MBA and MCA)
NAAC – Accredited with A+

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

Computer Science and Business Systems

FOURTH YEAR (VII and VIII 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 two of the PG programs, namely, MBA and MCA 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

Artificial Intelligence (AI) and Machine Learning (ML) are being looked as the drivers for the next industrial revolution happening in the world today. Artificial Intelligence has been utilized in various fields like Medicine, Language processing, Finance, Education, Transportation, Business, Law and more.

Artificial Intelligence is the branch of Computer Science that emphasizes the development of intelligent machines which think and work like humans. With the advancement in technology, we are already connected to AI in one way or the other – whether it is Siri, Watson or Alexa. More and more companies are investing resources in Machine Learning (ML), indicating a robust growth in AI products and apps in the near future.

AI and ML are integral parts of data science, where techniques from both such as regression, predictive analytics and more are applied for insight generation. Job Opportunities for AI & ML engineers such as - Business Intelligence Developer, Research Scientist, Full stack developer, Software architect, Data analyst, Data warehouse engineer and Product manager are highly demanding. Demand for AI and ML engineers is projected to be 1,25,00 in the next five years.

The four-year engineering course in AI and ML at SJEC offers subjects like Introduction to Sensors, ML with Python, Big Data Analytics, Natural Language Processing (NLP), Applied Statistics, Expert System, Fuzzy Logic, Virtual Reality, Robotics Process Automation (RPA), Internet of Things (IoT), Speech Processing, Computation Intelligence, Pervasive Computing, Knowledge and Data Engineering, ML and AI for Healthcare & Agriculture, Deep Learning, Game Theory, 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.

VII Semester (B.E. – Computer Science and Business Systems)													
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	
1	PCC	21CBS701	Digital Image Processing	CBS	CBS	2	2	-	03	50	50	100	3
2	PCC	21CBS702	Financial Management	CBS	CBS	2	2	-	03	50	50	100	3
3	PEC	21CB703X	Professional Elective - 2	CBS	CBS	3	-	-	03	50	50	100	3
4	PEC	21CB704X	Professional Elective - 3	CBS	CBS	3	-	-	03	50	50	100	3
5	OEC	21CB705X	Open Elective - 2	CBS	CBS	3	-	-	03	50	50	100	3
6	SDC	21CBS706	Technical Seminar	CBS	CBS	-	-	2	-	100	-	100	1
7	SDC	21CBP707	Major Project Work (Phase I & II)	CBS	CBS	-	-	6	03	50	50	100	5
Total						13	04	08	18	400	300	700	21

21CBS703X : Professional Elective II					
21CBS7031	Marketing Research and Marketing Management	21CBS7033	Business Intelligence	21CBS7035	Enterprise Systems
21CBS7032	Usability Design of Software Applications	21CBS7034	Blockchain Technology		
21CBS704X : Professional Elective III					
21CBS7041	Augmented and Virtual Reality	21CBS7043	Data Mining and Analytics	21CBS7045	Cryptography and Cyber Security
21CBS7042	Human Resource Management	21CBS7044	Behavioral Economics		

21CBS705X : Open Elective II					
21CBS7051	Deep Learning	21CBS7053	Design Thinking	21CBS7055	Internet of Things
21CBS7052	Robotics Process Automation	21CBS7054	Natural Language Processing		

VIII Semester (B.E. – Computer Science and Business Systems)														
Sl. 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	SDC	21AEC801	MOOC	Any MOOC topic (Choices are given by respective Department) with minimum 8 weeks to be completed between III Sem to VIII Sem								100	2	
2	SDC	21CBP802	Project Work (Final Presentation and Report Submission)	CBS		-	-	-	03	50	50	100	5	
3	INT	21INT803	Research / Industry Internship			-	-	-	03	50	50	100	10	
Total						-	-	-	06	100	100	300	17	

Note: Research Internship / Industry Internship is to be carried out during the 8th semester for 15 weeks.

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.

VII Semester

Digital Image Processing			
Course Code	21CBS701	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
Course Learning Objectives: The objective of the course is to • Understand the fundamentals of digital image processing. • Know the image enhancement techniques used in digital image processing. • Learn the image restoration techniques, Morphological Operations and Segmentation used in digital image processing. • Apply the digital image processing techniques in real-time captured images.			
Module-1: Digital Image Fundamentals			8 hours
Digital Image Fundamentals: What is Digital Image Processing? Origins of Digital Image Processing, Examples of fields that use DIP, Fundamental Steps in Digital Image Processing, Components of an Image Processing System, Elements of Visual Perception, Image Sensing and Acquisition, Image Sampling and Quantization, Some Basic Relationships between Pixels, Linear and Nonlinear Operations. TB1: Ch 1, Ch 2- 2.1 to 2.5, 2.6.2			
Module-2: Spatial and Frequency Domain			8 hours
Spatial Domain: Some Basic Intensity Transformation Functions, Histogram Processing, Fundamentals of Spatial Filtering, Smoothing Spatial Filters, Sharpening Spatial Filters. Frequency Domain: Preliminary Concepts, The Discrete Fourier Transform (DFT) of Two Variables, Properties of the 2-D DFT, Filtering in the Frequency Domain, Image Smoothing and Image Sharpening Using Frequency Domain Filters, and Selective Filtering. TB1: Ch 3 - 3.2 to 3.6, Ch 4 - 4.2, 4.5 to 4.10			
Module-3: Image Restoration			8 hours
Restoration: Noise models, Restoration in the Presence of Noise Only using Spatial Filtering and Frequency Domain Filtering, Linear, Position-Invariant Degradations, Estimating the Degradation Function, Inverse Filtering, Minimum Mean Square Error (Wiener) Filtering, and Constrained Least Squares Filtering. TB1: Ch 5 - 5.2 to 5.9			
Module-4 Processing Images			8 hours
Color Image Processing: Color Fundamentals, Color Models, and Pseudo-color Image Processing Wavelets: Background, Multiresolution Expansions. Morphological Image Processing Preliminaries, Erosion and Dilation, Opening and Closing, The Hit-or-Miss Transforms, and Some Basic Morphological Algorithms. TB1: Ch 6 - 6.1 to 6.3, Ch 7 - 7.1, 7.2, Ch 9 - 9.1 to 9.			
Module-5: Image Segmentation			8 hours
Segmentation: Introduction, classification of image segmentation algorithms, Detection of Discontinuities, Edge Detection, Hough Transforms and Shape Detection, Corner Detection, and Principles of Thresholding. Representation and Description: Representation, and Boundary descriptors. TB2: Ch 9 - 9.1 to 9.7, TB 1: Ch 11 - 11.1, 11.2			
Course Outcomes: At the end of the course the student will be able to:			
21CBS701.1	Describe the basics of image processing concepts through mathematical interpretation.		
21CBS701.2	Apply Image Enhancement techniques in both the spatial and frequency (Fourier) domains.		

21CBS701.3	Make use of Image Restoration process and its respective filters
21CBS701.4	Analyze different Morphological image processing techniques and Color processing.
21CBS701.5	Apply the Methodologies for Edge and Shape detection and Segmentation process.
21CBS701.6	Develop independent study for Image Processing Techniques in real-life use cases.

Sl. No.	Title of the Book	Name of the Author/s	Name of the Publisher	Edition and Year
Textbooks				
1	Digital Image Processing	Rafael C. Gonzalez and Richard E. Woods	Prentice Hall	4 th Edition, 2018
2	Digital Image Processing	S. Sridhar	Oxford University Press	2 nd Edition, 2016
Reference Books				
1	Fundamentals of Digital Image Processing	A. K. Jain	Pearson	1 st Edition, 2015
2	Digital Image Processing Using MATLAB	Ralph Gonzalez, Richard Woods, Steven Eddins	McGraw Hill Education	2 nd Edition, 2017

Web links and Video Lectures (e-Resources):

- <https://www.youtube.com/watch?v=jd6FWes1Ybw>
- <https://www.youtube.com/watch?v=RkcX28FnnO0>
- https://onlinecourses.nptel.ac.in/noc19_ee55/preview
- <https://www.mygreatlearning.com/academy/learn-for-free/courses/digital-image-processing>
- <https://www.coursera.org/learn/digital>
- <https://free.aicte-india.org/Digital-Image-Processing.php>

Course Articulation Matrix

Course Outcomes (COs)	Program Outcomes (POs)													
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
21CBS701.1	2		2							1				
21CBS701.2		2		2					2	2		2		
21CBS701.3					2		2						2	
21CBS701.4				2	2		1					2		
21CBS701.5					2	2	1	1	2			1	2	
21CBS701.6			2		2	2					1			

1: Low 2: Medium 3: High

Financial Management			
Course Code	21CBS702	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
Course Learning Objectives: The objective of the course is to • Understand how finance analysis is carried out. • Understand the principles of risk and return, and learn techniques for managing financial risk. • Distinguish various financial sources. • Describe financial decision making relates to Working Capital, Investment, Capital			
Module-1: Managing Finances			8 hours
Introduction to financial management, objectives of financial management. Changing role of finance managers. Interface of Financial Management with other functional areas. Emerging Issues in Financial Management: Risk management, Behavioural finance and financial engineering. Introduction to Financial System. Financial markets, Financial Instruments, Financial institutions and financial services. Introduction to derivatives. TB 1: Ch 1, 2			
Module-2: Time Value of Money			8 hours
Future value of single cash flow & annuity, present value of single cash flow, annuity & perpetuity. Simple interest & Compound interest, Capital recovery & loan amortization. (Theory & Problem) TB 1: Ch 6			
Module-3: Financial Sources			8 hours
Shares-Preference shares and Equity shares, Debentures, Term loans, Lease financing, Hybrid financing, Venture Capital, Angel investing and private equity, Warrants and convertibles (Theory Only). TB 1: Ch 17			
Module-4: Investment Decisions			8 hours
Capital budgeting process, Investment evaluation techniques – Net present value, Internal rate of return, modified internal rate of return, Profitability index, Payback period, discounted payback period, accounting rate of return (Theory & Problem). TB 2: Ch 9			
Module-5: Capital Management and Dividend Decision			8 hours
Factors influencing working capital requirements - Estimation of working capital requirements of a firm. Planning the capital structure - (No capital structure theories to be covered) Leverages, EBIT and EPS analysis. ROI & ROE analysis. Capital structure policy. Dividend policy – Factors affecting the dividend policy - Dividend Policies- Stable Dividend, Stable Pay-out (No dividend theories to be covered). TB 1: Ch.19, 20			

Course Outcomes: At the end of the course the student will be able to:	
21CBS702.1	Explain the basic concepts of financial management and the interface of financial management with other functional areas within organizations.
21CBS702.2	Apply principles of time value and money in solving real time finance problems.
21CBS702.3	Describe various sources of corporate financing in various applications.
21CBS702.4	Apply capital budgeting techniques to solve finance problems

21CBS702.5	Choose the Capital Structure and Dividend policies.
21CBS702.6	Develop critical thinking and judgment skills in financial analysis and decision-making.

Sl. No.	Title of the Book	Name of the Author/s	Name of the Publisher	Edition and Year
Textbooks				
1	Financial Management	Prasanna Chandra	McGraw Hill	10 th Edition, 2019
2	Financial Management	I M Pandey	Vikas Publishing House	11 th Edition, 2015
Reference Books				
1	Fundamentals of Financial Management	Brigham & Houston	Cengage Learning	1 st Edition, 2021
2	Financial Management	Rathod, Babitha Thimmaiah, Harish Babu	Himalaya Publishing House	1 st Edition, 2015

Web links and Video Lectures (e-Resources):

- https://youtu.be/KHHPGBWlJLQ?list=PL3sk8amcDFDk_jQEHCeGrBFVeZXDjuvsd
- <https://youtu.be/NZllhBCR8W4?list=PL7vKx60xdmSe59v0IJuv-vDDI4o06n0pF>
- <https://youtu.be/XnDwD3D83-Y>
- <https://youtu.be/1WFYjEppsSo?list=PLLhSIFdZcUWjAqEki4OcBZwbfbkleQIgb>
- <https://youtu.be/feJHbZks-c?list=PL7vKx60xdmSew9dtDcavu3j7XADMBqg1J>

Course Articulation Matrix

Course Outcomes (COs)	Program Outcomes (POs)													
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
21CBS702.1		2	2	2	2			2	2	2	2		1	
21CBS702.2		3		2	2									2
21CBS702.3	1				1			1	2					1
21CBS702.4	1		1	1						2				
21CBS702.5				2		1			1		1			
21CBS702.6			2					3					2	2

1: Low 2: Medium 3: High

Marketing Research and Marketing Management			
Course Code	21CBS7031	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: The objective of the course is to • Develop the student's basic analytical skills, conceptual abilities, and practical knowledge in marketing through lecture, discussions, and case studies • To gain an understanding of marketing activities that connect people, brands, and businesses. • Equip students with the key concepts and methods of marketing research. • Learn the application of research tools to solve real-life business problems			
Module-1: Introduction to Marketing Research			8 hours
Marketing Research Dynamics- Introduction, Meaning of Marketing research, when marketing research is unnecessary, Nature and Scope of Marketing Research, Marketing Research in the 21st Century (Indian Scenario) Understanding the role of marketing research in decision-making. Exploring the different types of marketing research (qualitative and quantitative). Ethical considerations in marketing research. Case Study on Marketing Research Dynamics TB1: Ch 1			
Module-2: Research Design and Data Collection			8 hours
Meaning and significance - Types: Exploratory and Conclusive Research Design. Formulating research objectives and hypotheses. Designing research methodologies (surveys, experiments, interviews, etc.). Sampling techniques and sample size determination. Data collection methods: online surveys, focus groups, observational research, etc. Data analysis techniques: quantitative analysis and qualitative analysis. Design and implementation of Marketing Research Projects. TB1: Ch 6,12			
Module-3: Data Analysis and Interpretation			8 hours
Editing, Coding, Classification, Tabulation, Validation Analysis and Interpretation, Use of SPSS for coding, tabulating, and analysis of data- Report writing and presentation of results: Importance of report writing, types of research report, report structure, guidelines for effective documentation. TB1: Ch 15,20			
Module-4: Marketing Management			8 hours
Marketing V/s Selling, Customer value, Marketing Myopia. Marketing Environment - Components of Environment to be analyzed- Micro/ Macro Environment, Technological Environment, Sociocultural Environment, Economic Environment, Legal Environment, Consumer/Demographic Environment, Government policies, Political environment. Contemporary Indian Marketing Environment. Market Segmentation, Targeting & Positioning (STP). Understanding marketing mix. Product development and lifecycle management. TB2: Ch 1,2			
Module-5: Marketing Research Application			8 hours
Applications of Marketing Research: Introduction, Consumer Market Research, Business-to-Business Market Research, Product Research, Product Adoption decisions, Pricing Research, Motivational Research, Distribution Research, Advertising Research, Media Research, Sales Analysis and Forecasting, Product prototypes, evaluating prototypes, Luxury and Lifestyle products. Case studies and practical examples of successful marketing research projects. Predictive analytics in marketing. TB1: Ch 24			

Course Outcomes: At the end of the course the student will be able to:	
21CBS7031.1	Explain the significance and opportunities of marketing research in contemporary business environments.

