Prerana Educational and Social Trust®

PES Institute of Technology and Management

VTU Handbook

VII Semester Scheme and Syllabus

Department of Computer Science & Design

Academic Year -2025-26

Name of the Student:

USN:

Year of Admission:

VISION

To be the most preferred institution for engineering & management education, research and entrepreneurship by creating professionally superior and ethically strong global manpower.

MISSION

To prepare students for professional accomplishments and responsible global citizenship while fostering continuous learning and to provide state-of-the-art education through the committed and highly skilled faculty by partnering and collaborating with industry.

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Shivamogga-577204
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ABOUT THE DEPARTMENT

The Department of Computer Science and Design came into existence in the year 2022. The CSD Department is headed by Dr. Pramod supported by a highly qualified and dedicated staff.

Computer Science and Design is a field that combines the principles of computer science with the principles of design. It is an interdisciplinary field that involves the study of software development, human-computer interaction, and user experience design.

The main objective of Computer Science and Design is to create software that is not only functional but also visually appealing, with an emphasis on usability and accessibility.

Computer Science and Design involves the study of programming languages, data structures, algorithms, software engineering, and user experience design. Students in this field learn how to create software applications that are easy to use and visually engaging. Student will also learn about the principles of design and how to apply these principles to software development.

VISVESVARAYA TECHNOLOGICAL UNIVERSITY, BELAGAVI

B.E. in Computer Science and Design

Scheme of Teaching and Examinations2022

Outcome Based Education (OBE) and Choice Based Credit System (CBCS)

(Effective from the academic year 2023-24)

VII SEMESTER (Swappable VII and VIII SEMESTER)

Sl. No	Course and Course Code		Course Title	Teaching Department (TD) and Question Paper Setting Board (PSB)	Teaching Hours /Week				Examination				Credits
					Theory Lecture	Tutorial	Practical / Drawing	SDA	Duration in hours	CIE Marks	SEE Marks	Total Marks	
					L	T	P	S					
1	IPCC	BCG701	Robotic Process Automation Design and Development (UiPath)	TD: CG PSB : CG	3	0	2		03	50	50	100	4
2	IPCC	BCS702	Parallel Computing	TD: CG PSB : CG	3	0	2		03	50	50	100	4
3	PCC	BCS703	Cryptography & Network Security	TD: CG PSB : CG	4	0	0		03	50	50	100	4
4	PEC	BCG714x	Professional Elective Course	TD: CG PSB : CG	3	0	0		03	50	50	100	3
5	OEC	BCG755x	Open Elective Course	TD: CG PSB : CG	3	0	0		01	50	50	100	3
6	PROJ	BCG786	Major Project Phase-II	TD: CG PSB : CG	0	0	12		03	100	100	200	6
										400	**300**	**700**	**24**

Professional Elective Course

BCS714A	Deep Learning	BIS714C	Embedded Systems
BCG714B	Virtual and Augmented Reality	BCG714D	Animation Principles and Design

Open Elective Course

BCG755A	Introduction to DBMS	BCG755C	Software Engineering
BCG755B	Introduction to Algorithms	BCG755D	Computer Graphics

PCC: Professional Core Course, **PCCL**: Professional Core Course laboratory, **PEC**: Professional Elective Course, **OEC**: Open Elective Course PR: Project Work, **L**: Lecture, **T**: Tutorial, **P**: Practical **S= SDA**: Skill Development Activity, **CIE**: Continuous Internal Evaluation, **SEE**: Semester End Evaluation. **TD**- Teaching Department, **PSB**: Paper Setting department, **OEC**: Open Elective Course, **PEC**: Professional Elective Course. **PROJ**: Project work

Note: VII and VIII semesters of IV years of the program

(1) Institutions can swap the VII and VIII Semester Schemes of Teaching and Examinations to accommodate research internships/ industry internships after the VI semester.

(2) Credits earned for the courses of VII and VIII Semester Scheme of Teaching and Examinations shall be counted against the corresponding semesters whether the VII or VIII semesters is completed during the beginning of the IV year or the later part of IV years of the program.

Professional Elective Courses (PEC): A professional elective (PEC) course is intended to enhance the depth and breadth of educational experience in the Engineering and Technology curriculum. Multidisciplinary courses that are added supplement the latest trend and advanced technology in the selected stream of engineering. Each group will provide an option to select one course. The minimum number of students' strengths for offering professional electives is 10. However, this conditional shall not be applicable to cases where the admission to the program is less than 10.

Open Elective Courses:

Students belonging to a particular stream of Engineering and Technology are not entitled to the open electives offered by their parent Department. However, they can opt for an elective offered by other Departments, provided they satisfy the prerequisite condition if any. Registration to open electives shall be documented under the guidance of the Program Coordinator/ Advisor/Mentor. The minimum numbers of students' strength for offering Open Elective Course is 10. However, this condition shall not be applicable to class where the admission to the program is less than 10.

PROJECT WORK (21XXP75): The objective of the Project work is

(i) To encourage independent learning and the innovative attitude of the students.

