Batch 2023-2024 and onwards **w.e.f. 2023 (Revised 25/06/24)**

CHOICE BASED CREDIT SYSTEM

EVALUATION SCHEME

AND

COURSE OF STUDY

IN

B.TECH.

COMPUTER SCIENCE AND ENGINEERING

(III SEMESTER & IV SEMESTER)

SCHEME OF EXAMINATION & SYLLABUS

DEPARTMENT OF COMPUTER SCIENCE & ENGINEERING

FACULTY OF ENGINEERING AND TECHNOLOGY
GURUKULA KANGRI (DEEMED TO BE UNIVERSITY), HARIDWAR

Faculty of Engineering & Technology

In the year 2000 Faculty of Engineering & Technology was established with an aim of imparting technical education in the spiritual surroundings of the Gurukula System. Keeping in mind the importance of technocrats with strong moral character, superior knowledge, and devotion to the nation. FET was established with a motto of Building Technocrats with ethics. FET is known in India and abroad for students with virtuous moral character and Technical abilities. Currently, it is providing education in B. Tech. in Computer Science & Engineering, Electronics & Communication Engineering, Electrical Engineering, and Mechanical Engineering. FET is one of the richest faculty of Gurukula Kangri (Deemed to be University), with a huge number of books in the library, well-equipped electronics electrical and mechanical laboratories, latest software, and computers in computer labs. Football field, Tennis court, Volleyball court, Basketball arena, and open gym for the students with athletic interests.

Vision of F.E.T.

To provide affordable & quality education to engineering aspirants and nurture them to be highly skilled & innovative technocrats with ethics and nation building spirit.

Mission of F.E.T.

M1: (ETHICS & VALUES)
To educate and nurture engineering aspirants with values, updated engineering curriculum & latest technology to make them globally trusted and accepted.

M2: (RESEARCH)
Provide conducive environment for teaching, learning & research that can lead to patents, publications and make country proud.

M3: (AFFORDABILITY)
Provide cost effective education so that every section of society can be benefitted.

M4: (SKILLED)
Design industry oriented curriculum that can make engineering graduates ready to work for Indian Industries as well as MNCs.

Department of Computer Science & Engineering

The Department of Computer Science and Engineering (CSE) provides in-depth technical knowledge and opportunities for innovation and research with the latest computer facilities.

Vision And Mission

Vision of the department

To be a frontier in the field of Computer Science by imparting the knowledge in legible, lucid and perspicuous way and preparing the human resource of high moral and ethical values that can cater to contemporary societal needs.

Mission of the department

- **[M1]: (Contemporary excellence)**
  Provide a sound technical foundation in Computer Engineering through the comprehensive curriculum with a rich skill set and practical experience.
- **[M2]: (Holistic Learning)**
  To enable students to become valuable and creative contributors to society. To continue their education in different facets of technology to grow them professionally along with the spirit of moral values.
- **[M3]: (Social Responsibility & Sustainable Development)**
  To contribute to National Development by meeting the needs of society and industry, empowering weaker and underprivileged sections, and building the economy through research and frugal innovation, anchored in the principle of achieving more with less.
- **[M4]: (Ethics & Values)**
  To uphold the highest ethical standards, inculcate values; create willingness and capacity to work with one's hands, and a spirit of devotion to serve humanity.

Program Educational Objectives (Under Graduate Program)

- **PEO1:** To provide a cogent foundation in Basic Sciences, analytical skills and engineering fundamentals required to succeed in engineering field.
- **PEO2:** To provide knowledge of various domains catering to the contemporary requirements of the industry.
- **PEO3:** To train students with good scientific and practical engineering application skills to comprehend, analyze, design, and create feasible solutions for societal vows.
- **PEO4:** Inculcate analytical reasoning and critical thinking through effective teaching learning and hands-on training to develop an innovative spirit and pursue higher education for nation-building.
- **PEO5:** To encourage students to develop lifelong learning skills, self-motivation, and high moral and ethical values for a successful professional career.

Program Specific Outcomes (Under Graduate Program)

- **PSO1:** Graduates of Computer Science & Engineering will achieve the adequate understanding of the contents to analyze, design and implement sustainable solution in their domain.
- **PSO2:** Able to use problem-solving skills to develop efficient algorithmic solutions.

B. Tech. (Computer Science and Engineering)

Programme Framework

- Minimum Credits requirements for completion of B.Tech program is 174.
- The curriculum is designed to meet the prevailing and ongoing industrial requirements.
- The curriculum is flexible and offers Choice Based Credit System (CBCS) and follows New Education Policy(NEP).
- The curriculum inherits the Value based Education and offers Interdisciplinary/Multidisciplinary Courses.
- The Curriculum offers Digital Pedagogy & Flipped Learning with adequate motivation for Entrepreneurship/ Startups.
- The curriculum aims at the Holistic Development of the students.

Students can attend MOOC/NPTEL/any online courses (as per the department list), and the student shall share the result after the examination. The credit transfer will be done according to the prevailing norms of Gurukula Kangri Deemed to be University, Haridwar.