21CBS7031.2	Comprehend the meaning and significance of various types of research designs, including exploratory and conclusive approaches.
21CBS7031.3	Describe the different phases of data collection and importance of effective report writing.
21CBS7031.4	Compare various marketing environment in contributing to strategic marketing initiatives.
21CBS7031.5	Differentiate various marketing application suitable for the model.
21CBS7031.6	Solve real-life business problems by using the application of research tools.

Sl.No.	Title of the Book	Name of the Author/s	Name of the Publisher	Edition and Year
Textbooks				
1	Business Research Methods	S. N. Murthy & U. Bhojanna	Excel Books	3 rd Edition, 2010
2	Marketing Management	Kotler, Keller, Koshy & Jha	Pearson Education	16 th Edition, 2022
Reference Books				
1	Marketing in India: Text and Cases	Neelamegham S	Vikas	4 th Edition, 2012
2	Market Research: Text and cases	Rajendra Nargundkar	Mc Graw Hill	3 rd Edition, 2016
Web links and Video Lectures (e-Resources): • https://www.youtube.com/watch?v=wuPqMenY56c • https://www.youtube.com/watch?v=rXBH3YcOI6k • http://www.icmrindia.org/Short%20Case%20Studies/Short%20Case%20Studies.asp?cat=Marketing%20Management • http://www.ibscdc.org/marketing_case_studies.asp • https://nptel.ac.in/courses/110107113/				

Course Articulation Matrix

Course Outcomes (COs)	Program Outcomes (POs)													
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
21CBS7031.1	2				2				1			1		
21CBS7031.2								2						
21CBS7031.3			1			1		2					1	
21CBS7031.4										2				
21CBS7031.5					2								2	
21CBS7031.6						2			2					1

1: Low 2: Medium 3: High

Usability Design of Software Applications			
Course Code	21CBS7032	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: The objective of the course is to • Understand the Foundations of Interaction Design and Interaction Design Process • Explore Conceptualization and Cognitive Aspects • Master Integrated Data Analytics and Visualization • Navigate Data at Scale and Interaction Design in Practice			
Module-1: Interaction Design			8 hours
Introduction to Interaction Design: Introduction, Good & Poor Design, what is Interaction Design? The User Experience, Understanding Users, Usability & User Experience Goals. The Process of Interaction Design: Introduction, What is involved in Interaction Design?, Practical Issues. TB1: Ch 1, 9			
Module-2: Conceptualizing Interaction & Cognitive Aspects			8 hours
Conceptualizing Interaction: Introduction, Conceptualizing Interaction, Conceptual Models, Interface Metaphors, Interaction Types, Paradigms, Visions, Theories, Models & Frameworks. Cognitive Aspects: Introduction, What is Cognition?, Cognitive Frameworks. TB1: Ch 2, 3			
Module-3: Social & Emotional Interaction			8 hours
Social Interaction: Introduction, Being Social, Face-to-Face Conversations, Remote Conversations, Co-Presence, Social Engagement. Emotional Interaction: Introduction, Emotions & User Experience, Expressive Interfaces & Emotional Design, Annoying Interfaces, Affective Computing & Emotional AI, Persuasive Technologies & Behavioral Change, Anthropomorphism. TB1: Ch 4, 5			
Module-4: Integrated Data Analytics and Visualization			8 hours
Data Gathering: Introduction, Five Key Issues, Data Recording, Interviews, Questionnaires, Observations. Data Analysis, Interpretation & Presentation: Introduction, Qualitative & Quantitative, Basic Quantitative Analysis, Basic Qualitative Analysis, Tools to Support Data Analysis. TB1: Ch 7, 8			
Module-5: Design, Prototyping & Construction & Introduction Design in Practice			8 hours
Design, Prototyping & Construction: Introduction, Prototyping, Conceptual Design, Concrete Design Interaction Design in Practice: Introduction, Agile UX, Design Patterns, Open-Source Resources, Tools for Interaction Design TB1: Ch 11, 12			

Course Outcomes: At the end of the course the student will be able to:	
21CBS7032.1	Describe the principles of good and poor design, defining Interaction Design and the User Experience.
21CBS7032.2	Illustrate the components and practical challenges in the Interaction Design process, applying knowledge in real-world scenarios.
21CBS7032.3	Apply conceptual models, metaphors, and interaction types while using cognitive frameworks.
21CBS7032.4	Analyze both qualitative and quantitative data and perform qualitative analysis

	using tools .
21CBS7032.5	Construct user interfaces through conceptual and concrete design, applying Agile UX principles.
21CBS7032.6	Develop usability designs by using the learnt concepts and principles through tools like Agile UX, design patterns, and open-source resources.

Sl. No.	Title of the Book	Name of the Author/s	Name of the Publisher	Edition and Year
Textbooks				
1	Interaction Design: Beyond Human-Computer Interaction	Jenny Preece, Helen Sharp and Yvonne Rogers	Wiley Publications	4 th Edition, 2015
Reference Books				
1	About Face the Essentials of Interaction Design	Alan Cooper and Robert Riemann	Wiley Publications	4 th Edition, 2014
2	The Elements of User Experience: User-Centered Design for the Web and Beyond.	Jesse James Garrett	New Riders	2 nd Edition, 2010
3	Observing the User Experience - A Practitioner's Guide to User Research	Elizabeth Goodman, Mike Kuniavsky, Andrea Moed	Morgan Kaufmann Publications.	2 nd Edition, 2012
Web links and Video Lectures (e-Resources):				
• https://www.google.co.in/books/edition/Interaction_Design/UDeQDwAAQBAJ?hl=en&gbpv=1&dq=Interaction+Design:+Beyond+Human-Computer+Interaction,+4th+Edition,+Jenny+Preece,+Helen+Sharp+and+Yvonne+Rogers&printsec=frontcover • https://www.coursera.org/learn/user-experience-design • https://www.coursera.org/learn/foundations-user-experience-design • https://www.careers360.com/courses-certifications/tcs-ion-digital-learning-hub-usability-design-of-software-applications-course				

Course Articulation Matrix

Course Outcomes (COs)	Program Outcomes (POs)													
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
21CBS7032.1	2													
21CBS7032.2	2		2											
21CBS7032.3		2											2	
21CBS7032.4			2						2					
21CBS7032.5					2									1
21CBS7032.6														1

1: Low 2: Medium 3: High

Business Intelligence			
Course Code	21CBS7033	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: The objective of the course is to • Understand the Business Intelligence, Analytics and Decision Support system. • Understand the decision-making process and identify the technologies for decision support systems • Understand data warehousing, business reporting, visual analytics and business performance management operations. • Understand the importance of data mining for the decision-making process. • Understand the importance of modelling and automated decision systems in various applications			
Module-1 Introduction to Business Intelligence, Analytics and Decision Support			8 hours
Overview of Business Intelligence, Analytics and Decision Support: Changing Business Environments and Computerized Decision Support, Managerial decision making, Information Systems Support for Decision Making, An Early Framework for Computerized Decision Support, The Concept of Decision Support Systems(DSS), A Framework for Business Intelligence, Business Analytics Overview, Brief Introduction to Big Data Analytics. Case Study: Business Intelligence, Business Analytics and Big Data. TB1			
Module-2 Decision Making and Decision Support Systems			8 hours
Foundations and Technologies for Decision Making: Decision Making, Models, Phases of the Decision-Making Process, The Intelligence Phase, The Design Phase, The Choice Phase, The Implementation Phase, How Decisions Are Supported, Decision Support Systems Capabilities, Decision Support Systems Classification, Decision Support Systems Components. Case Study: Decision making and Decision Support components. TB1			
Module-3 Descriptive Analytics: Data warehousing and Business Reporting			8 hours
Data warehousing: Data Warehousing Definitions and Concepts, Data Warehousing Process Overview, Data Warehousing Architectures, Data Integration and the Extraction, Transformation, and Load (ETL) Processes. Data warehouse Development, Data Warehousing Implementation Issues. Business Reporting, Visual Analytics, Business Performance Management: Business Reporting Definitions and Concepts, Data and Information Visualization, Different Types of Charts and Graphs, The Emergence of Data Visualization and Visual Analytics, Performance Dashboards, Business Performance Management, Performance Measurement, Balanced Scorecards, Six Sigma as a Performance Measurement System Case Study: Data Warehousing, ETL, Business Reporting TB1			
Module-4 Predictive Analytics: Data Mining			8 hours
Data Mining: Data Mining Concepts and Applications, Data Mining Applications, Data Mining Process, Data Mining Methods, Data Mining Software Tools, Data Mining Privacy Issues, Myths, and Blunders. Case Study: Data mining and Prediction applications TB1			
Module-5 Prescriptive Analytics			8 hours
Model based Decision Making: Decision Support Systems Modeling, Structure off Mathematical Models for Decision Support, Certainty, Uncertainty, and Risk, Management Support Systems,			

Multiple Goals, Sensitivity Analysis, What-If Analysis, and Goal Seeking.

Expert Systems: Basic Concepts of Expert Systems, Applications of Expert Systems, Structure of Expert Systems, Knowledge Engineering, Problem Areas Suitable for Expert Systems, Development of Expert Systems, Benefits, Limitations, and Critical Success Factors of Expert Systems.

Case Study: Application of expert systems.

TB1

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

21CBS7033.1	Apply the types of data to the Decision Support systems and Business Intelligence framework.
21CBS7033.2	Apply the decision making process and DSS concepts in the business applications supporting problem resolution..
21CBS7033.3	Analyze the importance of data warehousing and business reporting tools to perform descriptive analytics for business issues in the organizations.
21CBS7033.4	Analyze the relevance of data mining based predictions in decision making to perform prescriptive analytics for business decisions in the organizations.
21CBS7033.5	Analyze the value of model based and expert systems in the decision-making process and also discuss areas suitable for application of expert system.
21CBS7033.6	Analyze the influence of technologies & business intelligence in overcoming the issues in various business application cases.

Sl. No.	Title of the Book	Name of the Author/s	Name of the Publisher	Edition and Year
Textbooks				
1	Business Intelligence and Analytics: Systems for decision support	Ramesh Sharda, Dursun Delden, Efraim Turban	Pearson Publishers	10 th Edition, 2015
Reference Books				
1	Business Intelligence The Savvy Manager's Guide	David Loshin	Elsevier Publishers	2 nd Edition, 2013
2	Fundamentals of Business Analytics	R N Prasad, Seema Acharya	Wiley Publishers	2 nd Edition, 2016
3	Data Mining Techniques. For Marketing, Sales and Customer Relationship Management	Berry M. & Linoff G	Wiley Publishing Inc	2 nd Edition, 2004
4	Data Science for Business	Foster Provost and Tom Fawcett	O'Reilly Media, Inc	1 st Edition, 2013

Web links and Video Lectures (e-Resources):

- <https://www.youtube.com/watch?v=dn97ux9exbY>
- <https://www.youtube.com/watch?v=N8F7eOqgH8Q>
- <https://www.youtube.com/watch?v=zbcCdoHeS4w>
- <https://www.youtube.com/watch?v=KSJqdMqLQA4>
- https://www.youtube.com/watch?v=jkCCnwvO_fg
- <https://www.youtube.com/watch?v=Yb2KF-sAJh4>
- <https://www.netsuite.com/portal/resource/articles/business-strategy/business-intelligence-examples.shtml>

Course Articulation Matrix

Course Outcomes (COs)	Program Outcomes (POs)													
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
21CBS7033.1	1								1	2			1	
21CBS7033.2	2								1	2			1	
21CBS7033.3	2		2		2				1	2			1	
21CBS7033.4	2		2						1	2			2	
21CBS7033.5	2		2						1	2			2	1
21CBS7033.6	2				2				1	2			2	1

1: Low 2: Medium 3: High

Blockchain Technology			
Course Code	21CBS7034	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: The objective of the course is to - Understand basic of Blockchain Technology - Explain Bitcoins and Alternative coins used in Blockchain - Describe the idea of Ethereum Blockchain and Smart Contract - Explore Solidity Programming language and Remix IDE to develop smart contract using Hyperledger fabric			
Module-1: Introduction			8 hours
Blockchain 101: Distributed systems, History of blockchain, Introduction to blockchain, Types of blockchain, CAP theorem and blockchain, Benefits and limitations of blockchain. Decentralization: Decentralization using blockchain, Methods of decentralization, Routes to decentralization, Decentralized organizations. TB1: Ch 1, 2			
Module-2: Bitcoin			8 hours
Bitcoin: Introduction to Bitcoin, Digital keys and Addresses, Transactions, Blockchain, Mining Alternative Coins: Theoretical foundations, Bitcoin limitations, Namecoin, Litecoin, Primecoin, Zcash. TB1: Ch 5, 8			
Module-3: Smart Contracts and Ethereum			8 hours
Smart Contracts: Definition, Ricardian contracts. Ethereum 101: Introduction, Ethereum blockchain, Ethereum network, Elements of the Ethereum blockchain, Precompiled contracts. TB1: Ch 9,10			
Module-4: Development Tools and Frameworks			8 hours
Languages, Compilers, Solidity compiler (solc) Installation on Linux, Installation on macOS, Integrated Development Environments (IDEs), Tools and libraries, Ganache Meta Mask, Truffle Installation, Contract development and deployment. Introducing solidity: Types, Value types, Literals, Enums, Function types, Reference types, Global variables, Control structures, Layout of a solidity source code file. TB1: Ch 13			
Module-5: Hyperledger Fabric			8 hours
Hyperledger Fabric: Building on the foundations of open computing, Fundamentals of the Hyperledger project, The Linux Foundation, Hyperledger, Open source and open standards, Hyperledger frameworks, tools, and building blocks, Hyperledger Fabric component design, Principles of Hyperledger design, Hyperledger Fabric reference architecture, Hyperledger Fabric runtime architecture, Strengths and advantages of componentized design Blockchain-Outside of Currencies: Internet of Things, Government, Health, Finance, Media Exploring. TB1: Ch 17, TB2: Ch 2			

Course Outcomes: At the end of the course the student will be able to:	
21CBS7034.1	Explain the fundamental building blocks of Blockchain technology.
21CBS7034.2	Discuss the concepts of Bitcoin and their usage in various blockchain applications.
21CBS7034.3	Use the concept of smart contracts and Ethereum and their application in various applications
21CBS7034.4	Execute smart contract using Solidity, Remix IDE and Ethereum frameworks.
21CBS7034.5	Analyze Hyperledger fabric including its framework, design principles and architecture