(ii) To develop interactive attitude, communication skills, organization, time management, and presentation skills.

(iii) To impart flexibility and adaptability.

(iv) To inspire team working.

(v) To expand intellectual capacity, credibility, judgment and intuition.

(vi) To adhere to punctuality, setting and meeting deadlines.

(vii) To install responsibilities to oneself and others.

(viii) To train students to present the topic of project work in a seminar without any fear, face the audience confidently, enhance communication skills, involve in group discussion to present and exchange ideas.

CIE procedure for Project Work:

(1) Single discipline: The CIE marks shall be awarded by a committee consisting of the Head of the concerned Department and two senior faculty members of the Department, one of whom shall be the Guide.

The CIE marks awarded for the project work, shall be based on the evaluation of the project work Report, project presentation skill, and question and answer session in the ratio 50:25:25. The marks awarded for the project report shall be the same for all the batch mates.

(2) Interdisciplinary: Continuous Internal Evaluation shall be group-wise at the college level with the participation of all guides of the college. Participation of external guide/s, if any, is desirable. The CIE marks awarded for the project work, shall be based on the evaluation of project work Report, project presentation skill, and question and answer session in the ratio 50:25:25. The marks awarded for the project report shall be the same for all the batch mates.

Robotic Process Automation Design and Development (UiPath)		Semester	7
Course Code	**BCG701**	CIE Marks	50
Teaching Hours/Week (L:T:P: S)	3:0:2:0	SEE Marks	50
Total Hours of Pedagogy	40 hours Theory + 8-10 Lab slots	Total Marks	100
Credits	04	Exam Hours	03
Examination nature (SEE)	Theory/practical		

Course objectives:
This course will enable students to,

- Understand fundamental concepts of automation using UiPath StudioX.
- Learn and Understand UI Automation activities.
- Learn and Understand Mail Automation and Word Automation activities.
- Learn and Understand Excel Automation activities.
- Learn and Understand File Automation and Presentation Automation activities.

Teaching-Learning Process (General Instructions)
These are sample Strategies; that teachers can use to accelerate the attainment of the various course outcomes.

1. Lecturer method (L) need not be only a traditional lecture method, but alternative effective teaching methods could be adopted to attain the outcomes.
2. Use of Video/Animation to explain functioning of various concepts.
3. Encourage collaborative (Group Learning) Learning in the class.
4. Ask at least three HOT (Higher order Thinking) questions in the class, which promotes critical thinking.
5. Adopt Problem Based-Learning (PBL), which fosters student's Analytical skills, develop design thinking skills such as the ability to design, evaluate, generalize, and analyze information rather than simply recall it.

MODULE-1

Robotic Process Automation: Overview: Return on Investment (ROI), Automation Types, UiPath StudioX. **Common Concepts:** Notebook, Activity Inputs, Activity Outputs, Common Properties, Common Activities, Write Line: Message Box, Input Dialog. Modify Text., Text to Left/Right, Delay, if, Switch., Repeat Number Of Times. , Skip Current, Exit Loop, Get Username/Password, Get Orchestrator Asset, Save For Later, Wait for Download, Group.

Chapter 1 , Chapter 3

MODULE-2

UI Automation: Sample Overview, Activities Reference, Use Application/Browser, Go To URL, Navigate Browser, Highlight, Take Screenshot, Check App State, Click, Type Into, Select Item, Check/Uncheck, Get Text, Get Attribute, Extract Table Data, Hover, Keyboard Shortcuts, Get Active Window, Maximize Window, Minimize Window, Hide Window, Restore Window, Move Window. App/Web Recorder.

Chapter 4

MODULE-3

Mail Automation: Sample Overview: Desktop Outlook Setup, File System Structure, Activities Reference: Use Desktop Outlook App, Use Gmail, For Each Email, Mark Email As Read/Unread, Forward Email, Save Email Attachments, Save Email, Send Email, Send Calendar Invite, Move Email, Reply to Email, Archive Email, Delete Email. **Word Automation:** Sample Overview: Word Setup, File System Structure, Activities Reference: Use Word File..., Save Document As, Read Text, Set Bookmark Contant, Replace Text in Document, Append Text, Insert DataTable in Document, Replace Picture,Add Picture, Save Document as PDF.

Chapter 5 , Chapter 6

MODULE-4

Excel Automation: Sample Overview, Activities Reference, Use Excel File, Insert Sheet, Rename Sheet, Duplicate