Minor in CSE for Other Branches

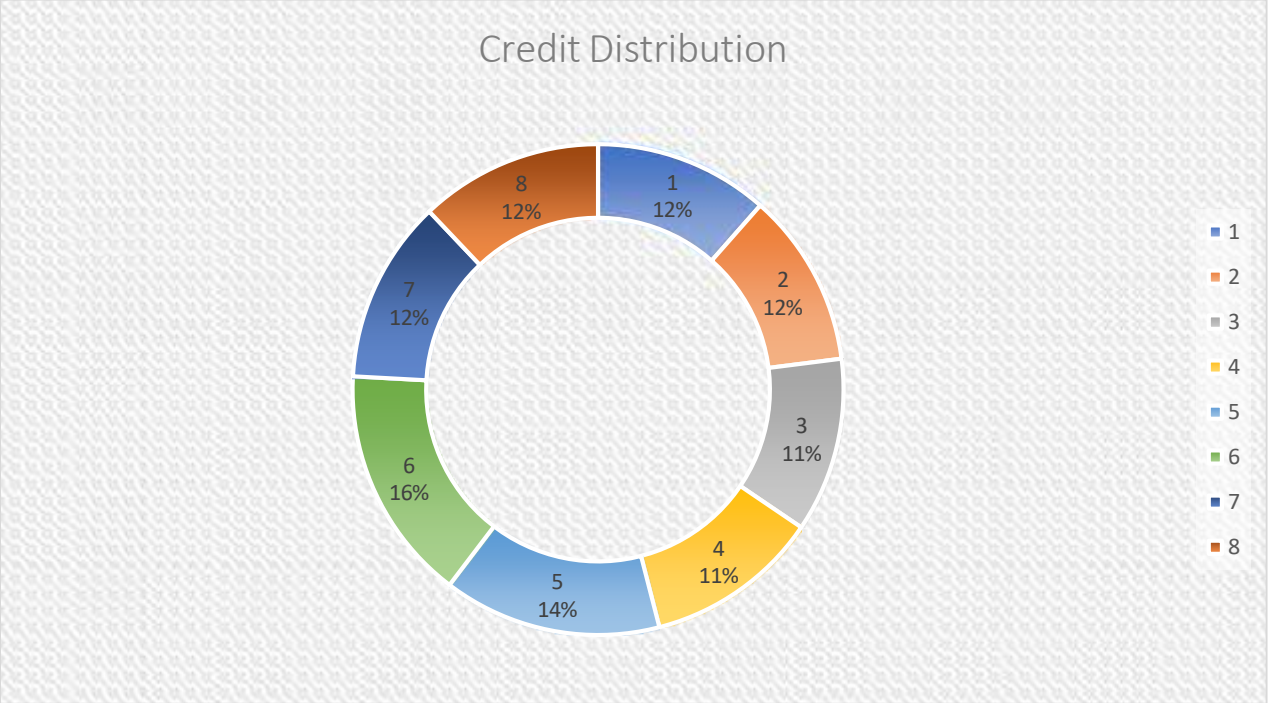
- The other branches students can opt for a Minor Degree in Computer Science and Engineering across any specialization offered by the department from the 5th Semester onwards by obtaining 20 credits in Computer Science and Engineering (18 credits in course work and 02 credits in projects which is compulsory) from the respective course pool.
- Students who have registered for B.Tech. Minor in Computer Science and Engineering can opt to study any courses completing 20 Credits listed below.
- Students enrolled for a Minor in CSE cannot take more than 2 subjects in one semester.
- Students should not have any repeat in the previous semesters.
- Minor Course certificate will only be issued once the student completes 20 credits from the above courses in the stipulated time.
- Students can attend MOOC/NPTEL/any online courses (as per department list), the student shall share the result after the examination. The credit transfer will be done according to the prevailing norms of Gurukula Kangri Deemed to be University, Haridwar.

S. No.	Course Code	Course Title	Credits
1	BCE-C305, BCE-C355	Data Structure I with LAB	3+1
2	BCE-C407	Operating System	3
3	BCE-C408, BCE-C455	Database Management System with LAB	3+1
4	BCE-C406 , BCE-C456	Object Oriented Programming using Java with Lab	3+1
5	BCE-C511	Computer Network	3
6	BCE-C513	Design & Analysis of Algorithm	3
7	BCE-C601	Theory of Computation	3
8	BCE-C711	Compiler Design	3
9	ON-MOOC2	MOOCS 1 (NPTEL)	3
10	ON-MOOC3	MOOCS 2 (NPTEL)	3
11	BCE-PXXX	Project (Compulsory)	2

Self-paced skill and ability enhancement courses:

To educate students globally faculty members of the Gurukula Kangri Deemed to be University are encouraged to develop self-paced courses individually or in collaboration with renowned mentors/ contributors/experts/companies. The students enrolled for the course shall be given certificate from the Gurukula Kangri Deemed to be University, Haridwar, after successful completion of the course. The courses shall be on a paid basis wherein 75 percent shall be given to the course instructor/course coordinator and 25 percent to the Faculty of Engineering & Technology, Gurukula Kangri Deemed to be University, Haridwar. The fee of the course shall be independently decided by the Course instructor/coordinator based on course hours and demand in the market.

Credit Distribution



ACADEMIC SESSION 2023-24

(Effective from the academic session 2023-24)

GURUKULA KANGRI (DEEMED TO BE UNIVERSITY), HARIDWAR
Faculty of Engineering & Technology
Computer Science & Engineering
B. Tech. Second Year
Syllabus in accordance with AICTE Model Curriculum

SEMESTER-III

DSC/SEC/DSE /AEC	SUBJECT	PERIODS			EVALUATION SCHEME				Subject Total	Credits
					SESSIONAL EVALUATION			EXAM ESE		
		L	T	P	CT	TA	Total			
THEORY										
BEM-C302	Engineering Mathematics– III	3	1	0	20	10	30	70	100	4
BET-C306	Digital System Design	3	0	0	20	10	30	70	100	3
BCE-C307	Python Programming	3	0	0	20	10	30	70	100	3
BCE-C305/ BCE-C405	Data Structure-I	3	0	0	20	10	30	70	100	3
BCE-C306	Computer Architecture & Organization	3	0	0	20	10	30	70	100	3
BCE-A360	MOOC	0	0	0	0	0	0	0	0	4
PRACTICAL										
BET-C355	Digital System Design Lab	0	0	2	10	5	15	35	50	1
BCE-C354	Python Programming lab	0	0	2	10	5	15	35	50	1
BCE-C355/ BCE-C454	Data Structure-I Lab	0	0	2	10	5	15	35	50	1
BCE-S361	Project I	0	0	2	35	15	50	--	50	1
		TOTAL CREDITS								
TOTAL		15	1	8	165	80	245	455	700	24

MOOC: Any 12-week MOOC course of 4 credits is valid and is dependent on the choice of students from the list of available courses at the NPTEL/SWAYAM platform. The student has to clear the examination and produce the certificate. Any fees applicable shall be incurred by the student himself. Henceforth, the credit will be transferred.