21CBS7034.6	Develop block chain-based solutions by using the concepts learnt to solve real world problems.
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Sl. No.	Title of the Book	Name of the Author/s	Name of the Publisher	Edition and Year
Textbooks				
1	Mastering Blockchain - Distributed ledgers, decentralization and smart contracts explained	Imran Bashir	Packt Publishing Ltd,	2 nd Edition, 2017
2	Hands-On Block Chain with Hyperledger: Building Decentralized Applications with Hyperledger Fabric and Composer	Salman Baset, Luc Desrosiers, Nitin Gaur, Petr Novotny, Anthony O'Dowd, Venkatraman Ramakrishna	Packt Publishing Ltd,	1 st Edition, 2018
Reference Books				
1	Blockchain Technology (Concepts and applications),	Kumar saurabh, Ashutosh saxena,	Wiley, 2020	11 th Edition 2010
2	Bitcoin and Cryptocurrency Technologies	Arvind Narayanan, Joseph Bonneau, Edward	Princeton University Press	1 st Edition, 2016
3	Blockchain Basics: A Non-Technical Introduction in 25 Steps	Daniel Drescher,	Apress	1 st Edition, 2017
4	Mastering Bitcoin: Unlocking Digital Cryptocurrencies	Andreas M. Antonopoulos	O'Reilly Media	1 st Edition, 2014

Web links and Video Lectures (e-Resources):

- <https://nptel.ac.in/courses/106105184/>
- <https://www.coursera.org/specializations/blockchain>
- <https://www.geeksforgeeks.org/blockchain/>
- <https://www.tutorialspoint.com/blockchain/index.htm>
- <https://www.youtube.com/watch?v=AWPisuBx1Zo>
- <https://www.youtube.com/watch?v=SyVMma1IkXM>

Course Articulation Matrix

Course Outcomes (COs)	Program Outcomes (POs)													
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
21CBS7034.1	2	1		1		1							1	
21CBS7034.2	1	2	1	2	1			1						
21CBS7034.3	1			2									2	
21CBS7034.4		1	2	1	2			1						
21CBS7034.5	2	1		1	2	1							2	
21CBS7034.6			1	1				2						

1: Low 2: Medium 3: High

Enterprise Systems			
Course Code	21CBS7035	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: The objective of the course is to • Understand the core concepts and components of enterprise systems. • Analyze enterprise system architecture and database management. • Develop skills in planning and implementing enterprise systems. • Explore the role of enterprise systems in enhancing business relationships.			
Module-1: Introduction to Enterprise System			8 hours
Enterprise systems in Organizations: Information Silos and Systems Integration. Enterprise Resource Planning Systems: What Is an ERP? Evolution of ERP, Business Process and ERP, ERP System Components, ERP Architecture, e-Business and ERP, Benefits and Limitations of ERP. Systems Integration: Logical Vs. Physical SI, Steps in Integrating Systems, Benefits of System Integration, Limitations of System Integration. ERP and Systems Integration: ERP's Role in Logical Integration, ERP's Role in Physical Integration. TB1: Ch1, 2			
Module-2: Enterprise System Architecture			8 hours
ERP Architecture: Layered Architecture Example, Benefits and Limitations, Web Services Architectures, Service-Oriented Architectures, SOA and Web Services, Enterprise Content Management and SOA, Cloud Architecture. ERP Implementation Life Cycle: ERP Implementation Plan, ERP Implementation Methodology, Traditional ERP Life Cycle, Rapid ERP Life Cycles, ERP Life Cycle Vs. SDLC. TB1: Ch3, 4			
Module-3: Implementation and Deployment of Enterprise system			8 hours
ERP Components: Hardware, Software, People Resources. ERP and Virtualization. Third-Party Products, What Are They and Why Are They Needed? Impacts of Integration with ERP, Support Overcoming Third-Party Integration Issues, Middleware. Database Requirements: Understanding Transactional and Reporting Needs, Selecting the Database, Staffing and Database Administration. Critical Success Factors: Decision-Making Process, Project Scope, Teamwork, Change Management, Implementation Team and Executive Team. TB1:Ch 5, 8			
Module-4: Business Relationships and Enterprise System			8 hours
Business Process Change: Business Process Reengineering, BPR Methodology, Current BPR Tools. Business Process Management: Difference between BPR and BPM, Best Practices of BPM, BPM Software Vendors, Core Business Processes, Optimizing Business Processes, Benefits of Implementing BPM. Outsourcing: What Is Outsourcing? Outsourcing Drawbacks, Offshore Outsourcing, Software as a Service, Outsourcing Best Practices. TB1:Ch9, 10			
Module-5: Supply Chain and Customer Relationship Management			8 hours
Supply Chain Management: SCM Drivers, SCM Flows, SCM Processes. e-Business and Supply Chain Management: e-Procurement, Collaborative Design and Product Development, ERP System and Supply Chain. Integration: Supply Chain Integration, Integrating ERP and SCM Systems. Customer Relationship Management: What is CRM? Customer Relationship Processes, CRM Technology, CRM Life Cycle. TB1:Ch 11, 12			

Course Outcomes: At the end of the course the student will be able to:	
21CBS7035.1	Explain the fundamental concepts of enterprise systems, ERP, and systems integration.
21CBS7035.2	Describe and explain ERP architectures and implementation methodologies.

21CBS7035.3	Apply strategic planning techniques to implement and deploy enterprise systems effectively.
21CBS7035.4	Demonstrate ERP, CRM, and SCM systems for optimizing business processes and enhancing organizational efficiency.
21CBS7035.5	Analyze the impact of enterprise systems on business relationships with customers and suppliers
21CBS7035.6	Compare emerging trends and technologies in enterprise systems for future business integration and innovation.

Sl. No.	Title of the Book	Name of the Author/s	Name of the Publisher	Edition and Year
Textbooks				
1	Enterprise Systems for Management	Luvai F. Motiwalla, Jeffrey Thompson	Prentice Hall	2 nd Edition, 2021
Reference Books				
1	Enterprise System & Business Relationships	Peter Ekman	Malardalen University	1 st Edition, 2006
2	Information and Enterprise Systems in Today's Businesses	Thomas Case & Michael Cuellar	Kendall Hunt Publishers	3 rd Edition 2020
3	Introduction to Business	Amit Shah, Carl McDaniel, and Lawrence J Gitman	12 th Media Services	1 st Edition, 2018
4	Enterprise Resource Planning	Vinod Kumar Grag and N.K. Venkitakrishnan	Prentice Hall of India	2 nd Edition 2006

Web links and Video Lectures (e-Resources):

- <https://youtu.be/JZTKRwHBkoM?si=qhTxRPSSgOvhc7al>
- <https://youtu.be/wo24YTZrCXg?si=BUBgYKQdsdogXMc->
- https://youtu.be/tnNNE_asoy8?si=aL4G5Q2nhDrVWle7
- https://youtu.be/tnNNE_asoy8?si=cOIPrd9429Ql7Tas
- https://youtu.be/gfzdwTa82CM?si=-oKTolIsVDx7z_nt
- <https://youtu.be/Da1hUqzoiAo?si=rsiCuMidQPkgPqsb>
- https://youtu.be/9TVc32M_gIY?si=A7RTEve2RNvnCxu5
- https://youtu.be/-NMg6yFJrlQ?si=FXcSVsSbfvacp_Fi
- <https://youtu.be/FLbNa4mfthQ?si=e5ujesLFbeFpGfJa>
- <https://youtu.be/H59sWSG0eI?si=OLvZplVr-T0Pmwd1>

Course Articulation Matrix

Course Outcomes (COs)	Program Outcomes (POs)													
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
21CBS7035.1														
21CBS7035.2		2												
21CBS7035.3			2									2		
21CBS7035.4			2	2										
21CBS7035.5				2									1	
21CBS7035.6				2						2		2	1	1

1: Low 2: Medium 3: High

Augmented and Virtual Reality			
Course Code	21CBS7041	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: The objective of the course is to • Understand the fundamental concepts and principles of Augmented Reality (AR) and Virtual Reality (VR). • Explore the historical development and evolution of AR and VR technologies. • Know the hardware components of AR and VR systems and their roles in immersive experiences. • Gain insights into software development principles for AR and VR applications. • Learn advanced topics in AR and VR, including multi-sensory experiences and ethical considerations.			
Module-1: Introduction to Augmented Reality Virtual Reality			8 hours
Introduction: What is VR/AR About? What is VR? What is AR? The Three I's of Virtual Reality, A Short History of Early Virtual Reality, Early Commercial VR Technology, VR Becomes an Industry, The Five Classic Components of a VR System. TB1: Ch 1.1- 1.3. TB2: Ch 1.1- 1.5.			
Module-2: Input and Output devices			8 hours
Input and Output devices: Three-Dimensional Position Trackers, Navigation and Manipulation Interfaces, Gesture Interfaces, Graphics Displays, Sound Displays, Haptic Feedback. TB2: Ch 2.1-2.3, 3.1-3.3			
Module-3: Computing Architectures for VR and Modelling			8 hours
The Rendering Pipeline, PC Graphics Architecture, Workstation-Based Architectures, Distributed VR Architectures, Geometric Modelling, Kinematics Modelling, Physical Modelling, Behavior Modelling. TB2: Ch 4.1- 4.4, 5.1- 5.4.			
Module-4: VR Programming and Human Factors in VR			8 hours
Toolkits and Scene Graphs, World ToolKit, Java 3D, Methodology and Terminology, User Performance Studies, VR Health and Safety Issues, VR and Society. TB2: Ch 6.1-6.3, 7.1-7.4.			
Module-5: Traditional and Emerging Applications of VR			8 hours
Medical Applications of VR, Education, Arts and Entertainment, Military VR Applications, VR Applications in Manufacturing, Applications of VR in Robotics, Information Visualization. TB2: Ch 8.1-8.3, 9.1-9.3.			

Course Outcomes: At the end of the course the student will be able to:	
21CBS7041.1	Describe the fundamental principles and concepts of Augmented Reality (AR) and Virtual Reality (VR).
21CBS7041.2	Identify the input and output devices of AR VR systems.
21CBS7041.3	Compare various computing architectures for VR and Modeling
21CBS7041.4	Utilize relevant tools towards development of AR and VR applications..
21CBS7041.5	Analyze advanced applications of AR and VR technology.
21CBS7041.6	Analyze ethical considerations to AR/VR design, development, and implementation, addressing societal and privacy issues.

Sl. No.	Title of the Book	Name of the Author/s	Name of the Publisher	Edition and Year
Textbooks				
1	Virtual and Augmented Reality (VR/AR)	Bernhard Jung, Paul Grimm, Ralf Doerner, Wolfgang Broll	Springer International Publishing	1 st Edition, 2022
2	Virtual Reality Technology	Grigore C. Burdea Philippe Coiffet	Wiley - IEEE	2 nd Edition, 2010
Reference Books				
1	Understanding Virtual Reality	William R.Sherman and Alan B. Craig	Morgan Kaufmann	1 st Edition 2002
2	Developing Virtual Reality Application	William R.Sherman, Alan B. Craig and Jeffrey D. Will	Morgan Kaufmann	1 rd Edition, 2005
3	Spatial Augmented Reality: Merging Real and Virtual Worlds	Oliver Bimber and Ramesh Raskar	A K Peters/CRC Press	1s ^t Edition, 2005
4	Virtual Reality Technology	Burdea, Grigore C and Philippe Coiffet	McGraw – Hill Book Co., New York	6 th Edition, 2017

Web links and Video Lectures (e-Resources):

- <https://youtu.be/WzfDo2Wpxks?feature=shared>
- <https://youtu.be/FJAO6jDYljs?feature=shared>
- <https://youtu.be/04AMaTsXFJU?feature=shared>
- <https://youtu.be/vz0UUVDt2ps?feature=shared>
- <https://youtu.be/XLP4YTpUpBI?feature=shared>
- <https://sopa.tulane.edu/blog/whats-difference-between-ar-and-vr>
- <https://timesofindia.indiatimes.com/readersblog/reflective-ruminations/ar-and-vr-technology-transforming-our-lives-through-immersive-experiences-52485/>
- <https://www.forbes.com/sites/ariannajohnson/2023/06/02/augmented-reality-ar-vs-virtual-reality-vr-whats-the-difference-and-how-do-they-work/>
- <https://edu.gcfglobal.org/en/thenow/understanding-virtual-reality-and-augmented-reality/1/>

Course Articulation Matrix

Course Outcomes (COs)	Program Outcomes (POs)													
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
21CBS7041.1	2													
21CBS7041.2		2												
21CBS7041.3				2										
21CBS7041.4		2											1	
21CBS7041.5			2											
21CBS7041.6			2								2			2

1: Low 2: Medium 3: High

Human Resource Management			
Course Code	21CBS7042	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: The objective of the course is to ● Understand the role of HRMs in organizations and discuss major HRM activities. ● Provide reasoning as to why diversity is important to maintain profitability. ● Learn components of retention plan and strategies. ● Explain how to develop a performance review system, and explain health concerns that affect employees at work.			
Module-1: Introduction			8 hours
Evolution of HRM, Concept of HRM, Functions of HRM, Role and status of HRM, Human Resource Planning: Concept, Stages, long term and short-term HR plans, Strategies for dealing with manpower, HRIS.			
Module-2: Job Analysis and Recruitment			8 hours
Importance and benefits of job analysis, Job Analysis process, Job description, Job specification, other aspects of job, Recruitment: concept of recruitment, Factors affecting recruitment, sources of recruitment, metrics and alternatives.			
Module-3: Strategizing			8 hours
Planning and decision making, Levels of planning, Single use plans, standard plans, Contingency planning, Business level strategy, corporate level strategy, managing operations, Productivity and efficiency, configuring the production system, asset utilization, quality management, managing inventory.			
Module-4: Organization Architecture			8 hours
Designing structure, vertical and horizontal differentiation, integrating mechanisms, management challenges, control systems, methods of control, matching controls, Organizational culture, developing high performance teams, team design features and processes, managing team conflict.			
Module-5: Leading			8 hours
Staffing and developing a diverse workforce, recruiting and selecting job applicants, motivating and rewarding employee performance, managing employee attitudes and wellbeing, managing through power, negotiation and influence, effective leadership, communication.			

Course Outcomes: At the end of the course the student will be able to:	
21CBS7042.1	Explain the evolution of Human Resource Management (HRM) and its significance in modern organizations.
21CBS7042.2	Analyze the job analysis process, including the creation of job descriptions and job specifications.
21CBS7042.3	Analyze different levels of planning, including single-use and standard plans, and their application in real-world scenarios.
21CBS7042.4	Apply the principles of organizational culture and team design to develop high-performance teams.
21CBS7042.5	Appraise the use of power, negotiation, and influence in effective leadership and communication within organizations.
21CBS7042.6	Describe strategies for motivating and rewarding employee performance to enhance job satisfaction and productivity.