Sheet, Delete Sheet, For Each Excel Sheet, Insert Column,Text To Columns..,Delete Column, Insert Rows, Delete Rows,Find First/Last Data Row, For Each Excel Row, Write Cell, Create Pivot Table, Format as Table, Change Pivot Data Source, Refresh Pivot Table, Append Range, Copy Range, Sort Range, Clear Sheet/Range/Table, Auto Fill, Fill Range, Write Range, Read Cell Formula.., Read Cell Value, Format Cells, Export to CSV.., Save Excel File, Save Excel File As...,Save Excel File As PDF, VLookup, Filter, Run Spreadsheet Macro. **Chapter 7**
MODULE-5
File Automation: Sample Overview. Activities Reference: Get Folder Info, Folder Exists, Create Folder, Delete Folder, Copy Folder., Move Folder, For Each File In Folder, Compress/Zip Files, Extract/Unzip Files, Get File Info, File Exists, Create File, Delete File, Copy File, Move File, Write Text File, Append Line.., Read Text File. **Presentation Automation:** Sample Overview, File System Structure., Activities Reference, Use PowerPoint Presentation, Copy Paste Slide, Delete Slide, Add New Slide, Replace Text in Presentation, Add Text to Slide., Add Data Table to Slide, Add Image/Video to Slide, Add File to Slide., Run Presentation Macro, Save PowerPoint File As., Save Presentation as PDF. **Chapter 9, Chapter 10**

PRACTICAL COMPONENT OF IPCC *(May cover all / major modules)*

Sl.NO	Experiments
1	Develop automation in UiPath StudioX to demonstrate the following activities: Write Line: Message Box, Input Dialog. Modify Text., Text to Left/Right and Delay
2	Develop automation in UiPath StudioX to demonstrate the following activities: if, Switch., Repeat Number Of Times. , Skip Current, Exit Loop
3	Develop UI automation in UiPath StudioX to demonstrate the following activities: Use Application/Browser, Go To URL, Navigate Browser, Highlight and Take Screenshot
4	Develop UI automation in UiPath StudioX to demonstrate the following activities: Check App State, Click, Type Into, Select Item, Check/Uncheck, Get Text, Get Attribute, Extract Table Data and Hover.
5	Develop UI automation in UiPath StudioX to demonstrate the following activities: Get Active Window, Maximize Window, Minimize Window, Hide Window, Restore Window and Move Window.
6	Develop Word automation in UiPath StudioX to demonstrate the following activities: Use Word File.., Save Document As, Read Text, Replace Text in Document, Append Text, Replace Picture, Add Picture, Save Document as PDF.
7	Develop Excel automation in UiPath StudioX to demonstrate the following activities: Use Excel File, Insert Sheet, Rename Sheet, Duplicate Sheet, Delete Sheet, For Each Excel Sheet, Insert Column, Text To Columns, Delete Column.
8	Develop Excel automation in UiPath StudioX to demonstrate the following activities: Insert Rows, Delete Rows, Find First/Last Data Row, For Each Excel Row, Write Cell, Create Pivot Table., Save Excel File As..., Save Excel File As PDF
9	Develop Excel automation in UiPath StudioX to demonstrate the following activities: Use Excel File, Insert Sheet, Rename Sheet, Duplicate Sheet, Delete Sheet, For Each Excel Sheet, Insert Column, Text To Columns., Delete Column.
10	Develop Excel automation in UiPath StudioX to demonstrate the following activities: Refresh Pivot Table, Append Range, Copy Range, Sort Range, Clear Sheet/Range/Table, Auto Fill, Fill Range, Write Range, Read Cell Formula.., Read Cell Value, Format Cells, Export to CSV
11	Develop File automation in UiPath StudioX to demonstrate the following activities: Get Folder Info, Folder Exists, , For Each File In Folder, Compress/Zip Files, Extract/Unzip Files, Get File Info, File Exists, Create File, Delete File, Copy File, Move File, Write Text File, Append Line.., Read Text File
12	Develop Presentation automation in UiPath StudioX to demonstrate the following activities: Use PowerPoint Presentation, Copy Paste Slide, Delete Slide, Add New Slide, Add Text to Slide., Add Data Table to Slide, Add Image/Video to Slide, Save PowerPoint File As.,Save Presentation as PDF.

Course outcomes (Course Skill Set):
At the end of the course, the student will be able to:

- Demonstrate Common RPA concepts using UiPath StudioX.
- Develop UI automation in UiPath StudioX.
- Implement Mail automation and Word automation in UiPath StudioX.
- Develop Excel automation in UiPath StudioX.
- Implement File automation and Presentation automation in UiPath StudioX.

Assessment Details (both CIE and SEE)

The weightage of Continuous Internal Evaluation (CIE) is 50% and for Semester End Exam (SEE) is 50%. The minimum passing mark for the CIE is 40% of the maximum marks (20 marks out of 50) and for the SEE minimum passing mark is 35% of the maximum marks (18 out of 50 marks). A student shall be deemed to have satisfied the academic requirements and earned the credits allotted to each subject/ course if the student secures a minimum of 40% (40 marks out of 100) in the sum total of the CIE (Continuous Internal Evaluation) and SEE (Semester End Examination) taken together.