****Project I – A project group shall consist of not more than 4 students. A group can choose any mentor from the department, in case the project is multidisciplinary, mentors from other departments can be consulted.***

ACADEMIC SESSION 2023-24

(Effective from the academic session 2023-24)

GURUKULA KANGRI (DEEMED TO BE UNIVERSITY), HARIDWAR

Faculty of Engineering & Technology

Computer Science & Engineering

B. Tech. Second Year

Syllabus in accordance with AICTE Model Curriculum

SEMESTER-IV

DSC/SEC/DSE/ AEC	SUBJECT	PERIODS			EVALUATION SCHEME				Subject Total	Credits
					SESSIONAL EVALUATION			EXAM ESE		
		L	T	P	CT	TA	Total			
THEORY										
BEM-C403	Discrete Mathematics	3	1	0	20	10	30	70	100	4
BCE-C408	Database Management System	3	0	0	20	10	30	70	100	3
BCE-C406	Object Oriented Programming using Java	3	0	0	20	10	30	70	100	3
BCE-C407	Operating System	3	0	0	20	10	30	70	100	3
BET-C411	Microprocessor and Interfacing	3	0	0	20	10	30	70	100	3
BKT-A403	Bhartiya Gyan Parampara (IKT)	2	0	0	20	10	30	70	100	0
PRACTICAL										
BCE-C455	DBMS Lab	0	0	2	10	5	15	35	50	1
BCE-C456	Object Oriented Programming using Java Lab	0	0	2	10	5	15	35	50	1
BET-C461	Microprocessor and Interfacing Lab	0	0	2	10	5	15	35	50	1
BCE- S460	Project II	0	0	2	10	5	15	35	50	3
		TOTAL CREDITS								
TOTAL		17	1	8	160	80	240	560	800	22

	Summer training and Internship	**To be pursued during summer vacations, a certificate of completion is to be submitted to the department. It can be done Online/Offline. Any Online Course skill oriented from IBM Skills build/ Infosys Springboard or equivalent shall also be considered.**

Project II – A project group shall consist of not more than 4 students. A group can choose any mentor from the department, in case the project is multidisciplinary, mentors from other departments can be consulted. Project should have real-world application and should focus on betterment of societal needs and nation building.

Course Code: BEM- C302
Course Name: Engineering Mathematics-III

MM: 100 **Sessional Examination: 30**
Time: 3 Hr. **End Semester Examination: 70**
L T P **Credit : 4**
3 1 0

Prerequisites:	Engineering Mathematics I, Engineering Mathematics II
Objectives:	This course provides an introduction to the basic concepts and techniques of: 1. Laplace transform and its application to the solution of ordinary differential equations. 2. Fourier transform and its application to solve partial differential equations. 3. Z transform of elementary sequences both from the definition and by using tables and use the appropriate theorems to calculate Z transforms and inverse Z transforms. 4. Basic theory of function of a complex variable and theory of contour integration using residue calculus. 5. Errors and numerical solution of algebraic and transcendental equations.
Course Coordinator	**Dr Lokesh Kumar Joshi**
Course Faculty	Dr. Lokesh Kumar Joshi, Dr Vivek Goel
Lectures	40 Hours

NOTE:	The question paper shall consist of two sections (Section-A and Section-B). Section-A shall contain ten (10) short answer type questions of six (06) mark each and student shall be required to attempt any five (05) questions. Section-B shall contain eight (08) long answer type questions of ten (10) marks each and student shall be required to attempt any four questions. Questions shall be uniformly distributed from the entire syllabus

UNIT	Module	Course Content	No. of Hours	POs mapped
UNIT-1	Module-1	Laplace Transform: Definition, Laplace transform of elementary functions, Shifting theorems, Transform of derivatives, Differentiation and Integration of transforms,	**04**	PO1/PO2/PO3/PO4/PO5/PO6/PO7 , PO09, PO11/PO12
	Module-2	Heaviside unit step and Dirac Delta functions, Convolution theorem,	**02**	
	Module-3	Solution of ordinary linear differential equations used in Mechanics, Electric circuits and Bending of beams.	**02**	
UNIT-2	Module-3	Fourier Transform: Definition of Fourier transform, Fourier sine and cosine transforms. Fourier integral formula, Parsevel's identity	**06**	PO1/PO2/PO3/PO4/PO5/PO6/PO7 ,PO09, PO11/PO12
	Module-4	Applications of Fourier transform in solving heat equations.	**02**	
UNIT-3	Module-5	Z Transform: Definition, Linearity property, Z transform of elementary functions, Shifting theorems, Initial and final value theorem, Convolution theorem,	**04**	PO1/PO2/PO3/PO4/PO5/PO6/PO7 ,PO09, PO11/PO12
	Module-6	Inversion of Z transforms, Solution of difference equations by Z transforms.	**03**	
UNIT-4	Module-7	Function of Complex Variable: Definition, Limit and Continuity of functions of Complex Variables: Analytic Functions, Harmonic Conjugate, Cauchy-Riemann Equations (without proof), Line Integral, Cauchy-Goursat theorem (without proof), Cauchy Integral formula (without proof).	**05**	PO1/PO2/PO3/PO4/PO5/PO6/PO7 ,PO09, PO11/PO12
	Module-8	Singular Points, Poles & Residues, Residue Theorem, Application of Residues theorem for Evaluation of Real Integral (Unit Circle).	**04**	
UNIT-5	Module-9	Errors and Roots of equations: Absolute, relative, round-off and truncation errors. Significant digits. Algebraic and Transcendental Equations, Numerical solution, Method of bisection, Newton-Raphson method, Direct iterative method, convergence.	**08**	PO1/PO2/PO3/PO4/PO5/PO6/PO7 ,PO09, PO11/PO12
Total No. of Hours			**40**	