Sl. No.	Title of the Book	Name of the Author/s	Name of the Publisher	Edition and Year
Textbooks				
1	Human Resources Management	Dr W G Prasanna Kumar Dr K N Rekha	Tata McGraw Hill	1 st edition, 2021
2	Principles of Management	Charles W.L. Hill Steven L. McShane	Tata McGraw Hill	1 st edition, 2017
Reference Books				
1	Human resource Management	Dr. Arati Deepak kale, Anshita Chelawat, Trupti Shivram shelke	Himalaya Publishing House	1 st Edition: 2018
2	Personnel / Human resource Management	Decenoz and robbins	PHI	3 rd edition 2002

Web links and Video Lectures (e-Resources):

- https://www.youtube.com/watch?v=aPEUKLxxh_k
- <https://www.youtube.com/watch?v=A2HFusWQIeE>
- <https://www.youtube.com/watch?v=vLIDpB2r5Cc>
- <https://www.youtube.com/watch?v=Jp7oM9mAIXQ>
- <https://www.youtube.com/watch?v=T7bSMzg7x-s>

Course Articulation Matrix

Course Outcomes (COs)	Program Outcomes (POs)													
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
21CBS7042.1									2		2		1	
21CBS7042.2								1			2			
21CBS7042.3								1			2		1	
21CBS7042.4									1		2		2	
21CBS7042.5									2		2			
21CBS7042.6									1		2			

1: Low 2: Medium 3: High

Data Mining and Analytics			
Course Code	21CBS7043	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: The objective of the course is to • Articulate data mining and data analytics principles and techniques • Deduce association rule mining for handling large data. • Apply classification for the retrieval purposes. • Examine clustering techniques in details for better organization and retrieval of data			
Module-1: Introduction and Data Pre-processing.			8 hours
wholeness of Data Analytics, Business Intelligence, pattern recognition, types of pattern, finding pattern, uses of pattern, data processing chain, data, database, data warehouse, data mining, data visualization			
TB2: Ch 1			
Module-2: Mining Frequent Patterns, Associations and Correlations			8 hours
Basic concepts and a Road Map, Efficient and scalable Frequent item set Mining methods, mining various kinds of association Rules, from association mining to cluster analysis, constraint based association mining			
TB1: Ch 4.1 - 4.3, 5.1, 5.3			
Module-3: Classification and Prediction			8 hours
Basic Concepts, Decision tree induction, Bayesian Classification, Rule-Based classification, Classification by Back propagation, Support Vector machines, Associative classification: classification by association rule analysis, Lazy learners, other classification methods. Prediction, accuracy and error measures, evaluating the accuracy of classifier or predictor.			
TB1: Ch 6.1-6.4, 6.6, 7.4			
Module-4: Cluster Analysis			8 hours
Basic concepts and methods, Partitioning methods, Hierarchical Methods, Density-based methods, Grid-Based Methods, Evaluation of clustering			
TB1: Ch 8			
Module-5: Data Mining Trends and Research Frontiers			8 hours
Mining complex data types, other methodologies of data mining, Data mining applications, Data Mining and society			
TB1: Ch 12			

Course Outcomes: At the end of the course the student will be able to:	
21CBS7043.1	Examine different concepts of Data Mining
21CBS7043.2	Design and deploy appropriate classification techniques
21CBS7043.3	Employ high dimensional data for better organization of the data
21CBS7043.4	Evaluate mathematical methods underlying the effective application of data mining
21CBS7043.5	Examine Instant based techniques and derive effectively learning rules to real world problems.
21CBS7043.6	Analyze data mining and analytics techniques in a range of real-world applications

Sl. No.	Title of the Book	Name of the Author/s	Name of the Publisher	Edition and Year
Textbooks				
1	Data Mining Concepts and Techniques	Jiawei Han, Micheline Kamber, Jian Pei	ELSEVIER(MK)	4 th Edition, 2022
2	Data Analytics Made Accessible	Dr. Anil Maheshwari	McGraw Hill Education	2 nd Edition, 2023
Reference Books				
1	Data Warehousing, Data Mining & OLAP	Alex Berson and Stephen J. Smith	Tata McGraw – Hill	10 th Edition, 2007
2	Introduction to Data Mining	Pang-Ning Tan, Michael Steinbach and Vipin Kumar	Pearson Education	2 nd Edition, 2021

Web links and Video Lectures (e-Resources):

- https://onlinecourses.nptel.ac.in/noc20_mg24/preview
- https://onlinecourses.nptel.ac.in/noc21_cs06/preview
- <https://www.wipro.com/natural-resources/driving-insight-from-data-in-mining-industry/>

Course Articulation Matrix

Course Outcomes (COs)	Program Outcomes (POs)													
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
21CBS7043.1	2								1	2			1	
21CBS7043.2		2			2					2				
21CBS7043.3	2		3							2				
21CBS7043.4		2	2		2				1	2			2	
21CBS7043.5			3			2				2			2	1
21CBS7043.6												2	2	1

1: Low 2: Medium 3: High

Behavioral Economics			
Course Code	21CBS7044	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: The objective of the course is to • Impart knowledge on current ideas and concepts in Economics. • Provide insight on current ideas and concepts regarding decision making in Economics. • Describe different types of theories and models related to Economics. • Make the students understand various theories that help in making a choice under uncertainty			
Module-1: Introduction		8 hours	
The neoclassical/standard model and behavioral economics in contrast; historical background; behavioral economics and other social sciences; theory and evidence in the social sciences and in behavioral economics; applications – gains and losses, money illusion, charitable donation.			
Ch 1			
Module-2: Basics of Choice Theory		8 hours	
Revisiting the neoclassical model; utility in economics and psychology; models of rationality; connections with evolutionary biology and cognitive neuroscience; policy analysis consumption and addiction, environmental protection, retail therapy; applications pricing, valuation, public goods, choice anomalies.			
Ch 2			
Module-3: Beliefs, Heuristics, and Biases		8 hours	
Revisiting rationality; causal aspects of irrationality; different kinds of biases and beliefs; self-evaluation and self-projection; inconsistent and biased beliefs; probability estimation; trading applications trade in counterfeit goods, financial trading behavior, trade in memorabilia.			
Choice under Uncertainty: Background and expected utility theory; prospect theory and other theories; reference points; loss aversion; marginal utility; decision and probability weighting; applications ownership and trade, income and consumption, performance in sports.			
Ch 4,5			
Module-4: Intertemporal Choice		8 hours	
Geometric discounting; preferences over time; anomalies of intertemporal decisions; hyperbolic discounting; instantaneous utility; alternative concepts – future projection, mental accounts, heterogeneous selves, procedural choice; policy analysis – mobile calls, credit cards, organization of government; applications – consumption and savings, clubs and membership, consumption planning.			
Ch 7,8			
Module-5: Strategic Choice		8 hours	
Review of game theory and Nash equilibrium – strategies, information, equilibrium in pure and mixed strategies, iterated games, bargaining, signaling, learning; applications – competitive sports, bargaining and negotiation, monopoly and market entry. Individual preferences; Choice anomalies and inconsistencies; social preferences; altruism; fairness; reciprocity; trust; learning; communication; intention; demographic and cultural aspects; social norms; compliance and punishment; inequity aversion; policy analysis – norms and markets, labor markets, market clearing, public goods; applications – logic and knowledge, voluntary contribution, compensation design.			
Ch 9, 10			
Course Outcomes: At the end of the course the student will be able to:			
21CBS7044.1	Explain the models in behavioral economics in relation to social sciences.		

21CBS7044.2	Illustrate the basics of choice theories along with cognitive neurosciences, evaluate and analyze strategic choice, anomalies, and their applications.
21CBS7044.3	Demonstrate an understanding of beliefs, heuristics, biases, and choices under uncertainty.
21CBS7044.4	Apply the intertemporal choices and their application.
21CBS7044.5	Analyze the strategic choice.
21CBS7044.6	Analyze the strategic anomalies and strategic applications.

Sl. No.	Title of the Book	Name of the Author/s	Name of the Publisher	Edition and Year
Textbooks				
1	An Introduction to Behavioral Economics	N. Wilkinson and M. Klaes	Red Globe Press.	3 rd Edition, 2017
Reference Books				
1	Judgment in Managerial Decision	Bazerman, Max and Don Moore	John Wiley & Sons.	8 th Edition, 2012.
2	Thinking, Fast and Slow	Kahneman, Daniel	New York: Farrar, Straus and Giroux.	1 st Edition, 2011

Web links and Video Lectures (e-Resources):

- <https://news.uchicago.edu/explainer/what-is-behavioral-economics>
- <https://www.behavioraleconomics.com/resources/introduction-behavioral-economics/>
- https://www.youtube.com/watch?v=5JGz3ua_48o
- <https://www.youtube.com/playlist?list=PLL6RiAl2WHXG14F7Bt64Udd6Xr-bvTGiB>

Course Articulation Matrix

Course Outcomes (COs)	Program Outcomes (POs)													
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
21CBS7044.1	1		2										2	
21CBS7044.2		2	2										1	
21CBS7044.3	1		2										2	
21CBS7044.4		2	2										2	
21CBS7044.5			2											1
21CBS7044.6		2			2									1

1: Low 2: Medium 3: High

Cryptography and Cyber Security			
Course Code	21CBS7045	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: The objective of the course is to - Analyze classical encryption techniques for practical application. - Understand the principles and workings of block ciphers along with their practical applications. - Acquire knowledge of public-key cryptography, and other public-key cryptosystems. - Explore various aspects of cybercrime, including its definition, origins, classifications, legal perspectives, and preventive measures.			
Module-1: Classical Encryption Techniques			8 hours
Information and Network Security Concepts: Cybersecurity, Information Security and Network Security, OSI Security Architecture, Security Attacks, Security Services, Security Mechanisms, Cryptography, Network Security, Trust and Trustworthiness, Standards. Classical Encryption Techniques: Symmetric Cipher Model, Substitution Techniques, Transposition Technique. Block Ciphers and the Data Encryption Standard: Traditional Block Cipher Structure, The Data Encryption Standard, A DES Example, The Strength of DES, Block Cipher Design Principles TB1: Ch 1, 3, 4			
Module-2: Block Cipher Operation			8 hours
Block Cipher Operation: Multiple Encryption and Triple DES, Electronic Codebook, Cipher Block Chaining Mode, Cipher Feedback Mode, Output Feedback Mode, Counter Mode, XTS-AES Mode for Block-Oriented Storage Devices, Format-Preserving Encryption. Public-Key Cryptography and RSA: Principles of Public-Key Cryptosystems, The RSA Algorithm. TB1: Ch 7, 9			
Module-3: Introduction: Why Cybersecurity			8 hours
Introduction: Why Cybersecurity? Information Security and Cybersecurity, How Do Computers Work Together?, Cyberattacks Today, Security Targets, Technique and Human Beings: Psychological Attacks, Phishing, Humans vs. Machines, Can Psychological Attacks Be Prevented?. Risk : What Is Risk?, Threats in IT Systems, Countermeasures, Risk Management, Systematic Security Analysis, Risk Management as a PDCA Process. TB2: Ch 1, 2, 3			
Module-4: Cybercrime			8 hours
Introduction to Cybercrime: Introduction, Cybercrime: Definition and Origins of the Word, Cybercrime and Information Security, Classifications of Cybercrimes, Cybercrime: The Legal Perspective, Cybercrimes: An Indian Perspective, Cybercrime and the Indian ITA 2000, A Global Perspective on Cybercrimes, Cybercrime Era. Cyber offences: How criminals plan them: Introduction, how criminals plan the attacks, Social Engineering, Cyberstalking, Cybercafé and Cybercrimes, Botnets, Attack Vector, Cloud Computing TB3: Ch 1, 2			
Module-5: Tools used in Cyber Crime and Forensics			8 hours
Tools and Methods used in Cybercrime: Introduction, Proxy Servers and Anonymizers, Phishing Password Cracking, Keyloggers and Spywares, Virus and Worms, Trojan Horses and Backdoors Steganography, DoS and DDoS Attacks, SQL Injection, Buffer Overflow, Attacks on Wireless Networks. Understanding Computer Forensics: Introduction, Historical Background, Digital Forensic Science, The need for Computer Forensics, Cyberforensics and Digital Evidence, Forensics Analysis			

of E-Mail, Digital Forensics Life Cycle, Chain of Custody Concept, Network Forensics Approaching a Computer Forensics Investigation, Setting up a Computer Forensic Lab, Computer Forensic and Steganography, Relevance of OSI 7 Layer Model to Computer Forensics, Forensic and Social Networking Sites, Computer Forensics from Compliance Perspective, Challenges in Computer Forensics, Special Tools and Techniques, Forensics auditing, Antiforensics.
TB3: Ch 4, 7

Course Outcomes: At the end of the course the student will be able to:	
21CBS7045.1	Identify the vulnerabilities in any computing system and explain the basics of cryptography techniques for enhancing the security
21CBS7045.2	Describe different cryptographic algorithms and their applications in network security
21CBS7045.3	Discuss fundamental cybersecurity concepts used to assess and manage risks in IT systems.
21CBS7045.4	Analyze the proliferation of mobile and wireless devices and emerging trends in mobility and their implications for cybersecurity.
21CBS7045.5	Analyze the importance of legal aspects of cybercrime, need for cyber law and computer forensics.
21CBS7045.6	Develop the attribute of self-learning, skill of oral and written communication and ability to work in teams to solve real world cybercrime scenarios.