CIE for the theory component of the IPCC (maximum marks 50)

- IPCC means practical portion integrated with the theory of the course.
- CIE marks for the theory component are **25 marks** and that for the practical component is **25 marks**.
- 25 marks for the theory component are split into **15 marks** for two Internal Assessment Tests (Two Tests, each of 15 Marks with 01-hour duration, are to be conducted) and **10 marks** for other assessment methods mentioned in 22OB4.2. The first test at the end of 40-50% coverage of the syllabus and the second test after covering 85-90% of the syllabus.
- Scaled-down marks of the sum of two tests and other assessment methods will be CIE marks for the theory component of IPCC (that is for **25 marks)**.
- The student has to secure 40% of 25 marks to qualify in the CIE of the theory component of IPCC.

CIE for the practical component of the IPCC

- **15 marks** for the conduction of the experiment and preparation of laboratory record, and **10 marks** for the test to be conducted after the completion of all the laboratory sessions.
- On completion of every experiment/program in the laboratory, the students shall be evaluated including viva-voce and marks shall be awarded on the same day.
- The CIE marks awarded in the case of the Practical component shall be based on the continuous evaluation of the laboratory report. Each experiment report can be evaluated for 10 marks. Marks of all experiments' write-ups are added and scaled down to **15 marks**.
- The laboratory test **(duration 02/03 hours)** after completion of all the experiments shall be conducted for 50 marks and scaled down to **10 marks.**
- Scaled-down marks of write-up evaluations and tests added will be CIE marks for the laboratory component of IPCC for **25 marks**.
- The student has to secure 40% of 25 marks to qualify in the CIE of the practical component of the IPCC.

SEE for IPCC

Theory SEE will be conducted by University as per the scheduled timetable, with common question

papers for the course (**duration 03 hours**)

1. The question paper will have ten questions. Each question is set for 20 marks.
2. There will be 2 questions from each module. Each of the two questions under a module (with a maximum of 3 sub-questions), **should have a mix of topics** under that module.
3. The students have to answer 5 full questions, selecting one full question from each module.
4. Marks scored by the student shall be proportionally scaled down to 50 Marks.

The theory portion of the IPCC shall be for both CIE and SEE, whereas the practical portion will have a CIE component only. Questions mentioned in the SEE paper may include questions from the practical component.

Suggested Learning Resources:

Textbooks

1. Adeel Javed, Anum Sundrani, Nadia Malik, Sidney Madison Prescott, Robotic Process Automation using UiPath StudioX: A Citizen Developer's Guide to Hyperautomation, 1st Edition, Apress, April 2021

Reference Books:

1. Tom Taulli , The Robotic Process Automation Handbook : A Guide to Implementing RPA Systems, 2020, ISBN-13 (electronic): 978-1-4842-5729-6, Publisher : Apress
2. Alok Mani Tripathi, Learning Robotic Process Automation, Publisher: Packt Publishing Release Date: March 2018 ISBN: 9781788470940

Web links and Video Lectures (e-Resources):

- https://docs.uipath.com/studio/standalone/2022.10/user-guide/install-studio
- https://docs.uipath.com/studiox/standalone/2024.10/user-guide/automation-basics
- https://docs.uipath.com/studiox/standalone/2024.10/user-guide/common-activities
- https://docs.uipath.com/studiox/standalone/2024.10/user-guide/ui-automation
- https://www.youtube.com/watch?v=QE3dFUlTb-A
- https://docs.uipath.com/studiox/standalone/2024.10/user-guide/excel-automation
- https://www.youtube.com/watch?v=R-QszWgB29A
- https://docs.uipath.com/studiox/standalone/2024.10/user-guide/csv-automation
- https://www.youtube.com/watch?v=hBV4-FkR31I
- https://docs.uipath.com/studiox/standalone/2024.10/user-guide/mail-automation
- https://www.youtube.com/watch?v=4Tu4-cwuKqY
- https://docs.uipath.com/studiox/standalone/2024.10/user-guide/word-automation
- https://www.youtube.com/watch?v=NsRejhgvrsI
- https://docs.uipath.com/studiox/standalone/2024.10/user-guide/powerpoint-automation
- https://www.youtube.com/watch?v=Ht2I3IqNmLI

Activity Based Learning (Suggested Activities in Class)/ Practical Based learning

1. Installation of UiPath StudioX (Refer: https://docs.uipath.com/studio/standalone/2022.10/user-guide/install-studio)
2. Demonstrate the difference between UiPath Studio and UiPath StudioX
3. Course project (Automation of a process) – 10 Marks

PARALLEL COMPUTING		Semester	VII
Course Code	**BCS702**	CIE Marks	50
Teaching Hours/Week (L:T:P: S)	3:0:2:0	SEE Marks	50
Total Hours of Pedagogy	40 hours Theory + 8-10 Lab slots	Total Marks	100
Credits	04	Exam Hours	03
Examination nature (SEE)	Theory/Practical		

Course objectives:

This course will enable to,

- Explore the need for parallel programming
- Explain how to parallelize on MIMD systems
- To demonstrate how to apply MPI library and parallelize the suitable programs
- To demonstrate how to apply OpenMP pragma and directives to parallelize the suitable programs
- To demonstrate how to design CUDA program

Teaching-Learning Process (General Instructions)

These are sample Strategies that teachers can use to accelerate the attainment of the various course outcomes.