Course Outcome:	On completion of this course, the students will be able to 1. Apply Laplace transform in various engineering problems and solve the differential equations arising in mechanics and electrical circuits (L2, L3, L5, L6) 2. Understand the concept of Fourier transform and use it to solve partial differential equations having initial and boundary values (L1, L2, L3, L4). 3. Apply Z transform to convert discrete-time signals to the Z-domain, analyze system behavior, and use these techniques in digital signal processing and control systems. (L1, L2, L3, L4). 4. Learn the functions of complex variables and apply it to solve the problems of complex differentiation and integration(L1, L2, L3, L5). 5. Solve algebraic and transcendental equations by applying iterative methods and analyze their convergence.(L2,L3, L4,L5)

Suggested books:

S. No.	Name of Authors /Books /Publisher	Year of Publication
1.	Kreyszig E., Advanced Engineering Mathematics 10 edition, Wiley India Pvt. Ltd, ISBN- 9788126554232	2015
2.	Gerald, C.F., Wheatley P.O., Applied Numerical Analysis, Pearson, 2007, ISBN-ISBN-10 032119019X	2007
3.	Grewal B.S., Higher Engineering Mathematics, Khanna, New Delhi, ISBN-9788174091956	2000
4.	Jain R. K., Iyenger S.R.K., Jain M.K., Numerical Methods for Scientific and Engineering Computation, New Age International Publishers, ISBN- 812242001X	2010

L1 – Remember, L2 – Understand, L3 – Apply, L4 – Analyze, L5 – Evaluate, L6 – Create

Scheme of Evaluation

- Attendance required: 75 %
- End semester exam: 70 marks (complete syllabus)
- Sessional Exam: 20 marks
- Assignment/seminar/tutorial: 10 marks (Each student in small groups will apply these concepts to solve practical problems)

Course Outcomes	**Program Outcomes (POs)**											
(COs)	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**
CO1	3	3	1	3	2	2	1	-	1	-	3	2
CO2	3	3	2	2	2	2	1	-	1	-	1	2
CO3	3	3	3	2	2	2	1	-	1	-	2	2
CO4	3	2	3	3	2	2	1	-	1	-	1	2
CO5	3	2	2	2	2	2	1	-	1	-	3	3

Course Code: BET-C306
Course Name: DIGITAL SYSTEM DESIGN

MM: 100 **Sessional: 30**
Time: 3 Hr. **ESE: 70**
L T P **Credit : 3**
3 0 0

Prerequisites:	For this course, no pre-requisites are required. But should have knowledge of Diodes, transistors.
Objectives:	1. To get good knowledge of digital system. 2. Learn about the different number system that have different bases which plays very significant role in computer world. 3. During the course we can learn how to design the digital circuits by using Boolean algebra, K-maps and logic gates. 4. And to enable to implement synchronous state machines using flip-flops.
Course Coordinator	Dr. Tanuj Kumar Garg

NOTE:	The question paper shall consist of two sections (Section-A and Section-B). Section-A shall contain Ten (10) short answer type questions of six (06) mark each and student shall be required to attempt any five (05) questions. Section-B shall contain eight (08)long answer type questions of ten (10) marks each and student shall be required to attempt any four questions. Questions shall be uniformly distributed from the entire syllabus

UNIT	Module	Course Content	No. of Hours	POs mapped	PSOs mapped
UNIT-1	*Module-1*	**Number System**: Representation of negative numbers, 9's and 1's complement, 10's and 2's complement, arithmetic using 2's complement. BCD Code, Gray Code, Excess-3 Code, Introduction to Boolean algebra, Truth table verification of various gates, Realization of Switching functions with gates.	**3**	PO1/ PO2/ PO3/ PO5/ PO10/PO12	PSO1/ PSO2
	Module-2	**K- Map:** Representation up to 4 variables, simplification and realization of various functions using gates, Tabular Method, Combinational logic and design procedure.	**3**	PO1/ PO2/ PO3/ PO5/ PO10/PO12	PSO1/ PSO2
UNIT-2	*Module-3*	**Combinational logic Circuits:** Arithmetic circuits, Half and Full adder, Subtractors, BCD adders, Code Conversion, 4 bit Magnitude Comparator (IC -7485), Cascading of IC 7485, Decoder, Multiplexer, Demultiplexers, Encoders. Parallel Binary adder, IC 7483, 4-bit Binary parallel adder/subtractor	**9**	PO1/ PO2/ PO3/ PO5/ PO10/PO12	PSO1/ PSO2
UNIT-3	*Module-4*	**Sequential Logic Circuits:** Flip Flops, S-R latch, gated latches, Edge triggered Flip Flops, Master-slave Flip Flops, Conversion of flip flops, Analysis of clocked sequential circuits, Design of synchronous circuits, State transition diagram, state reduction and assignment.	**10**	PO1/ PO2/ PO3/ PO5/ PO10/PO12	PSO1/ PSO2
UNIT-4	*Module-5*	**Counters:** Design of Asynchronous and Synchronous Counters, Two bits & four bits up & down counters and their design, Shift registers, Serial & Parallel data transfer, Shift left/Right register, Shift Register applications.	**8**	PO1/ PO2/ PO3/ PO5/ PO10/PO12	PSO1/ PSO2
UNIT-5	*Module-6*	**Logic Families:** Diode switching, Transistors as a switching element, MOS as a digital circuit element, concept of transfer characteristics, input characteristics and output characteristics of logic gates, fan in, fan out, noise margin, Logic families: TTL, IIL, ECL, NMOS, & CMOS, Open collector outputs.	**7**	PO1/ PO2/ PO3/ PO5/ PO10/PO12	PSO1/ PSO2
Total No. of Hours			**40**		