Sl. No.	Title of the Book	Name of the Author/s	Name of the Publisher	Edition and Year
Textbooks				
1	Cryptography and Network Security - Principles and Practice	Dr. William Stallings	Pearson Education	8 th Edition, 2023
2	Introduction to Cybersecurity	Robin Sharp	Springer	1 st Edition, 2023
3	Cyber Security	Nina Godbole , Sunit Belapure	Wiley	2 nd Edition, 2017
Reference Books				
1	Introduction to Cryptography with Coding Theory	Wade Trappe and Lawrence C. Washington	Pearson	2 nd Edition, 2005
2	Cybersecurity: A Practical Guide to the Law of Cyber Risk	Jeffrey R. Koseff	Wiley	1 st Edition, 2020
3	Network Security Essentials: Applications and Standards	William Stallings	Pearson	7 th Edition, 2017,
4	Cryptography Engineering: Design Principles and Practical Applications	Niels Ferguson, Bruce Schneier, and Tadayoshi Kohno	Wiley	1 st Edition, 2010

Web links and Video Lectures (e-Resources):

- <https://www.coursera.org/learn/classical-cryptosystems>
- <https://toc.seas.harvard.edu/links/cs-127-cryptography>
- <https://pll.harvard.edu/subject/cybersecurity>
- <https://www.coursera.org/learn/cybercrime>
- <https://learning.edx.org/course/course-v1:RITx+CYBER502x+2T2017/home>

Course Articulation Matrix

Course Outcomes (COs)	Program Outcomes (POs)													
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
21CBS7045.1	2	2						1	1	1	1			
21CBS7045.2	2	2						1	1	1	1			
21CBS7045.3	3	3												
21CBS7045.4	3	3												
21CBS7045.5					2	2								
21CBS7045.6					1	1		1		1			1	

1: Low 2: Medium 3: High

Deep Learning			
Course Code	21CBS7051	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: The objective of the course is to - Understand major deep neural network frameworks and issues in basic neural networks. - Solve real-world applications using Deep learning. - Select suitable deep learning approaches for given application. - Demonstrate the working of Tensor Flow for Deep Neural Networks.			
Module-1: Introduction to Neural Networks and Deep Neural Networks 8 Hours			
What is Deep Learning, Math behind Deep Learning- linear algebra and statistics, Vector Data. Time Series Data. Image Data. Video Data. How does machine learning work, Evaluating the Machine Learning models. Neural Networks, The Biological Neuron, The Perceptron, Multilayer Feed-Forward Networks. TB1: Ch 1			
Module-2: Training feed-forward Neural Network 8 hours			
Training Neural Networks-Backpropagation Learning, Activation Functions- Linear, Sigmoid, Tanh, Softmax, Rectified Linear Loss Functions-Loss Functions for Regression, Loss Functions for Classification, Hyperparameters- Learning Rate, Regularization, Momentum, Sparsity, Implementation of neural network using TensorFlow. TB1: Ch 2			
Module-3: Convolutional Neural Network 8 hours			
Foundations of Convolutional Neural Networks – CNN operations – Architecture – Simple Convolution Network – Deep Convolutional Models – ResNet, AlexNet, Inception Net and others. TB 1: Ch 7 , TB2: Ch 8			
Module-4: Models for Sequence analysis 8 hours			
Recurrent Neural Networks, The Challenges with Vanishing Gradients, Long Short-Term Memory (LSTM) Units, TensorFlow Primitives for RNN Models, implementing a Sentiment Analysis Model, Solving seq2seq Tasks with Recurrent Neural Networks. TB2: Ch 7			
Module-5: Introduction to Auto Encoders and GAN 8 hours			
Autoencoders: Efficient data representation, Performing PCA, Stacked, Autoencoders, Denoising, Sparse autoencoders, variational and other autoencoders. Generative Adversarial Networks. TB1: Ch 4, 5 , TB2: Ch 10			

Course Outcomes: At the end of the course the student will be able to:	
21CBS7051.1	Describe the basic concepts of Neural Networks and Deep Learning.
21CBS7051.2	Make use of Tensor Flow to build neural network model.
21CBS7051.3	Identify Convolutional Neural Network for a given scenario
21CBS7051.4	Select Deep Learning models for sequence analysis.
21CBS7051.5	Apply the concept of Autoencoders and GAN.
21CBS7051.6	Build Deep learning models for Real-world applications.

Sl. No.	Title of the Book	Name of the Author/s	Name of the Publisher	Edition and Year
Textbooks				
1	Deep Learning A Practitioner's Approach	Josh Patterson and Adam Gibson	O'Reilly	1 st Edition, 2017
2	Neural Networks and Deep Learning	Charu C Aggarwal	Springer	2 nd Edition, 2018
Reference Books				
1	Hands on Machine Learning with Scikit-Learn & TensorFlow	Aurelien Geron	O'Reilly	2019
2	Deep Learning	Lan Good fellow and Yoshua Bengio	MIT Press	2 nd Edition, 2016

Web links and Video Lectures (e-Resources):

- <https://www.youtube.com/watch?v=dPWYUELwIdM>
- <https://www.youtube.com/watch?v=ILsA4nyG7I0>
- <https://www.youtube.com/watch?v=TtyoFTyJuEY>
- <https://www.youtube.com/watch?v=tIExopLw29U&list=PLv8Cp2NvcY8AbK0RNZGeQFEPEsSqCzHQvj>

Course Articulation Matrix

Course Outcomes (COs)	Program Outcomes (POs)													
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO 10	PO 11	PO12	PSO1	PSO2
21CBS7051.1	2				2									
21CBS7051.2			1										1	
21CBS7051.3			2		2								1	
21CBS7051.4			2										1	
21CBS7051.5			2											
21CBS7051.6		2			2								1	

1: Low 2: Medium 3: High

Robotic Process Automation			
Course Code	21CBS7052	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: The objective of the course is to • Understand the basic concepts of RPA. • Know where RPA can be applied and how it is implemented. • Learn the different types of variables, Control Flow and data manipulation techniques. • Know various types of Exceptions and strategies to handle			
Module-1: RPA Foundations and Skills			8 hours
IRPA Foundations: What is RPA?, Flavors of RPA, History of RPA, The Benefits of RPA, The downsides of RPA, RPA Compared to BPO, BPM and BPA, Consumer Willingness for Automation, The Workforce of the Future. RPA Skills: On-Premise Vs. the Cloud, Web Technology, Programming Languages and Low Code, OCR, Databases, APIs, AI, Cognitive Automation, Agile, Scrum, Kanban and Waterfall, DevOps, Flowcharts. TB1: Ch 1, 2			
Module-2: Robotic Process Automation, Record and Play			8 hours
Robotic process automation: Components of RPA, RPA Platforms, About UiPath, The future of automation. Record and Play: Downloading and installing UiPath Studio, Learning UiPath Studio, Task recorder - Step-by-step examples using the recorder. TB2: Ch 1, 2			
Module-3: Sequence, Flowchart, and Control Flow and Data Manipulation			8 hours
Sequence, Flowchart, and Control Flow: Sequencing the workflow, Activities, Control flow, various types of loops, and decision making, Step-by-step example using Sequence and Flowchart, Step-by-step example using Sequence and Control flow. Data Manipulation: Variables and Scope, Collections, Arguments - Purpose and use, Data table usage with examples, Clipboard management, File operation with step-by-step example, CSV/Excel to data table and vice versa (with a step-by-step example). TB2: Ch 3, 4			
Module-4: Taking Control of the Controls			8 hours
Taking Control of the Controls: Finding and attaching windows, Finding the control, Techniques for waiting for a control, Act on controls - mouse and keyboard activities, Working with UiExplorer, Handling events, Revisit recorder, Screen Scraping, When to use OCR, Types of OCR available, How to use OCR, Avoiding typical failure points. TB2: Ch 5			
Module-5: Exception Handling, Debugging, and Logging, Future of RPA			8 hours
Exception Handling, Debugging, and Logging: Exception handling, Common exceptions, ways to handle, Logging and taking screenshots, Debugging techniques, Collecting crash dumps, Error reporting. Future of RPA: Consolidation and IPOs, Microsoft, Attended Automation, Vertical-Specific Companies, Hype Factor, SaaS, Chatbots, AI, Privacy and Ethics. TB2: Ch 8, 10			

Course Outcomes: At the end of the course the student will be able to:	
21CBS7052.1	Describe the basic concepts and challenges of Robotic Process Automation
21CBS7052.2	Explain the components of RPA and the basic functionalities of UiPath Studio.
21CBS7052.3	Demonstrate the ability to create workflows and perform data manipulation using UiPath.
21CBS7052.4	Analyze and implement various techniques for interacting with user interface controls using UiPath.
21CBS7052.5	Evaluate and apply methods for exception handling, debugging, and logging

	within RPA projects.
21CBS7052.6	Design and develop a comprehensive RPA project that integrates the foundational concepts, workflow design and error management skills.

Sl. No.	Title of the Book	Name of the Author/s	Name of the Publisher	Edition and Year
Textbooks				
1	The Robotic Process Automation Handbook : A Guide to Implementing RPA Systems	Tom Taulli	Apress	1 st Edition, 2020
2	Learning Robotic Process Automation	Alok Mani Tripathi	Packt Publishing	1 st Edition, 2018
Reference Books				
1	Introduction to Robotic Process Automation :A Primer	Frank Casale ,Rebecca Dilla,Heidi Jaynes,Lauren Livingston	The Institute for Robotic Process Automation (IRPA)	1 st Edition, 2018
2	Robotic Process Automation: Guide To Building Software Robots,Automate Repetitive Tasks& Become An RPA Consultant	Richard Murdoch	Richard Murdoch & RPA Ultra	3 rd Edition, 2020
3	Robotic Process Automation Tools, Process Automation and their benefits: Understanding RPA and Intelligent Automation	Srikanth Merianda	Consulting Opportunity Holdings Llc	1 st Edition, 2018

Web links and Video Lectures (e-Resources):

- <https://www.uipath.com/rpa/robotic-process-automation>
- <https://irpanetwork.com/>
- <https://www.udemy.com/course/robotic-process-automation-fundamentals-and-build-a-robot/>
- <https://www.hfsresearch.com/research/the-rpa-bible-your-practical-technical-guide-to-rpa/>

Course Articulation Matrix

Course Outcomes (COs)	Program Outcomes (POs)													
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
21CBS7052.1	3	2						1					3	
21CBS7052.2		3	2											
21CBS7052.3	3		3				1							
21CBS7052.4			2	3					1					2
21CBS7052.5			2		3	1								
21CBS7052.6	2		3										3	3

1: Low 2: Medium 3: High

Design Thinking			
Course Code	21CBS7053	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: The objective of the course is to

- Expose students to the design process as a tool for innovation.
- Develop students' professional skills in client management and communication.
- Demonstrate the value of developing a local network and assist students in making lasting connections with the business community.
- Develop a portfolio of work to set them apart in the job market.

Module-1: Introduction to Design Thinking and Product Design 8 hours

What Is Design Thinking, really? The Butterfly Effect and Long-Range Planning, Applied Design Thinking Is Strategic Innovation, Time to Think beyond Crisis Mode, Changing Management Paradigms, **Foundation Building for Design Thinking Project:** Scoping of design challenge, Phase I Explore, methods & tools, steep analysis, strategic priorities, activity system.

TB 1: Ch 1,2

Module-2: Team Work and Service Design 8 hours

Applied Design Thinking in Business and Strategy: Design Thinking to the Rescue, We've Lost Touch with What's around Us, Every Future Business Leader Needs to Be a Good Design Thinker, the 10 Design Thinking Principles That Redefine Business Management, stakeholder mapping, opportunity framing, Phase II empathize, methods & tools, field observation deep user interview.

TB 1: Ch 3

Module-3: Business or Systems Design 8 hours

Business Challenge 01: Growth, Business Challenge 02: Predictability, Business Challenge 03: Change, Business Challenge 04: Maintaining Relevance, Business Challenge 05: Extreme Competition, Business Challenge 06: Standardization, Business Challenge 07: Creative Culture Business Challenge 08: Strategy and Organization, Phase II: needs finding, SPICE Needs Framework.

TB 1: Ch 4

Module-4: Methods and Tools to Ideate, Prototype Phase 8 hours

Hiring Design Thinkers Is Not Enough, We Need to Create Design Thinking Companies, persona development, Team Building Activity, Phase III: Experiment, methods & tools, ideation using scamper, ideation using analogous inspiration, ideation using deconstruct & reconstruct, user experience journey, prototyping.

TB 1,3: Ch 5

Module-5: Solution Overview 8 hours

Phase IV Engage, Storytelling, Storyboarding, Co-Creation, Phase V: Evolve, Concept Synthesis, Strategic Requirements (Advancing from Ideas to Reality, Activity System Integration, Viability Analysis (Impact Evaluation, Innovation Tool Using User Needs, Cap, 4s, Change Management Tool Using Review, Quick Wins, Action Planning to Advance Design Challenge Project, Explore, Emphasize Phase, Templates.

TB 3: Ch 1,2,3,4

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

21CBS7053.1	Develop a strong understanding of the Design Process and how it can be applied in a variety of business settings
21CBS7053.2	Outline a problem, apply methods of empathy on user groups.
21CBS7053.3	Develop and test innovative ideas through a rapid iteration cycle,

21CBS7053.4	Apply ideation tools to generate ideas to solve problems, create physical prototypes / a visual representation of an idea.
21CBS7053.5	Develop a prototype, test the ideas and demonstrate story telling ability to present the ideas.
21CBS7053.6	Understand the long term impact of design decisions, and to take ownership of the quality of their work and final products

Sl. No.	Title of the Book	Name of the Author/s	Name of the Publisher	Edition and Year
Textbooks				
1	Design thinking for strategic innovation	Idris Mootee	Wiley	2 nd edition 2013
2	Design Thinking for innovation	Walter Brenner, Falk	Springer series	1 st edition, 2016
3	Design Thinking the Guidebook	Dasho Karma Tshiteem	Guide book	1 st edition, 2016
Reference Books				
1	Design thinking	Gavin Ambrose, Paul Harris	AVA Publishing	2010
2	The Design Thinking Toolbox	Michael Lewrick, Patrick Link, Larry Liefer	Wiley	2020

Web links and Video Lectures (e-Resources):

- <https://designthinking.ideo.com/>
- <https://thinkibility.com/2018/12/01/engineering-vs-design-thinking>
- <https://www.coursera.org/learn/design-thinking-innovation>
- https://swayam.gov.in/nd1_noc20_mg38/preview
- <https://www.youtube.com/watch?v=p5m7CoHC4r4>

Course Articulation Matrix

Course Outcomes (COs)	Program Outcomes (POs)													
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
21CBS7053.1	2		1									2		
21CBS7053.2		2	1	1										
21CBS7053.3	2		1											
21CBS7053.4	2		1									2		
21CBS7053.5	2	2	1	1								2		
21CBS7053.6		2	1									2	1	

1: Low 2: Medium 3: High

Natural Language Processing			
Course Code	21CBS7054	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: The objective of the course is to • Introduce the fundamental concepts and techniques of natural language processing. • Gain an in-depth understanding of the computational properties of natural languages • Understand the commonly used algorithms for processing linguistic information. • Examine NLP models and algorithms using both the traditional symbolic and the more recent statistical approaches.			
Module-1: Introduction and Language Modelling		8 hours	
Introduction: What is NLP, Origins of NLP, Language and Knowledge, Challenges, Different levels of Language Analysis, Language and grammar, NLP applications. Language Modelling: Introduction, Grammar based Language Models-Generative Grammars, Statistical Language Model- N-gram models. TB1: Ch 1, 2 , TB2: Ch 1			
Module-2: Word Level Analysis		8 hours	
Word Level Analysis: Introduction, Regular Expressions, Finite State Automata, Morphological Parsing, Spelling Error Detection and Correction, Words and Word Classes, Part of-Speech. TB1: Ch 3, TB2: Ch 4			
Module-3: Syntactic Analysis		8 hours	
Syntactic Analysis: Context-Free Grammar, Parsing Top-down Parsing, Bottom-up Parsing, A Basic Top-Down Parser, Ambiguity in Parsing. TB1: Ch 4 , TB2: Ch 17			
Module-4: Semantics Analysis and Discourse		8 hours	
Semantics Analysis: The representation of meaning, Lexical semantics, Word Sense Disambiguation. Computational Discourse: Discourse segmentation, Text Coherence Relations, Reference Resolution, Anaphora resolution. TB1: Ch 5, 6, TB2: Ch 20, 22			
Module-5: Application of NLP		8 hours	
Applications- Machine Translation, Information Retrieval and Extraction, Text Categorization and Summarization Information Extraction, Question Answering Systems. TB1: Ch 8, 9, 11			