1. Lecturer method (L) need not to be only traditional lecture methods, but alternative effective teaching methods could be adopted to attain the outcomes.
2. Use of Video/Animation to explain functioning of various concepts.
3. Encourage collaborative (Group Learning) Learning in the class.
4. Ask at least three HOT (Higher order Thinking) questions in the class, which promotes critical thinking.
5. Adopt Programming assignment, which fosters student's Analytical skills, develop design thinking skills such as the ability to design, evaluate, generalize, and analyze information rather than simply recall it.

MODULE-1

Introduction to parallel programming, Parallel hardware and parallel software – Classifications of parallel computers, SIMD systems, MIMD systems, Interconnection networks, Cache coherence, Shared-memory vs. distributed-memory, Coordinating the processes/threads, Shared-memory, Distributed-memory.

MODULE-2

GPU programming, Programming hybrid systems, MIMD systems, GPUs, Performance – Speedup and efficiency in MIMD systems, Amdahl's law, Scalability in MIMD systems, Taking timings of MIMD programs, GPU performance.

MODULE-3

Distributed memory programming with MPI – MPI functions, The trapezoidal rule in MPI, Dealing with I/O, Collective communication, MPI-derived datatypes, Performance evaluation of MPI programs, A parallel sorting algorithm.

MODULE-4

Shared-memory programming with OpenMP – openmp pragmas and directives, The trapezoidal rule, Scope of variables, The reduction clause, loop carried dependency, scheduling, producers and consumers, Caches, cache coherence and false sharing in openmp, tasking, tasking, thread safety.

MODULE-5

GPU programming with CUDA - GPUs and GPGPU, GPU architectures, Heterogeneous computing, Threads, blocks, and grids Nvidia compute capabilities and device architectures, Vector addition, Returning results from CUDA kernels, CUDA trapezoidal rule I, CUDA trapezoidal rule II: improving performance, CUDA trapezoidal rule III: blocks with more than one warp.

PRACTICAL COMPONENT OF IPCC

Sl.NO	Experiments
1	Write a OpenMP program to sort an array on n elements using both sequential and parallel mergesort(using Section). Record the difference in execution time.
2	Write an OpenMP program that divides the Iterations into chunks containing 2 iterations, respectively (OMP_SCHEDULE=static,2). Its input should be the number of iterations, and its output should be which iterations of a parallelized for loop are executed by which thread. For example, if there are two threads and four iterations, the output might be the following: a. Thread 0 : Iterations 0 −− 1 b. Thread 1 : Iterations 2 −− 3
3	Write a OpenMP program to calculate n Fibonacci numbers using tasks.
4	Write a OpenMP program to find the prime numbers from 1 to n employing parallel for directive. Record both serial and parallel execution times.
5	Write a MPI Program to demonstration of MPI_Send and MPI_Recv.
6	Write a MPI program to demonstration of deadlock using point to point communication and avoidance of deadlock by altering the call sequence
7	Write a MPI Program to demonstration of Broadcast operation.
8	Write a MPI Program demonstration of MPI_Scatter and MPI_Gather
9	Write a MPI Program to demonstration of MPI_Reduce and MPI_Allreduce (MPI_MAX, MPI_MIN, MPI_SUM, MPI_PROD)

Course outcomes (Course Skill Set):

At the end of the course, the student will be able to:

- Explain the need for parallel programming
- Demonstrate parallelism in MIMD system.
- Apply MPI library to parallelize the code to solve the given problem.
- Apply OpenMP pragma and directives to parallelize the code to solve the given problem
- Design a CUDA program for the given problem.

Assessment Details (both CIE and SEE)

The weightage of Continuous Internal Evaluation (CIE) is 50% and for Semester End Exam (SEE) is 50%. The minimum passing mark for the CIE is 40% of the maximum marks (20 marks out of 50) and for the SEE minimum passing mark is 35% of the maximum marks (18 out of 50 marks). A student shall be deemed to have satisfied the academic requirements and earned the credits allotted to each subject/ course if the student secures a minimum of 40% (40 marks out of 100) in the sum total of the CIE (Continuous Internal Evaluation) and SEE (Semester End Examination) taken together.

CIE for the theory component of the IPCC (maximum marks 50)

- IPCC means practical portion integrated with the theory of the course.
- CIE marks for the theory component are **25 marks** and that for the practical component is **25 marks**.
- 25 marks for the theory component are split into **15 marks** for two Internal Assessment Tests (Two Tests, each of 15 Marks with 01-hour duration, are to be conducted) and **10 marks** for other assessment methods mentioned in 22OB4.2. The first test at the end of 40-50% coverage of the syllabus and the second test after covering 85-90% of the syllabus.
- Scaled-down marks of the sum of two tests and other assessment methods will be CIE marks for the theory component of IPCC (that is for **25 marks)**.
- The student has to secure 40% of 25 marks to qualify in the CIE of the theory component of IPCC.