Learning Outcomes:	At the end of this course students will demonstrate the ability to • Design and analyze combinational logic circuits. • Design & analyze modular combinational circuits with MUX/DEMUX, Decoder, Encoder. • Design & analyze synchronous sequential logic circuits.

Suggested books:

S. No.	Name of Authors /Books /Publisher
1.	M.Morris Mano, Digital Design, PHI
2.	R.P.Jain, Modern Digital electronics, TMH
3.	A.Anand Kumar, Fundamentals of Digital Circuits, PHI
4.	Lee S.C, Modern Switching Theory and Digital design, PHI
5.	Greenfield J.D., Practical Digital design using ICs, John Wiley.

	CO-PO/PSO MAPPING													
Course Outcomes (COs)	**Program Outcomes (POs)**												**Program Specific Outcomes (PSOs)**	
	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**	**PSO1**	**PSO2**
CO1	**3**		**3**	**3**	**3**							**3**	**3**	**3**
CO2	**3**		**3**	**3**	**3**							**3**	**3**	**3**
CO3	**3**		**3**	**3**	**3**							**3**	**3**	**3**
CO4	**3**		**2**	**1**	**3**							**3**	**3**	**3**
CO5	**3**		**2**	**1**	**3**							**3**	**3**	**3**
CO6	**3**		**1**	**1**	**3**							**3**	**3**	**3**
CO7	**3**		**1**	**3**	**3**							**3**	**3**	**3**
CO8	**3**		**1**	**3**	**3**							**3**	**3**	**3**
CO9	**3**		**1**	**3**	**3**							**3**	**3**	**3**
CO10	**3**		**1**	**1**	**3**							**3**	**3**	**3**

Course Code: BCE-C307
Course Name: Python Programming

MM: 100 **Sessional: 30**
Time: 3 Hr. **ESE: 70**
L T P **Credit : 3**
3 1 0

Prerequisites:	Object Oriented Programming Paradigms, C
Objectives:	1. Describe the core syntax and semantics of Python programming language. 2. Understand working with the strings and functions. 3. Illustrate the process of structuring the data using lists, dictionaries, tuples and sets.
Course Coordinator	Mr. Namit Khanduja

NOTE:	The question paper shall consist of two sections (Section-A and Section-B). Section-A shall contain Ten (10) short answer type questions of six (06) mark each and student shall be required to attempt any five (05) questions. Section-B shall contain eight (08)long answer type questions of ten (10) marks each and student shall be required to attempt any four questions. Questions shall be uniformly distributed from the entire syllabus

Module	Course Content	No. of Hours	POs mapped	PSOs mapped
Module-1	Introduction to Python – Installation – Python Interpreter – Variables, Expressions and Statement – Assignment Statements, Variables Name, Expressions & Statements, Order of Operations & String Operations.	**06**	1,9	1
Module-2	Functions – Function Calls, Math Functions, Adding New Functions, Definition & Uses, Parameters & Arguments	**10**	1,2,9	1
Module-3	Conditional & Recursions – Boolean Expressions, Logical Operators, Conditional Execution, Chained Conditional Executions, Recursion	**08**	1,2,3,4,5, 9,12	1
Module-4	Strings, Lists, Dictionaries, Tuples – Introduction to Strings, Lists, Dictionaries and Tuples.	**08**	1,2,3,4,5, 9,12	1
Module-5	Introduction to Objects and classes.	**08**	1,2,5,9, 12	1,2
Total No. of Hours		**40**		

Learning Outcomes:	**CO1 Knowledge (Remembering) L1** Define the features, basic syntax and fundamental data types in Python. Recall and explain the principles of variables, data structures, and control structures used in Python programming. **CO2 Comprehension (Understanding) L2** Interpret and explain Python code snippets and programs. Compare and contrast different data structures and their appropriate usage in Python. **CO3 Application (Applying) L3** Develop simple Python programs to solve real-world problems. Apply conditional statements, loops, and functions to solve programming challenges. **CO4 Analysis (Analyzing) L4** Analyze and debug Python code to identify and correct errors. Evaluate and critique the efficiency and readability of Python programs. **CO5 Synthesis (Creating) L5** Create Python applications and scripts to automate tasks or address specific problems. Design and implement Python functions for solving complex problems or building reusable code.