Course Outcomes: At the end of the course the student will be able to:	
21CBS7054.1	Discuss importance of NLP and challenges in processing natural language texts.
21CBS7054.2	The techniques used for the language modelling in NLP.
21CBS7054.3	Discover the tools and techniques for Processing natural language texts at word and sentence level.
21CBS7054.4	Analyze natural language texts for syntax.
21CBS7054.5	Analyze natural language texts for semantics and pragmatics.
21CBS7054.6	Build applications to carry out natural language processing

Sl. No.	Title of the Book	Name of the Author/s	Name of the Publisher	Edition and Year
Textbooks				
1	Natural Language Processing and Information Retrieval.	U.S. Tiwary, Tanveer Siddiqui	Oxford University Press	1-Edition 2008

2	Speech and Language processing: Introduction to Natural Language Processing, Computational Linguistics and Speech Recognition.	Daniel Jurafsky, James H Martin	Pearson Publications	2 nd Edition 2009 Or 3 rd Edition, 2023
Reference Books				
1	Practical Natural Language Processing: A Comprehensive Guide to Building Real-World NLP Systems	Sowmya Vajjala, Bodhisattwa Majumder, Anuj Gupta, Harshit Surana	O'Reilly Media, Inc.	First Edition, 2020
2	Information Storage and Retrieval systems – Theory and Implementation	Gerald J. Kowalski and Mark. T. Maybury	Kluwer academic Publishers	2 nd Edition, 2006

Web links and Video Lectures (e-Resources):				
• https://scikitlearn.org/stable/tutorial/text_analytics/working_with_text_data.html • https://nptel.ac.in/courses/106101007 • https://onlinecourses.nptel.ac.in/noc19_cs56/preview • https://www.youtube.com/watch?v=3_oCVemqzFo • https://www.youtube.com/playlist?list=PLEuhkeqNvDnJ00VSJsv9VuRnIocxGs_DB				

Course Articulation Matrix

Course Outcomes (COs)	Program Outcomes (POs)													
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
21CBS7054.1						2				2				
21CBS7054.2				2										1
21CBS7054.3							2							1
21CBS7054.4				2										1
21CBS7054.5				2										1
21CBS7054.6							1			2				

1: Low 2: Medium 3: High

Internet of Things			
Course Code	21CBS7055	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: The objective of the course is to • To understand the definition and significance of the Internet of Things. • To learn the, and business benefits of an IoT solution. • To examine the potential Security issues in IoT and explore the relationship between IoT, cloud computing, and big data. • Design and program IoT devices, use real IoT protocols for communication, Secure the elements of an IoT device.			
Module-1: Introduction			8 hours
IoT Definition, what is the Internet of Things? IoT-enabled Applications, Envisioning the Internet of Things Era, The Popular M2M Applications, The Emergence of the IoT Platform as a Service (PaaS) Realization of IoT Ecosystem Using Wireless Technologies: Architecture for IoT Using Mobile Devices, Mobile Technologies for Supporting IoT Ecosystem, Mobile Use Cases for IoT TB1: Ch1, Ch2			
Module-2: Architecture and Communication Protocol			8 hours
Low Power Wide Area Networking Technologies, Standards: Physical/Link Layer, IEEE 802.3 (Ethernet, IEEE 802.11, Network Layer, IPv6 and IPv4, Transport Layer, TCP and UDP, Application Layer. Layered Architecture for IoT, Protocol Architecture of IoT, Infrastructure Protocols, IPv6 over Low-Power Wireless Personal Area Networks, Z-Wave, ZigBee, Protocols for IoT Service Discovery. TB1: Ch2, Ch3			
Module-3: Networking Protocol			8 hours
Network Layer, The 6LoWPAN Adaptation Layer, CoAP, CoSIP Protocol Specification, A Protocol for Constrained Session Initiation, The DNMP Protocol, Implementation with IEEE 802.15.4 and IEEE 802.11s, IoT Gateway, A P2P-based Large-scale Service Discovery Architecture, Sensor and Actuator Networks, Message Queue Telemetry Transport, Extensible Messaging and Presence Protocol, Advanced Message Queuing Protocol, Constrained Application Protocol, Security Issues in the IoT, Authorization Mechanisms for Secure IoT Services. TB1: Ch 4			
Module-4: Platforms for IOT Applications and Analytics			8 hours
The IoT Building Blocks, Azure IoT Hub, The IoT Data Analytics Platforms, The IoT Data Virtualization Platforms, IoT Data Visualization Platform, The IoT Edge Data Analytics, Hardware for the IoT, Classes of Constrained Devices, Hardware Platforms, Raspberry Pi, Arduino, IoT and Cloud-Inspired Smarter Environments, The Architectural Components of the Smarter Traffic System, Big Data Analytics: The Prominent Use Cases. TB1: Ch 5, 6, 7			
Module-5: Edge/Fog Computing Paradigm and Security of IOT			8 hours
Introduction of Fog/Edge Computing, Mobile Edge Computing (MEC), Mobile Cloud Computing (MCC), IoT Data Security, Introducing Integrated Fog Computing Platforms, Wearable Technology, Future Trends for IoT in Health Care, Security Requirements of an IoT Infrastructure, Security Threats in Different Use Cases of IoT. TB1: Ch 8, 9, 10			
Course Outcomes: At the end of the course the student will be able to:			
21CBS7055.1	Illustrate the smart objects and the technologies to connect them to network		
21CBS7055.2	Interpret the impact and challenges posed by IoT networks leading to new architectural models.		

21CBS7055.3	Explain the basics of IoT network models, protocols of all layers with the constrained network.
21CBS7055.4	Compare different Application protocols for IoT. Infer the role of Data Analytics and Security in IoT.
21CBS7055.5	Identify sensor technologies for sensing real world entities and understand the role of IoT in various domains of Industry and security issues.
21CBS7055.6	Build applications using basic technologies of IOT.

Sl. No.	Title of the Book	Name of the Author/s	Name of the Publisher	Edition and Year
Textbooks				
1	The Internet of Things: Enabling Technologies, Platforms, and Use Cases	Pethuru Raj and Anupama C. Raman	CRC Press,	1 st Edition, 2017
Reference Books				
1	Security and Privacy in Internet of Things (IoTs): Models, Algorithms, and Implementations	Fei Hu	CRC	2016
2	Internet of Things: Principles and Paradigms	R. Buyya and A.K. Dastjerdi (eds.),	Cambridge, MA, USA: Morgan Kaufmann (Elsevier),	2016
3	Internet of Things: Architectures, Protocols and Standards	Simone Cirani, Gianluigi Ferrari, Marco Picone, Luca Veltri	Wiley	1st Edition, 2018

Web links and Video Lectures (e-Resources):

- <https://www.youtube.com/watch?v=LlhmzVL5bm8>
- <https://www.youtube.com/watch?v=h0gWfVCSGQQ>
- <https://www.youtube.com/watch?v=UrwbeOIlc68>
- <https://www.youtube.com/watch?v=Gah1B7GyFZE>
- <http://digimat.in/nptel/courses/video/106105166/L02.html>

Course Articulation Matrix

Course Outcomes (COs)	Program Outcomes (POs)													
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
21CBS7055.1	2												1	
21CBS7055.2		2	3	2									1	
21CBS7055.3		2	2										1	
21CBS7055.4	1	2	3										1	
21CBS7055.5			3										1	
21CBS7055.6													1	

1: Low 2: Medium 3: High

Technical Seminar			
Course Code	21CBS706	CIE Marks	100
Course Type (Theory/Practical/Integrated)	Practical	SEE Marks	-
		Total Marks	100
Teaching Hours/Week (L:T:P)	(0:0:2)	SEE	-
Total Hours	20 hours	Credits	01
Course Learning Objectives:			
1. To equip students with the ability to conduct in-depth research, analyze technical literature, and explore contemporary advancements in their field of study. 2. To effectively organize, design, and deliver technical presentations that convey complex information clearly to a diverse audience. 3. To encourage students to critically analyse and evaluate emerging trends, technologies, or methodologies relevant to their chosen seminar topic. 4. To enable students to improve their written and oral communication by preparing well-structured seminar reports and articulating ideas confidently during presentations. 5. To stimulate independent learning and problem-solving abilities by allowing students to explore specific topics of interest, enhancing self-directed research and learning. 6. To prepare students to effectively discuss and defend their technical knowledge in a professional setting, such as viva-voce, aligning with future industry or academic pursuits.			
1. Selection of Technical Seminar Topic			
• Students should select a technical topic related to their field of study, preferably focusing on recent advancements or emerging technologies. Inter-disciplinary/Multi-disciplinary topics are appreciated. • Topics must be approved by the seminar coordinator within the first few weeks of the semester.			
2 Research and Preparation			
• Extensive research should be carried out using credible sources such as research papers, technical journals, books, and online databases. • A minimum of 10-20 references is recommended, ensuring a mix of primary and secondary sources.			
3. Seminar Report			
• A detailed report (approximately 20-30 pages) must be prepared, summarizing the research findings and organized in a structured manner. • The report should include sections like introduction, literature review, methodology, results, discussion, conclusion, and references. • The report should follow a standard format as prescribed by the Department (font, spacing, citation style, etc.).			
4. Oral Presentation			
• Students must deliver an oral presentation lasting 15-20 minutes, followed by a question-and-answer session. • Presentations should be well-structured, with appropriate use of visuals (slides, graphs, diagrams) to clearly convey technical content. • All presentations must be conducted on scheduled dates, and attendance is mandatory for both presenters and all other students.			
5. Question and Answer Session			
• After the presentation, students will face a viva-voce where they are required to answer questions posed by the Departmental Seminar Evaluation Committee regarding their seminar topic. • The viva will test the student's depth of understanding, research analysis, and ability to think critically about the subject matter.			

6. Evaluation Criteria
• Seminar Report: Clarity, technical depth, comprehensiveness, quality of research, organization, and adherence to format (50 marks). • Oral Presentation: Communication skills, visual aids, clarity of content, timing, etc. (25 marks). • Viva-Voce: Ability to answer questions effectively, depth of understanding, and analytical skills (25 marks).
7. Submission Deadlines
• The report should be submitted at least one week prior to the scheduled presentation date. • Late submissions will be penalized as per department rules.
8. Plagiarism Check
• All seminar reports must be subjected to plagiarism checking, and the similarity index should be within acceptable limits specified by the Department. • Instances of plagiarism will result in penalties, which could include rejection of the report or a reduction in marks.
9. Mentorship and Feedback
• Students are required to consult with their faculty mentors regularly throughout the preparation phase to seek guidance and feedback. • At least three mentorship meetings should be recorded before the final presentation.
10. Attendance
• Students must attend all seminar sessions conducted by their peers, as it promotes collaborative learning and constructive feedback. • Attendance could be considered for internal evaluation.

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

21CBS706.1	Demonstrate a thorough understanding of a specialized topic by conducting extensive research and presenting technical content effectively.
21CBS706.2	Exhibit proficiency in delivering well-organized and visually supported oral presentations, clearly articulating complex technical ideas to an audience.
21CBS706.3	Apply critical thinking and research methodologies to explore, analyze, and synthesize information from various sources, leading to sound conclusions.
21CBS706.4	Prepare a detailed and well-structured seminar report that adheres to technical writing standards, showcasing the ability to document research findings comprehensively.
21CBS706.5	Respond confidently and competently to questions during the viva-voce, defending the technical work and demonstrating an in-depth understanding of the topic.
21CBS706.6	Engage actively in peer seminars, providing constructive feedback, and reflecting on insights gained from discussions with fellow students and faculty.

Useful Links:

- <https://homes.cs.washington.edu/~memst/advice/giving-talk.html> (How to give a technical presentation)
- <https://learnerbits.com/essential-tips-for-engineering-presentations>
- https://onlinecourses.nptel.ac.in/noc24_hs175/preview (Technical English for Engineers)

Course Articulation Matrix

Course Outcomes (COs)	Program Outcomes (POs)													
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
21CBS706.1	-	1	-	3	-	-	-	-	-	2	-	-	-	-
21CBS706.2	-	-	-	-	2	-	-	-	-	3	-	1	-	-
21CBS706.3	-	2	-	3	-	-	-	-	-	-	-	-	-	-
21CBS706.4	-	-	-	-	-	1	-	2	-	3	-	-	-	-
21CBS706.5	-	-	-	-	-	-	-	-	-	3	-	-	-	-
21CBS706.6	-	-	-	-	-	1	-	-	-	3	-	2	-	-

1: Low 2: Medium 3: High

Major Project Work			
Course Code	21CBP707	CIE Marks	50
Course Type (Theory/Practical/Integrated)	Practical	SEE Marks	50
		Total Marks	100
Teaching Hours/Week (L:T:P)	(0:0:6)	SEE	3 Hrs
Total Hours	60 hours	Credits	05
Course Learning Objectives:			
- Utilize fundamental principles of engineering and interdisciplinary knowledge to identify, analyse, and solve complex problems in the project domain. - Develop and execute a comprehensive project plan that includes designing, prototyping, testing, and evaluating a system, component, or process to meet specific needs and constraints. - Conduct in-depth research, critically review literature, and integrate innovative solutions or techniques within the project framework. - Demonstrate effective teamwork, communication, and collaboration skills in a multidisciplinary environment to achieve project objectives. - Incorporate ethical considerations, societal impact, and sustainable practices in the project development, while adhering to professional engineering standards. - Prepare and present a well-structured project report, supported by technical documentation and visual aids, and confidently defend the work during project viva-voce or presentations.			
1. Project Selection			
Relevance: Projects should align with the students' specialization and current industry trends. Innovation: Projects that offer innovative solutions to existing problems or explore new ideas are encouraged. Feasibility: The project should be achievable within the given timeframe and resources. Team Composition: Students can work in teams, typically comprising maximum 4 members.			
2. Project Proposal			
Submission: Students must submit a detailed project proposal (project synopsis) outlining the problem statement, objectives, methodology, expected outcomes, and a work plan. Approval: The proposal should be reviewed and approved by the Department Project Evaluation Committee (DPEC).			
3. Project Execution			
Regular Meetings: Students should meet regularly with their project-guide to discuss progress, challenges, and next steps. Documentation: Maintain detailed documentation throughout the project in a project work-dairy, including design decisions, experiments, and testing results. Milestones: Set clear milestones and deadlines to ensure steady progress. These could include design completion, initial prototype, testing, etc.			
4. Mid-term Review			
Progress Presentation: DPEC shall conduct a mid-term review where students present their progress to a panel of faculty members. Feedback: Provide constructive feedback and guidance to help students refine their projects.			
5. Final Submission			
Report: The final project report should include an abstract, introduction, literature review, methodology, implementation, results, discussion, conclusion, and references. Code and Data: If applicable, students should submit their code, datasets, and any other relevant materials.			
6. Project Presentations			
Oral Presentation: Students should present their projects to a panel, explaining their work, findings, and contributions.			