CIE for the practical component of the IPCC

- **15 marks** for the conduction of the experiment and preparation of laboratory record, and **10 marks** for the test to be conducted after the completion of all the laboratory sessions.
- On completion of every experiment/program in the laboratory, the students shall be evaluated including viva-voce and marks shall be awarded on the same day.
- The CIE marks awarded in the case of the Practical component shall be based on the continuous evaluation of the laboratory report. Each experiment report can be evaluated for 10 marks. Marks of all experiments' write-ups are added and scaled down to **15 marks**.
- The laboratory test **(duration 02/03 hours)** after completion of all the experiments shall be conducted for 50 marks and scaled down to **10 marks.**
- Scaled-down marks of write-up evaluations and tests added will be CIE marks for the laboratory component of IPCC for **25 marks**.
- The student has to secure 40% of 25 marks to qualify in the CIE of the practical component of the IPCC.

SEE for IPCC

Theory SEE will be conducted by University as per the scheduled timetable, with common question papers for the course (**duration 03 hours**)

1. The question paper will have ten questions. Each question is set for 20 marks.
2. There will be 2 questions from each module. Each of the two questions under a module (with a maximum of 3 sub-questions), **should have a mix of topics** under that module.
3. The students have to answer 5 full questions, selecting one full question from each module.
4. Marks scored by the student shall be proportionally scaled down to 50 Marks

The theory portion of the IPCC shall be for both CIE and SEE, whereas the practical portion will have a CIE component only. Questions mentioned in the SEE paper may include questions from the practical component.

Suggested Learning Resources:

Textbook:

1. Peter S Pacheco, Matthew Malensek – An Introduction to Parallel Programming, second

edition, Morgan Kauffman.
2. Michael J Quinn – Parallel Programming in C with MPI and OpenMp, McGrawHill.

Reference Books:

1. Calvin Lin, Lawrence Snyder – Principles of Parallel Programming, Pearson
2. Barbara Chapman – Using OpenMP: Portable Shared Memory Parallel Programming, Scientific and Engineering Computation
3. William Gropp, Ewing Lusk – Using MPI:Portable Parallel Programing, Third edition, Scientific and Engineering Computation

Web links and Video Lectures (e-Resources):

1. Introduction to parallel programming: https://nptel.ac.in/courses/106102163

Activity Based Learning (Suggested Activities in Class)/ Practical Based learning

- Programming Assignment at higher bloom level (10 Marks)

	CRYPTOGRAPHY & NETWORK SECURITY		Semester	7
	Course Code	**BCS703**	CIE Marks	50
	Teaching Hours/Week (L:T:P: S)	4:0:0:0	SEE Marks	50
	Total Hours of Pedagogy	50	Total Marks	100
	Credits	04	Exam Hours	3
	Examination type (SEE)	Theory		

Course objectives:

1. Understand the basics of Cryptography concepts, Security and its principle
2. To analyse different Cryptographic Algorithms
3. To illustrate public and private key cryptography
4. To understand the key distribution scenario and certification
5. To understand approaches and techniques to build protection mechanism in order to secure computer networks

Teaching-Learning Process

These are sample Strategies, which teachers can use to accelerate the attainment of the various course outcomes.

1. Lecturer method (L) needs not to be only a traditional lecture method, but alternative effective teaching methods could be adopted to attain the outcomes.
2. Use of Video/Animation to explain functioning of various concepts.
3. Encourage collaborative (Group Learning) Learning in the class.
4. Ask at least three HOT (Higher order Thinking) questions in the class, which promotes critical thinking.
5. Adopt Problem Based Learning (PBL), which fosters students' Analytical skills, develop design thinking skills such as the ability to design, evaluate, generalize, and analyze information rather than simply recall it.
6. Introduce Topics in manifold representations.
7. Show the different ways to solve the same problem with different circuits/logic and encourage the students to come up with their own creative ways to solve them.
8. Discuss how every concept can be applied to the real world - and when that's possible, it helps improve the students' understanding
9. Use any of these methods: Chalk and board, Active Learning, Case Studies

Module-1 10 hours

A model for Network Security, Classical encryption techniques: Symmetric cipher model, Substitution ciphers-Caesar Cipher, Monoalphabetic Cipher, Playfair Cipher, Hill Cipher, Polyalphabetic Ciphers, One time pad, Steganography.

Block Ciphers and Data Encryption Standards: Traditional Block Cipher structures, data Encryption Standard (DES), A DES Example, The strength of DES, Block cipher design principles.