Suggested books:

S. No.	Name of Authors /Books /Publisher
1.	How to Think Like a Computer Scientist: Learning with Python (3nd edition) Peter Wentworth Jeffrey Elkner, Allen B. Downey, and Chris Meyers. http://openbookproject.net/thinkcs/python/english3e/
2.	A Byte of Python by Swarooph CH https://python.swaroopch.com/
3.	The Python Tutorial available at http://docs.python.org/3.3/tutorial/
4.	Python Documentation available at http://www.python.org/doc/

CO-PO/PSO MAPPING														
Course Outcomes	**Program Outcomes (POs)**												**Program Specific Outcomes (PSOs)**	
(COs)	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**	**PSO1**	**PSO2**
CO1	**3**	**2**											**1**	
CO2	**3**	**2**	**1**										**1**	
CO3	**3**	**2**	**1**										**1**	
CO4	**1**	**1**		**1**	**1**				**1**			**1**	**1**	
CO5	**1**	**1**	**1**	**1**	**1**				**1**			**1**	**1**	**1**

Course Code: BCE-C305/BCE-C405
Course Name: DATA STRUCTURE - I

MM: 100 **Sessional: 30**
Time: 3 Hr. **ESE: 70**
L T P **Credit : 3**
3 0 0

Prerequisites:	None
Objectives:	1. Analyze the asymptotic performance of algorithms. 2. Write rigorous correctness proofs for algorithms. 3. Demonstrate a familiarity with major algorithms and data structures. 4. Apply important algorithmic design paradigms and methods of analysis. 5. Synthesize efficient algorithms in common engineering design situations.
Course Coordinator	Dr. Suyash Bhardwaj

NOTE:	The question paper shall consist of two sections (Section-A and Section-B). Section-A shall contain Ten (10) short answer type questions of six (06) mark each and student shall be required to attempt any five (05) questions. Section-B shall contain eight (08)long answer type questions of ten (10) marks each and student shall be required to attempt any four questions. Questions shall be uniformly distributed from the entire syllabus

Module	Course Content	No. of Hours	POs mapped	PSOs mapped
Module-1	**Introduction to Algorithm Design and Data Structure**: Design & analysis of algorithm, Top-down and Bottom-up approaches to algorithm design, Analysis of Algorithm, Frequency count, Complexity measures in terms of time and space. **Arrays, Stacks and Queues**: Representation of Array (Single & Multi-Dimensional Arrays), Address Calculation using column & row major Ordering, Array and linked representation and implementation of queues. Applications of Arrays, Stacks & Queues; Conversion from Infix to Postfix & Prefix and Evaluation of Prefix expressions using Stack, Array and linked representation and implementation of queues, Operations on Queue: Create, Add, Delete, Full and Empty. Circular queue, Deque and Priority Queue	**10**	1,2,9,12	1
Module-2	**Linked List**: Representation and Implementation of Singly Linked List, Two-way Header List, Traversing and Searching of Linked List, Overflow and Underflow, Insertion and Deletion to/from Linked List, Insertion and Deletion Algorithms, doubly linked List, Linked List in Array, Polynomial representation and addition, generalized linked list, Uses and Application	**07**	1,2,3,9,12	1
Module-3	**Trees**: Basic terminology, Binary Trees, Binary Tree Representation, Algebraic Expressions, Complete Binary Tree. Extended Binary Trees, Array and Linked representation of Binary trees, Traversing Binary trees. **Binary Search Tree**: Binary Search Tree (BST), Insertion and Deletion in BST, Complexity of search algorithm, Path Length, AVL Tree, Balancing in AVL Trees, B-trees, uses and applications.	**07**	1,2,3,9,12	1,2
Module-4	**Graphs:** Introduction, Definition, Directed and undirected graph, Degree, incidence, adjacent vertices, path, cycle, connected and unconnected graph, complete graph, connectedness, weighted graph, subgraph, spanning trees.	**08**	1,2,3,4,9, 12	1,2

	Graph Representation: Adjacency matrix, adjacency list, Incidence matrix. Traversal of graph: Depth first search, Breadth first search. Shortest path problem, Dijkstra's algorithm. Minimum spanning tree, Kruskal's algorithm, prim's algorithm			
Module-5	**Searching:** Sequential Search, Binary Search, Comparison and implementation. **Sorting:** Insertion Sort, Bubble Sorting, Quick Sort, Two-way Merge Sort, Heap Sort, Sorting on Different Keys, Practical consideration for Internal Sorting. **Hashing**: Hash table, Hash Functions, Collision Resolution Strategies, Hash Table Implementation. Uses and applications.	**08**	1,2,3,4,5,9 ,12	1,2
Total No. of Hours		**40**		

Learning Outcomes:	● Design correct programs to solve problems. ● Choose efficient data structures and apply them to solve problems. ● Analyze the efficiency of programs based on time complexity. ● Prove the correctness of a program using loop invariants, pre-conditions, and post-conditions in programs ● Develops skills in implementations and applications of data structures.

Suggested books:

S. No.	Name of Authors /Books /Publisher
1.	Horowitz and Sahani, Fundamentals of Data Structure, Galgotia.
2.	R.Kruse etal, Data Structures and Program Design in C, Pearson Education.
3.	Lipschutz, Data Structure, TMH.
4.	Bruno R Preiss, Data Structures and Algorithms with Object Oriented Design Pattern in C++, John Wiley & Sons, Inc.
5.	Yashwant Kanetkar, Pointers in C, BPB.
6.	A M Tenenbaum etal, Data Structure using C & C++, PHI.
7.	K. Loudon, Mastering Algorithms with C, Sheoff Publisher & Distributors.