• Demonstration: If possible, include a live demonstration of the project or show relevant simulations and results. • Q&A: Be prepared to answer questions from the panel and justify the project's methodology and conclusions.
7. Evaluation Criteria
• Originality and Innovation: Assess the novelty and creativity of the project. • Technical Competence: Evaluate the depth of technical knowledge and problem-solving ability demonstrated. • Project Execution: Consider the effectiveness of project planning, adherence to timelines, and quality of implementation. • Presentation and Communication: Judge the clarity and coherence of the final report, presentation, and the ability to answer questions.
8. Plagiarism Check
• Academic Integrity: Ensure that the work submitted is original and properly cites all references and sources. • Plagiarism Check: Run all reports through plagiarism detection software and ensure that similarity index is less than the threshold value (25%).
9. Mentorship and Feedback
• Feedback: Students are required to consult with their project guide regularly throughout the project work to seek guidance and feedback. • Weekly Meetings: At least one mentorship meeting every week shall be held and recorded in the project work-dairy.
10. Post Submission
• Publication: DPEC shall encourage students to publish their work in conferences or journals, especially if it contributes significantly to their field. • Project Archive: Store all projects in the department's digital archive for future reference.

Continuous Internal Evaluation (CIE)		
Description	Proposed Dates	CIE Weightage (Max 50 marks)
1. Project Synopsis Evaluation (Phase I)	Beginning of the 7 th Semester	10 marks
2. Project Progress Evaluation	Middle of the 7 th Semester	20 marks
3. Project Report Evaluation (Phase II)	End of the 7 th Semester	20 marks
Semester End Examinations (SEE)		
4. SEE will be conducted for 100 marks (after the last working day of the 7 th semester) in the presence of the external examiner with the weightage as Project Report: 50 marks, Project Presentation: 25 marks and Question & Answer Session: 25 marks . Marks awarded for Project Report is same for all batch-mates.		
• When all the Project Objectives are met and the Project Work is successfully completed and final Project Report is submitted as reported by the Department Project Evaluation Committee (DPEC), the CIE and SEE performance of the 7th semester will be carried forward to the 8th semester. There will not be any separate CIE and SEE for such project batches in the 8th semester.		

- In case of any Project Objectives not met, Project Work not completed or final Project Report not submitted, as reported by the DPEC, the CIE and SEE will be conducted in the 7th semester for the completed portion of the Project Work. In such cases, the submission of the Draft Copy of the Project Report is mandatory for evaluation. The remaining part of the project shall be completed during the 8th semester and there will be a CIE and SEE for the Project Work in the 8th semester.

Students are advised to complete the Project Work during the 7th semester and devote the 8th semester for Industry Internship/Research Internship.

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

21CBP707.1	Demonstrate the ability to identify, define, and solve complex engineering problems using appropriate methodologies and modern tools.
21CBP707.2	Successfully design, develop, and test an engineering solution that meets specified requirements, addressing technical, economic, environmental, and social constraints.
21CBP707.3	Apply research skills to review existing literature, gather and analyze data, and incorporate innovative or state-of-the-art technologies in the project
21CBP707.4	Collaborate effectively within a team, taking on leadership or supportive roles as needed, while ensuring clear communication and efficient project management.
21CBP707.5	Demonstrate awareness of professional ethics, societal impact, and sustainability in the design and implementation of engineering solutions.
21CBP707.6	Exhibit strong written and oral communication skills by preparing technical reports, project documentation, and delivering persuasive project presentations.

Course Articulation Matrix

Course Outcomes (COs)	Program Outcomes (POs)													
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
21CBP707.1	2	3	-	-	1	-	-	-	-	-	-	-	-	-
21CBP707.2	-	-	3	-	-	2	1	-	-	-	-	-	-	-
21CBP707.3	1	2	-	3	-	-	-	-	-	-	-	-	-	-
21CBP707.4	-	-	-	-	-	1	-	-	3	2	2	-	-	-
21CBP707.5	-	-	1	-	-	-	2	3	-	-	-	-	-	-
21CBP707.6	-	-	-	-	-	-	-	-	-	3	2	1	-	-

1: Low 2: Medium 3: High

VIII Semester

Massive Open Online Course (MOOC)			
Course Code	21AEC801	CIE Marks	50
Course Type (Theory/Practical/Integrated)	Theory	SEE Marks	50
		Total Marks	100
Teaching Hours/Week (L:T:P)	(2:0:0)	SEE	3 Hrs
Total Hours	20 hours	Credits	02

Course Learning Objectives:

1. Enable students to acquire a strong foundation in core engineering subjects through high-quality, accessible online resources.
2. Facilitate skill development in specific engineering domains using practical exercises, simulations, and projects offered through the MOOC platform.
3. Encourage students to develop autonomy in learning by navigating and managing their course content, assignments, and assessments independently.
4. Expose students to interdisciplinary concepts and applications, fostering an understanding of how engineering principles integrate with other fields.
5. Provide exposure to global best practices and trends in engineering, allowing students to learn from international faculty and peer collaboration.
6. Develop essential soft skills by participating in discussion forums, group projects, and peer assessments, enhancing communication and teamwork skills.

1. Selection of MOOCs

1.1 Accredited Platforms: Students shall select MOOCs from accredited platforms such as Coursera, edX, SWAYAM/NPTEL, Udacity, or any online learning platform recognized by the respective Engineering Department / Board of Studies (BoS). Engineering Departments with the approval of BoS shall publish a list of MOOCs courses in the beginning of every semester.

1.2 Prerequisites: Students shall ensure that he/she has completed any foundational courses or prerequisites required for the chosen MOOCs.

1.3 Relevant Courses: Students shall choose courses that are relevant to the Student's Engineering discipline and career goals. Students shall NOT opt for the course which is part of their curriculum (I to VIII semester B.E program) and Honors Degree/Minor Degree courses. In case of any overlapping in the contents of the MOOC Course with that in the curriculum or other courses, the maximum permitted overlapping in the course contents (syllabus) is 20-25%.

1.4 Credit Value: Students shall ensure that the selected MOOCs collectively account for 2 credits. Typically, a 2-credit MOOC will require around 20-25 hours of study and a 1-credit MOOC will require 10-12 hours of study.

1.5 Duration of Course: A 4-weeks MOOCs is eligible for 1-credit. Students are advised to enrol for one 8-weeks MOOCs course to earn 2 credits. However, Students can also take two 4-weeks MOOCs instead of one course. In each case, the number of hours of study mentioned shall be satisfied.

2. Approval Process

2.1 Pre-Approval: Students must seek pre-approval from the Department MOOCs Coordinator before enrolling in MOOCs.

2.2 Submission of Proposal: Students can submit a detailed proposal to Department MOOCs Coordinator including the name of the MOOCs, the platforms, course duration, credit value, and relevance to their field of study.

If a Student has already completed any MOOCs course/s from the beginning of the III semester B.E, that satisfies the criteria mentioned in the clause 1. Selection of MOOCs, such course/s can be considered by the Department for credit transfer, provided the student has NOT already claimed the benefit of completing the MOOCs under any assessment in any of the subject.

2.3 Evaluation: The Department will evaluate the proposal for relevance, academic rigor, and credit equivalence and will communicate the decision to the Students.

3. Registration and Enrollment	
3.1 Official Enrollment: Students shall register for the approved MOOCs on the respective platforms. 3.2 Documentation: Students shall keep documentation of registration and course details for future reference and provide the same when asked by the Department.	
4. Course Completion	
4.1 Active Participation: Students shall engage actively in all course activities including lectures, assignments, quizzes, and discussion forums. 4.2 Completion Certificate: Students shall obtain a verified certificate of completion for MOOC Course. Free versions without certificates are NOT eligible for credit.	
5. Assessment and Evaluation	
5.1 Performance Tracking: Students shall maintain records of performance in all assessments throughout the course. 5.2 Final Assessment: The Department may conduct a final assessment (proctored exam) to ensure that the knowledge gained aligns with the academic standards. This summative assessment (proctored exam) by the Engineering Department is mandatory in the absence of such assessment in the MOOC course/s by the online platform.	
6. Credit Transfer	
6.1 Submission of Certificates: Students shall submit the completion certificate/s and performance records to the Department MOOCs Coordinator. 6.2 Credit Evaluation: The Department will evaluate the certificates and performance records to approve the credit transfer. 6.3 Grade Conversion: College will take care to convert the grades from the MOOCs into the grading system as per established Academic Rules and Regulations.	
7. Integration into Academic Record	
7.1 Transcript Update: Upon approval, the credits and grades will be integrated into the student's academic transcript. 7.2 Grade Point Average (GPA) Calculation: The MOOC grades are included in the calculation of the student's GPA.	
8. Support and Resources	
8.1 Academic Advising: The Department MOOCs Coordinator shall provide guidance and support to the students throughout the process. 8. 2 Technical Support: The Department MOOCs Coordinator shall ensure that students have access to the necessary technical resources to complete MOOCs courses.	
9. Feedback and Improvement	
9.1 Student Feedback: Department MOOCs Coordinator shall collect feedback from students on their MOOC experiences to improve future implementations. 9.2 Continuous Improvement: MOOCs guidelines and processes will be updated based on student feedback, Department feedback and evolving educational standards.	

Course Outcomes: At the end of the course the student will be able to :	
21AEC801.1	Students will demonstrate a strong grasp of essential engineering concepts and methodologies relevant to their chosen field.
21AEC801.2	Students will apply engineering knowledge to solve real-world problems through projects and case studies presented in the course.
21AEC801.3	Students will proficiently use online tools and resources, including simulations, interactive modules, and digital libraries, to enhance their learning experience.
21AEC801.4	Students will gain insights into new technologies and innovations within engineering, preparing them to adapt to technological advancements.

21AEC801.5	Students will exhibit improved teamwork and communication skills by engaging in online discussions, group projects, and peer assessments.
21AEC801.6	Students will develop a broader understanding of how engineering intersects with other disciplines and cultural contexts, informed by national/global perspectives gained through the MOOC.

Course Articulation Matrix

Course Outcomes (COs)	Program Outcomes (POs)													
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
21AEC801.1	3	2	-	-	1	-	-	-	-	-	-	-	-	-
21AEC801.2	3	-	2	-	-	-	-	-	-	-	-	2	-	-
21AEC801.3	-	-	-	-	3	-	-	-	-	-	-	2	-	-
21AEC801.4	3	-	-	-	2	-	-	-	-	-	-	1	-	-
21AEC801.5	-	-	-	-	-	-	-	-	2	3	-	1	-	-
21AEC801.6	-	2	-	-	-	2	-	-	-	-	-	1	-	-

1: Low 2: Medium 3: High

Major Project Work			
Course Code	21CBP802	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 Hrs
Total Hours	20 hours	Credits	05
Course Learning Objectives:			
- Utilize fundamental principles of engineering and interdisciplinary knowledge to identify, analyse, and solve complex problems in the project domain. - Develop and execute a comprehensive project plan that includes designing, prototyping, testing, and evaluating a system, component, or process to meet specific needs and constraints. - Conduct in-depth research, critically review literature, and integrate innovative solutions or techniques within the project framework. - Demonstrate effective teamwork, communication, and collaboration skills in a multidisciplinary environment to achieve project objectives. - Incorporate ethical considerations, societal impact, and sustainable practices in the project development, while adhering to professional engineering standards. - Prepare and present a well-structured project report, supported by technical documentation and visual aids, and confidently defend the work during project viva-voce or presentations.			
1. Project Execution			
Regular Meetings: Students should meet regularly with their project-guide to discuss progress, challenges, and next steps. Documentation: Maintain detailed documentation throughout the project in a project work-dairy, including design decisions, experiments, and testing results. Milestones: Set clear milestones and deadlines to ensure steady progress. These could include design completion, initial prototype, testing, etc.			
2. Progress Review			
Progress Presentation: DPEC shall conduct a mid-term review where students present their progress to a panel of faculty members. Feedback: Provide constructive feedback and guidance to help students refine their projects.			
3. Final Submission			
Report: The final project report should include an abstract, introduction, literature review, methodology, implementation, results, discussion, conclusion, and references. Code and Data: If applicable, students should submit their code, datasets, and any other relevant materials.			
4. Project Presentations			
Oral Presentation: Students should present their projects to a panel, explaining their work, findings, and contributions. Demonstration: If possible, include a live demonstration of the project or show relevant simulations and results. Q&A: Be prepared to answer questions from the panel and justify the project's methodology and conclusions.			
5. Evaluation Criteria			
Originality and Innovation: Assess the novelty and creativity of the project. Technical Competence: Evaluate the depth of technical knowledge and problem-solving ability demonstrated. Project Execution: Consider the effectiveness of project planning, adherence to timelines, and quality of implementation. Presentation and Communication: Judge the clarity and coherence of the final report, presentation, and the ability to answer questions.			

6. Plagiarism Check	
• Academic Integrity: Ensure that the work submitted is original and properly cites all references and sources. • Plagiarism Check: Run all reports through plagiarism detection software and ensure that similarity index is less than the threshold value (25%).	
7. Mentorship and Feedback	
• Feedback: Students are required to consult with their project guide regularly throughout the project work to seek guidance and feedback. • Weekly Meetings: At least one mentorship meeting every week shall be held and recorded in the project work-dairy.	
8. Post Submission	
• Publication: DPEC shall encourage students to publish their work in conferences or journals, especially if it contributes significantly to their field. • Project Archive: Store all projects in the department's digital archive for future reference.	

Continuous Internal Evaluation (CIE)		
Description	Proposed Dates	CIE Weightage (Max 50 marks)
1. Progress Review	During the 8 th semester	25 marks
2. Project Report Evaluation	End of the 8 th Semester	25 marks
Semester End Examinations (SEE)		
3. SEE will be conducted for 100 marks (after the last working day of the 7 th semester) in the presence of the external examiner with the weightage as Project Report: 50 marks, Project Presentation: 25 marks and Question & Answer Session: 25 marks. Marks awarded for Project Report is same for all batch-mates.		