Chapter 1: 1.8 Chapter 3: 3.1, 3.2, 3.5 Chapter 4: 4.1, 4.2, 4.3, 4.4, 4.5

Module-2 10 hours

	Pseudorandom number Generators: Linear Congruential Generators, Blum Blum Shub Generator. Public key cryptography and RSA: Principles of public key cryptosystems-Public key cryptosystems, Applications for public key cryptosystems, Requirements for public key cryptography, Public key Cryptanalysis, The RSA algorithm: Description of the Algorithm, Computational aspects, The Security of RSA. Diffie-Hellman key exchange: The Algorithm, Key exchange Protocols, Man-in-the-middle Attack, Elliptic Curve Cryptography: Analog of Diffie-Hellman key Exchange, Elliptic Curve Encryption/Decryption, Security of Elliptic Curve Cryptography. Chapter 8: 8.2 Chapter 9: 9.1, 9.2 Chapter 10: 10.1, 10.4
	Module-3 10 hours
	Applications of Cryptographic Hash functions, Two simple Hash functions, Key management and distribution: Symmetric key distribution using symmetric encryption, Symmetric key distribution using asymmetric encryption, Distribution of public keys, X.509 Certificates, Public Key Infrastructures Chapter 11: 11.1, 11.2 Chapter 14: 14.1, 14.2, 14.3, 14.4, 14.5
	Module-4 10 hours
	User Authentication: Remote user authentication principles**,** Kerberos**,** Remote user authentication using asymmetric encryption. Web security consideration, Transport layer security. Email Threats and comprehensive email security, S/MIME, Pretty Good Privacy. Chapter 15: 15.1, 15.3, 15.4 Chapter 17: 17.1, 17.2 Chapter 19: 19.3, 19.4, 19.5
	Module-5 10 hours
	Domainkeys Identified Mail. IP Security: IP Security overview, IP Security Policy, Encapsulating Security Payload, Combining security associations, Internet key exchange. Chapter 19: 19.9 Chapter 20: 20.1, 20.2, 20.3, 20.4, 20.5

Course outcome

At the end of the course, the student will be able to :

CO1: Explain the basic concepts of Cryptography and Security aspects

CO2: Apply different Cryptographic Algorithms for different applications

CO**3:** Analyze different methods for authentication and access control.

CO4: Describe key management, key distribution and Certificates.

CO5: Explain about Electronic mail and IP Security.

Assessment Details (both CIE and SEE)

The weightage of Continuous Internal Evaluation (CIE) is 50% and for Semester End Exam (SEE) is 50%. The minimum passing mark for the CIE is 40% of the maximum marks (20 marks out of 50) and for the SEE minimum passing mark is 35% of the maximum marks (18 out of 50 marks). A student shall be deemed to have satisfied the academic requirements and earned the credits allotted to each subject/ course if the student secures a minimum of 40% (40 marks out of 100) in the sum total of the CIE (Continuous Internal Evaluation) and SEE (Semester End Examination) taken together.

Continuous Internal Evaluation:

- For the Assignment component of the CIE, there are 25 marks and for the Internal Assessment Test component, there are 25 marks.
- The first test will be administered after 40-50% of the syllabus has been covered, and the second test will be administered after 85-90% of the syllabus has been covered
- Any two assignment methods mentioned in the 22OB2.4, if an assignment is project-based then only one assignment for the course shall be planned. The teacher should not conduct two assignments at the end of the semester if two assignments are planned.
- For the course, CIE marks will be based on a scaled-down sum of two tests and other methods of assessment.

Internal Assessment Test question paper is designed to attain the different levels of Bloom's taxonomy as per the outcome defined for the course.

Semester-End Examination:

Theory SEE will be conducted by University as per the scheduled timetable, with common question papers for the course (**duration 03 hours).**

1. The question paper will have ten questions. Each question is set for 20 marks.
2. There will be 2 questions from each module. Each of the two questions under a module (with a maximum of 3 sub-questions), **should have a mix of topics** under that module.
3. The students have to answer 5 full questions, selecting one full question from each module.
4. Marks scored shall be proportionally reduced to 50 marks

Books

Text Books:

William stallings, "Cryptography and Network Security", Pearson Publication, Seventh Edition.

References:

1. Keith M Martin, "Everyday Cryptography", Oxford University Press
2. V.K Pachghare,"Cryptography and Network Security", PHI, 2nd Edition

Activity Based Learning (Suggested Activities in Class)/ Practical Based learning

- Group assignment (TWO) to implement Cryptographic Algorithms (15 + 10 marks)

EMBEDDED SYSTEMS		Semester	7
Course Code	**BIS714C**	CIE Marks	50
Teaching Hours/Week (L: T:P: S)	3:0:0:0	SEE Marks	50
Total Hours of Pedagogy	40	Total Marks	100
Credits	03	Exam Hours	03
Examination type (SEE)	Theory		

Course objectives:

- Identify the components, purpose and applications of the Embedded Systems
- Learn the RTOS and IDE for Embedded System Design
- Understand the fundamentals of ARM-based systems and basic architecture of CISC and RISC
- Familiarize with ARM programming modules along with registers, CPSR and Flags

Teaching-Learning Process (General Instructions)

These are sample strategies; which teachers can use to accelerate the attainment of the various course outcomes.