CO-PO/PSO MAPPING

Course Outcomes	Program Outcomes (POs)												Program Specific Outcomes	
(COs)	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	3			1				1			1	2	2
CO2	3	2											2	2
CO3	2	2	3	3									1	1
CO4	1	1	2	2									2	2
CO5	1	1							1			1	1	1

Course Code: BCE-C306
Course Name: Computer Architecture and Organization

MM: 100 **Sessional: 30**
Time: 3 Hr. **ESE: 70**
L T P **Credit : 3**
3 0 0

Prerequisites:	None
Objectives:	1. The purpose of the course is to introduce principles of computer organization and the basic architectural concepts. 2. It begins with basic organization, design, and programming of a simple digital computer and introduces simple register transfer language to specify various computer operations. 3. Topics include computer arithmetic, instruction set design, microprogrammed control unit, pipelining and vector processing, memory organization and I/O systems, and multiprocessors
Course Coordinator	Dr. Aman Tyagi

NOTE:	The question paper shall consist of two sections (Section-A and Section-B). Section-A shall contain Ten (10) short answer type questions of six (06) mark each and student shall be required to attempt any five (05) questions. Section-B shall contain eight (08) long answer type questions of ten (10) marks each and student shall be required to attempt any four questions. Questions shall be uniformly distributed from the entire syllabus.

Module	Course Content	No. of Hours	POs mapped	PSOs mapped
Module-1	Register Transfer Language, Bus and Memory Transfers, Bus Architecture, Bus Arbitration, Arithmetic Logic, Shift Micro-operation, Arithmetic Logic Shift Unit, Arithmetic Algorithms (addition, subtraction, Booth's Multiplication), IEEE standard for Floating point numbers	**08**	1,2	1
Module-2	Control Design: Hardwired & Micro Programmed Control Unit, Fundamental Concepts (Register Transfers, performing of arithmetic or logical operations, fetching a word from memory, storing a word in memory), Execution of a complete instruction, Multiple-Bus organization, Microinstruction, Microprogram sequencing, Wide-Branch addressing, Microinstruction with Next-address field, Prefetching Microinstruction.	**09**	1,2,3	1
Module-3	Processor Design: Processor Organization: General register organization, Stack organization, addressing mode, Instruction format, Data transfer & manipulations, Program Control, Reduced Instruction Set Computer (RISC), Complex Instruction Set Computer (CISC).	**09**	1,2,3,5	1,2
Module-4	Input-Output Organization: I/O Interface, Modes of transfer, Interrupts & Interrupt handling, Direct Memory access, Input-Output processor, Serial Communication	**08**	1,2,3,4, 6	1,2
Module-5	Memory Organization: Memory Hierarchy, Main Memory (RAM and ROM Chips), organization of 2D, Auxiliary memory, Cache memory, Virtual Memory, Memory management hardware.	**06**	1,2,3,4, 8	1,2
TOTAL	**40**			

Learning Outcomes:	• List various types of microoperations and arithmetic algorithms • Elaborate the concept of control design and microinstruction • Illustrate Processor Organization, addressing mode, Instruction format • Compare the Reduced Instruction Set Computer (RISC) & Complex Instruction Set Computer (CISC) and Hardwired & Micro Programmed Control Unit • Explain the concept of Input-Output Organization, Memory Organization

Suggested books:

S. No.	Name of Authors /Books /Publisher
1.	M. Mano, Computer System Architecture, PHI
2.	Vravice, Zaky & Hamacher, Computer Organization, TMH Publication
3.	Tannenbaum, Structured Computer Organization, PHI
4.	Stallings, Computer Organization, PHI
5.	John P.Hayes, Computer Organization, McGraw Hill

CO-PO/PSO MAPPING

Course Outcomes	Program Outcomes (POs)												Program Specific Outcomes (PSOs)	
(COs)	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	3	1		1								1	1
CO2	3	3	1										1	1
CO3	3	2	2			1							1	1
CO4	2	2	2	1				1					1	1
CO5	2	2	1	1									1	1

Course Code: BET-C355
Course Name: Digital System Design Lab

MM: 100 **Sessional: 15**
Time: 3 Hr. **ESE: 35**
L T P **Credit: 1**
0 0 2

Prerequisites:	Basic Electrical Engg.
Objectives:	Students will perform different combinational and sequential digital circuits using gates and ICs.
Course Coordinator	Ashish Nainwal
Notes	1. In practical examination the student shall be required to perform one experiment. 2. A teacher shall be assigned 20 students for daily practical work in laboratory. 3. No batch for practical class shall consist of more than 20 students. 4. The number of students in a batch allotted to an examiner for practical examination shall not exceed 20 students. 5. Addition/deletion in above list may be made in accordance with the facilities available with the approval of H.O.D./Dean.

LIST OF EXPERIMENTS:

1. To verify the truth tables of various types of gates using IC 7400.
2. To verify the truth tables of Multiplexer & also implement a function using Multiplexer.
3. To design & verify the truth table of half & full adder.
4. To design & verify the truth table SR flip-flop using NOR/NAND gates.
5. To design & verify the truth table JK flip-flop using NOR/NAND gates.
6. To design & study counters.
7. To design & study Shift registers.
8. To verify the truth tables of de Multiplexer.