Course Outcomes: At the end of the course the student will be able to :	
21CBP802.1	Demonstrate the ability to identify, define, and solve complex engineering problems using appropriate methodologies and modern tools.
21CBP802.2	Successfully design, develop, and test an engineering solution that meets specified requirements, addressing technical, economic, environmental, and social constraints.
21CBP802.3	Apply research skills to review existing literature, gather and analyze data, and incorporate innovative or state-of-the-art technologies in the project
21CBP802.4	Collaborate effectively within a team, taking on leadership or supportive roles as needed, while ensuring clear communication and efficient project management.
21CBP802.5	Demonstrate awareness of professional ethics, societal impact, and sustainability in the design and implementation of engineering solutions.
21CBP802.6	Exhibit strong written and oral communication skills by preparing technical reports, project documentation, and delivering persuasive project presentations.

Course Articulation Matrix

Course Outcomes (COs)	Program Outcomes (POs)													
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
21CBP802.1	2	3	-	-	1	-	-	-	-	-	-	-	-	-
21CBP802.2	-	-	3	-	-	2	1	-	-	-	-	-	-	-
21CBP802.3	1	2	-	3	-	-	-	-	-	-	-	-	-	-
21CBP802.4	-	-	-	-	-	1	-	-	3	2	2	-	-	-
21CBP802.5	-	-	1	-	-	-	2	3	-	-	-	-	-	-
21CBP802.6	-	-	-	-	-	-	-	-	-	3	2	1	-	-

1: Low 2: Medium 3: High

Research/Industry Internship			
Course Code	21INT803	CIE Marks	50
Course Type (Theory/Practical/Integrated)	Practical	SEE Marks	50
		Total Marks	100
Number of Weeks	15 Weeks	SEE	3 Hours
		Credits	10
Research Internship			
Course Learning Objectives:			
1. To equip students with the knowledge of fundamental research principles, methodologies, and techniques applicable to their engineering discipline. 2. To enable students to formulate research questions, design experiments or studies, and use appropriate data collection and analysis tools. 3. To foster the ability to think critically and innovatively while solving complex engineering problems during the research process. 4. To guide students in developing the skills necessary for writing clear and well-structured research reports, papers, and presentations. 5. To instill an understanding of ethical practices in research, including integrity, responsible data handling, and respect for intellectual property. 6. To prepare students to work effectively in research teams, communicate their ideas clearly, and present their findings to both technical and non-technical audiences.			
Pre-Internship Preparation			
1. Orientation Session: Attend an orientation session with the academic mentor (allotted from the Department) and the Research Supervisor to understand the research goals, expectations, and assessment criteria. 2. Documentation: Complete necessary documentation, including the approval from the Department, processing of the internship request application, research agreements and confidentiality agreements, if applicable. 3. Research Proposal: Develop a research proposal in consultation with the Research Supervisor and academic mentor outlining the objectives, methodology, and expected outcomes.			
During the Internship			
1. Work Plan: Follow a structured research plan provided by the supervising researcher or mentor. 2. Literature Review: Conduct a comprehensive literature review to understand the current state of research in the chosen area. 3. Regular Meetings: Participate in regular meetings with academic and research mentors to discuss progress, challenges, and next steps. 4. Lab Work/Field Work: Engage in experimental work, simulations, or field studies as required by the research project. 5. Data Collection and Analysis: Collect, analyze, and interpret data using appropriate tools and techniques. 6. Documentation: Maintain detailed records of research activities, experiments, and findings.			
Deliverables			
1. Weekly Reports: Submit weekly progress reports to academic and research mentors. 2. Monthly Reports: Submit monthly progress reports to academic and research mentors. 3. Mid-Term Review: Participate in a mid-term review meeting to assess progress and realign research goals if necessary. 4. Report and Research Paper: Prepare a draft report and a research paper detailing the research problem, methodology, results and discussions, and conclusions. 5. Presentation: Deliver a presentation summarizing the research work to faculty, peers, and other stakeholders upon completion of the internship.			

Assessment Criteria	
1. Research Quality: Evaluate the quality and rigor of the research conducted. 2. Report Quality: Assess the clarity, organization, and thoroughness of the report and the research paper. 3. Presentation: Evaluate the effectiveness and clarity of the final presentation. 4. Innovation and Creativity: Consider the originality and innovative aspects of the research. 5. Self-Reflection: Review the student's ability to critically reflect on their research experience and identify areas for future growth.	
Post-Internship	
1. Feedback Session: Attend a feedback session with academic mentors to discuss the research experience and areas of improvement. 2. Publication: Explore opportunities to publish the research findings in academic journals or conferences. 3. Networking: Maintain professional relationships established during the internship for future research collaborations.	
Additional Tips	
• Curiosity: Cultivate a curious mindset and a willingness to explore new ideas. • Collaboration: Work collaboratively with other researchers and team members. • Adaptability: Be open to modifying research approaches based on findings and feedback. • Communication: Develop strong written and oral communication skills to effectively present research findings. • Time Management: Prioritize tasks and manage time efficiently to meet research deadlines.	

Evaluation Scheme	
Continuous Internal Evaluation (CIE): I (Only OFFLINE)	Will be conducted during the 7 th semester BE. Students shall submit the Research Internship Proposal and make a presentation and answer questions raised by the Departmental Internship Evaluation Committee (DIEC). Marks split-up: Research Internship Proposal – 50 marks + Oral Presentation-25 marks + Question and Answer-25 marks.
Continuous Internal Evaluation (CIE): II (ONLINE/OFFLINE)	Will be conducted during the middle of the 8 th semester BE. Students shall submit the Reports (daily/weekly/monthly reports), make a presentation on progress done so far and answer questions raised by the Departmental Internship Evaluation Committee. Marks split-up: Reports – 50 marks + Oral Presentation-25 marks + Question and Answer-25 marks.
Continuous Internal Evaluation (CIE): III (Only OFFLINE)	Will be conducted at the end of the 8 th semester BE. Students shall submit the Reports (daily/weekly/monthly reports) and the final internship report, make a presentation on work completed and answer questions raised by the Departmental Internship Evaluation Committee. Marks split-up: Reports – 50 marks + Oral Presentation-25 marks + Question and Answer-25 marks.
CIE Marks (Max 100)	Average of the CIE:I , CIE-II and CIE:III marks
Semester-End-Examinations (SEE) (Only OFFLINE)	Will be conducted within a week of the last working day of the 8 th semester BE. Student shall submit the internship report approved by all the concerned, make a presentation and answer the questions raised by the internal and external examiners. Marks split-up: Reports – 50 marks + Oral Presentation-25 marks + Question and Answer-25 marks.

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

21INT803.1	Apply appropriate research methodologies and tools to design and conduct experiments, analyze data, and draw conclusions.
21INT803.2	Demonstrate the ability to identify and solve complex engineering problems through innovative and systematic research approaches.
21INT803.3	Acquire proficiency in using advanced technologies, tools, and techniques relevant to their field of research.
21INT803.4	Develop skills in writing comprehensive research reports, documentation, and effectively presenting research findings.
21INT803.5	Understand and apply ethical standards in research, including plagiarism avoidance, proper citations, and data integrity.
21INT803.6	Gain experience in working collaboratively within a research team and contributing effectively to the shared goals of the project.

References

- AICTE Internship Policy : Guidelines and Procedures 2019.**
Available at <https://aicte-india.org/sites/default/files/AICTE%20Internship%20Policy.pdf>
- UGC Guidelines for Internship/Research Internship for Under Graduate Students 2023.**
Available at https://www.ugc.gov.in/pdfnews/0063650_Draft-Guidelines-for-Internship-and-Research-Internship-for-Under-Graduate-Students.pdf
- VTU Mandatory Internship Guidelines 2021.**
Available at <https://vtu.ac.in/pdf/regulations2021/anex4.pdf>

Course Articulation Matrix

Course Outcomes (COs)	Program Outcomes (POs)													
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
21INT803.1	1	-	2	3	-	-	-	-	-	-	-	-	-	-
21INT803.2	3	2	-	-	-	-	-	-	-	-	-	-	-	-
21INT803.3	-	-	-	-	3	2	-	-	-	-	-	1	-	-
21INT803.4	-	-	-	-	-	-	-	-	-	3	-	1	-	-
21INT803.5	-	-	-	-	-	2	-	3	-	-	-	1	-	-
21INT803.6	-	-	-	-	-	-	-	-	3	2	1	-	-	-

1: Low 2: Medium 3: High

Research/Industry Internship			
Course Code	21INT803	CIE Marks	50
Course Type (Theory/Practical/Integrated)	Practical	SEE Marks	50
		Total Marks	100
Number of Weeks	15 Weeks	SEE	3 Hours
		Credits	10
Industry Internship			
Course Learning Objectives:			
1. To develop practical engineering skills through hands-on experience in a real-world industrial environment. 2. To enhance the ability to identify, analyze, and solve complex engineering problems encountered during the internship. 3. To gain an understanding of the functioning of the industry, including exposure to its standards, practices, and emerging technologies. 4. To improve communication, collaboration, and teamwork skills by working with professionals in a multidisciplinary team setting. 5. To foster adaptability by learning to work in dynamic and fast-paced industrial environments while embracing lifelong learning. 6. To instill a sense of professional ethics, responsibility, and accountability in engineering practice by adhering to industry-specific codes of conduct.			
Pre-Internship Preparation			
1. Orientation Session: Attend an orientation session with the academic mentor (allotted from the Department) to understand the internship goals, expectations, and assessment criteria. 2. Documentation: Complete necessary documentation, including the approval from the Department, processing of the internship request application, internship agreements if applicable etc. 3. Goal Setting: Define specific, measurable, achievable, relevant, and time-bound (SMART) goals in consultation with academic and industry mentors.			
During the Internship			
1. Work Plan: Follow a structured work plan provided by the host organization. 2. Mentorship: Regularly meet with assigned industry and academic mentors to review progress and seek guidance. 3. Work Diary/Daily Report/Learning Diary: Maintain a diary/logbook documenting daily activities, learnings, challenges, and reflections. 4. Professional Conduct: Adhere to the professional and ethical standards of the host organization, including dress code, punctuality, and communication protocols. 5. Skill Application: Actively participate in projects and tasks assigned, applying theoretical knowledge to practical situations.			
Deliverables			
1. Weekly Reports: Submit the weekly progress reports to academic and industry mentors. 2. Monthly Reports: Submit the monthly progress reports to academic and industry mentors. 3. Mid-Term Review/Evaluation: Participate in a mid-term review meeting/evaluation to assess progress and realign goals if necessary. 4. Final Report: Prepare a comprehensive final report in the specified format detailing the projects undertaken, skills acquired, challenges faced, and overall learning experience. 5. Presentation: Deliver a presentation summarizing the internship experience to faculty evaluators and peers upon completion of the internship.			
Assessment Criteria			
1. Performance Evaluation: Receive feedback from the industry mentor based on work performance, technical skills, and professional behaviour.			

2. Report Quality: Evaluate the quality, clarity, and comprehensiveness of the final report. 3. Presentation: Assess the effectiveness and clarity of the final presentation. 4. Self-Reflection: Review the student's ability to critically reflect on their learning experience and identify areas for future growth.
Post-Internship
1. Feedback Session: Attend a feedback session with academic mentors to discuss the internship experience and areas of improvement. 2. Certification: Obtain an internship completion certificate from the host organization. 3. Networking: Maintain professional relationships established during the internship for future opportunities.
Additional Tips
• Professionalism: Demonstrate a professional attitude and work ethic at all times. • Adaptability: Be open to learning and adapting to new environments and technologies. • Communication: Develop strong communication skills to effectively collaborate with colleagues and mentors. • Time Management: Prioritize tasks and manage time efficiently to meet deadlines.

Evaluation Scheme	
Continuous Internal Evaluation (CIE): I (ONLINE/OFFLINE)	Will be conducted during the middle of the 8 th semester BE. Students shall submit the Reports (daily/weekly/monthly reports), make a presentation on work done so far and answer questions raised by the Departmental Internship Evaluation Committee. Marks split-up: Reports – 50 marks + Oral Presentation 25 marks + Question and Answer 25 marks.
Continuous Internal Evaluation (CIE): II (Only OFFLINE)	Will be conducted at the end of the 8 th semester BE. Students shall submit the Reports (daily/weekly/monthly reports) and the final report, make a presentation on work completed and answer questions raised by the Departmental Internship Evaluation Committee. Marks split-up: Reports – 50 marks + Oral Presentation 25 marks + Question and Answer 25 marks.
CIE Marks (Max 100)	Average of the CIE:I and CIE:II marks
Semester-End-Examinations (SEE) (Only OFFLINE)	Will be conducted within a week of the last working day of the 8 th semester BE. Student shall submit the internship report approved by all the concerned, make a presentation and answer the questions raised by the internal and external examiners. Marks split-up: Reports – 50 marks + Oral Presentation 25 marks + Question and Answer 25 marks.

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

21INT803.1	Apply engineering concepts and theoretical knowledge to solve real-world industry problems.
21INT803.2	Enhance their problem-solving abilities by identifying, analyzing, and providing innovative solutions to engineering challenges in the industry.
21INT803.3	Develop key professional skills such as teamwork, communication, and time management in a corporate or industrial environment.
21INT803.4	Gain exposure to industry-standard tools, technologies, methodologies, and regulatory standards relevant to their field of study.
21INT803.5	Demonstrate understanding and adherence to professional ethics, safety regulations, and responsibilities in an industrial setting.
21INT803.6	Build a network of industry professionals and gain insights into career opportunities, preparing them for future employment in the engineering sector.

References**1. AICTE Internship Policy : Guidelines and Procedures 2019.**Available at <https://aicte-india.org/sites/default/files/AICTE%20Internship%20Policy.pdf>**2. UGC Guidelines for Internship/Research Internship for Under Graduate Students 2023.**Available at https://www.ugc.gov.in/pdfnews/0063650_Draft-Guidelines-for-Internship-and-Research-Internship-for-Under-Graduate-Students.pdf**3. VTU Mandatory Internship Guidelines 2021.**Available at <https://vtu.ac.in/pdf/regulations2021/anex4.pdf>**Course Articulation Matrix**

Course Outcomes (COs)	Program Outcomes (POs)													
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
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21INT803.2	-	3	2	1	-	-	-	-	-	-	1	-	-	-
21INT803.3	-	-	-	-	-	-	-	-	3	2	-	-	-	-
21INT803.4	-	-	-	-	3	2	-	-	-	-	-	1	-	-
21INT803.5	-	-	-	-	-	2	-	3	-	-	-	-	-	-
21INT803.6	-	-	-	-	-	-	-	-	2	3	-	1	-	-

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

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