1. Lecturer method (L) does not mean only the traditional lecture method, but different types of teaching methods may be adopted to achieve the outcomes.
2. Utilize video/animation films to illustrate the functioning of various concepts.
3. Promote collaborative learning (Group Learning) in the class.
4. Pose at least three HOT (Higher Order Thinking) questions in the class to stimulate critical thinking.
5. Incorporate Problem-Based Learning (PBL) to foster students' analytical skills and develop their ability to evaluate, generalize, and analyze information rather than merely recalling it.
6. Introduce topics through multiple representations.
7. Demonstrate various ways to solve the same problem and encourage students to devise their own creative solutions.
8. Discuss the real-world applications of every concept to enhance students' comprehension.
9. Use any of these methods: Chalk and board, Active Learning, Case Studies.

Module-1

Introduction to Embedded Systems: What is an Embedded System? Embedded Systems Vs General Computing Systems, History of Embedded Systems, Classification of Embedded systems, Major Application Areas of Embedded Systems. Purpose of Embedded Systems.

The Typical Embedded System: Microprocessor vs. Microcontroller, RISC vs. CISC Processors, Harvard vs. Von-Neumann Processor Architecture, Big-Endian vs. Little-Endian Processors, Memory-ROM and RAM types, Sensors & Actuators, The I/O Subsystem – I/O Devices, Light Emitting Diode (LED), 7-Segment LED Display, Optocoupler, Relay, Piezo Buzzer, Push button switch, Communication Interfaces, On-board Communication Interfaces, External Communication Interfaces.

Textbook 1: Ch. 1.1-1.6, Ch. 2.1-2.4

Module-2

Embedded System Design Concepts: Characteristics and Quality Attributes of Embedded Systems, Operational and Non-Operational Quality Attributes. Embedded Systems-Application and Domain Specific, Hardware Software Co-Design and Program Modelling.

Embedded Firmware Design and Development: Embedded Firmware Design Approaches, Embedded Firmware Development Languages, Programming in Embedded C (Excluding C language).

Textbook 1: Ch. 3.1-3.2, Ch. 4.1-4.2 (4.2.1 and 4.2.2 only), Ch. 7.1-7.2, Ch. 9.1-9.3 (9.3.1 and 9.3.2 only)

Module-3

RTOS and IDE for Embedded System Design: Operating System Basics, Types of Operating Systems, Tasks, Process and Threads (Only POSIX Threads with an example program), Thread Preemption, Preemptive Task Scheduling Techniques, Task Communication, Task Synchronization Issues – Racing and Deadlock. How to Choose an RTOS, Integration and Testing of Embedded Hardware and Firmware, The Embedded System Development Environment.

Textbook 1: Ch. 10.1-10.3, 10.5.2, 10.7, 10.8.1.1, 10.8.1.2, 10.10, Ch. 12.1-12.2, Ch. 13.1

Module-4

ARM Embedded Systems: The RISC Design Philosophy, The ARM Design Philosophy, Embedded System Hardware, Embedded System Software.

ARM Processor Fundamentals: Registers, Current Program Status Register, Pipeline, Exceptions, Interrupts, and the Vector Table, Core Extensions

Textbook 2: Ch. 1.1-1.4, Ch. 2.1-2.5

Module-5

Introduction to the ARM Instruction Set: Data Processing Instructions, Branch Instructions, Load-Store Instructions, Software Interrupt Instruction, Program Status Register Instructions, Loading Constants.

Textbook 2: Ch. 3.1-3.6

Course outcome (Course Skill Set)

At the end of the course, the student will be able to:

1. Explain the characteristics and attributes of an Embedded System.
2. Illustrate the hardware software co-design and firmware design approaches of Embedded Systems.
3. Demonstrate the need of real time operating system for Embedded System applications.
4. Explain the ARM Architectural features and Instructions.
5. Develop programs using ARM instruction set for an ARM Microcontroller.

Assessment Details (both CIE and SEE)

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3. The students have to answer 5 full questions, selecting one full question from each module.
4. Marks scored shall be proportionally reduced to 50 marks

Suggested Learning Resources:

Text Book:

1. Shibu K V, "Introduction to Embedded Systems", Second Edition, Tata McGraw Hill Education.
2. Andrew N Sloss, Dominic Symes and Chris Wright, "ARM System Developers Guide – Designing and Optimizing System Software", Elsevier, Morgann Kaufman Publishers.

Reference Books:

1. Raj Kamal, "Embedded Systems: Architecture and Programming", Tata McGraw Hill, 2008.
2. Raghunandan.G.H, "Microcontroller (ARM) and Embedded System", Cengage learning Publication, 2019.
3. "Insider's Guide to the ARM7 based microcontrollers", Hitex Ltd.,1st edition, 2005.

Web links and Video Lectures (e-Resources):

- https://alison.com/tag/embedded-systems
- https://www.youtube.com/watch?v=uFhDGagZzjs
- https://www.youtube.com/watch?v=G1c_WMD_5pU
- https://archive.nptel.ac.in/courses/106/105/106105193/

Activity Based Learning (Suggested Activities in Class)/ Practical Based learning

- Demonstrate the Installation and working of Keil Software - Student group of TWO (10 Marks).
- Using Keil software, observe the various Registers, Dump, CPSR etc. and write Assembly Language Programs (15 Marks).