Course Outcomes:		Bloom's Knowledge Level
CO1	Understanding of Digital Binary System and implementation of Gates.	L2
CO2	Analyze the Sequential circuits with the help of combinational circuits and feedback element.	L4
CO3	Evaluate and design the counters with the help of sequential circuit and basic Gates.	L5
CO4	Design data selector circuits with the help of universal Gates.	L6
CO5	Design the shift registers using sequential circuit and basic Gates	L6

			CO-PO/PSO MAPPING													
Course Outcomes (COs)			**Program Outcomes (POs)**												**Program Specific Outcomes (PSOs)**	
			PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**	**PSO1**	**PSO2**
CO1	**Define**	**L1**	**3**												**3**	**3**
CO2	**Interpret**	**L2**	**3**	**2**	**2**										**3**	**3**
CO3	**Explain**	**L2**	**3**	**2**	**2**										**2**	**2**
CO4	**Experiment with**	**L3**	**3**	**3**	**3**	**2**									**2**	**3**
CO5	**Analyze**	**L4**	**3**	**3**	**2**	**2**									**2**	**3**

Course Code: BCE-C354
Course Name: Python Programming Lab

MM: 50 **Sessional: 15**
Time: 3 Hr. **ESE: 35**
L T P **Credit: 01**
0 0 2

Objectives:	1. To demonstrate Python data structures like Strings, Lists, Tuples, Sets, and dictionaries. 2. To understand Functions, generators, comprehension, and Operators in Python Programming.
Course Coordinator	Mr. Namit Khanduja

NOTE:	1. In practical examination, the student must perform one experiment. 2. A teacher shall be assigned 20 students for daily practical work in the laboratory. 3. No batch for a practical class shall consist of more than 20 students. 4. The number of students in a batch allotted to an examiner for practical examination shall not exceed 20 students. **5.** Addition/deletion in above list may be made in accordance with the facilities available with the approval of H.O.D./Dean.

LIST OF EXPERIMENTS	**No. of Hours / Week**	**POs mapped**	**PSOs mapped**
1. Programs with variables, lists, tuples, dictionaries	**02**	1,2,3	1,2
2. Programs for functions, lambda functions, and various function parameters		1,2,3	
3. Programs for operators and string operations.		1,2,3	
4. Milestone projects		1,2,3	
5. Compulsory Capstone Project		1,2,3,4,5,9,12	

Learning Outcomes	**CO1 Knowledge (Remembering):** List and explain basic programming concepts in Python, such as variables, loops, and conditionals. **CO2 Comprehension (Understanding):** Demonstrate an understanding of the principles of input/output operations and error handling in Python. **CO3 Application (Applying):** Construct Python programs that utilize functions and modules to solve real-world tasks. **CO4 Analysis (Analyzing):** Analyze and identify errors in Python code, offering explanations and solutions. Break down complex programming problems into smaller, manageable components. **CO5 Synthesis (Creating):** Design and create original Python programs to address complex tasks or problems. Combine various Python concepts, data structures, and libraries to develop functional and efficient applications.

CO-PO/PSO MAPPING

Course Outcomes	**Program Outcomes (POs)**												**Program Specific Outcomes (PSOs)**	
(COs)	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**	**PSO1**	**PSO2**
CO1	3	2											1	
CO2	3	2											1	1
CO3	3	1			1					1		1	1	1
CO4	1	1	1	1	1					1		1	1	1
CO5	1	1	1	1	1					1		1	1	1

Course Code: BCE-C355/BCE-C454
Course Name: Data Structure 1 Lab

MM: 50 **Sessional: 15**
Time: 3 Hr. **ESE: 35**
L T P **Credit: 01**
0 0 2

Objectives:	1. To develop skills to design and analyze simple linear and non-linear data structures. 2. To develop skills to implement searching and sorting.
Course Coordinator	Dr. Suyash Bhardwaj

NOTE:	1. In practical examination the student shall be required to perform one experiment. 2. A teacher shall be assigned 20 students for daily practical work in laboratory. 3. No batch for practical class shall consist of more than 20 students. 4. The number of students in a batch allotted to an examiner for practical examination shall not exceed 20 students. 5. Addition/deletion in above list may be made in accordance with the facilities available with the approval of H.O.D./Dean

LIST OF EXPERIMENTS	**No. of Hours/ Week**	**POs mapped**	**PSOs mapped**
1. Array implementation of Stack.	**02**	1	1,2
2. Array implementation of Queue.		1	1,2
3. Array implementation of Circular Queue.		1	1,2
4. Implementation of Linked List.		2	1,2
5. Implementation of Circular Linked List		2	1,2
6. Implementation of Doubly Linked List		2	1,2
7. Implementation of Stack using list.		3	1,2
8. Implementation of Queue using list.		3	1,2
9. Implementation of Binary Search Tree.		4	1,2
10. Insertion and Deletion in BST.		4	1,2
11. Implementation of Searching and Sorting Algorithms.		5	1,2
12. Implementation of a hash function.		5	1,2

Learning Outcomes:	● Develop program for stack, queue and circular queue ● Compile linked list, Circular linked list, doubly linked list via program ● Apply list in stack and queue via programs ● Create and delete from Binary search tree via programs ● Illustrate different types of searching and sorting algorithms by making programs

CO-PO/PSO MAPPING

Course Outcomes	**Program Outcomes (POs)**												**Program Specific Outcomes (PSOs)**	
(COs)	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**	**PSO1**	**PSO2**
CO1	3	2	1										1	1
CO2	3	2	1										1	1
CO3	3	1	1										1	1
CO4	3	1	1	1									1	1
CO5	3	1	1	1	1								2	2

Course Code: BET-C361
Course Name: Project I

MM: 50 **Sessional: 50**
Time: 3 Hr. **ESE: 0**
L T P **Credit : 1**
0 0 2

The project is to be done by students in batches with maximum number of students four. A single student is not allowed to do the project. Project must focus on solving some problem and demonstrate the skills learned till fourth semester. Examples of projects can be taken from various hackathon conducted from time to time by different organizations/companies.

Here are some websites that can be referred:

1. GitHub - [GitHub Topics] (https://github.com/topics)
2. IEEE Xplore - [IEEE Project Ideas] (https://ieeexplore.ieee.org)
3. Hackster.io - [Hackster.io Projects] (https://www.hackster.io/projects)
4. Instructables - [Instructables Technology Projects] (https://www.instructables.com/technology/projects/)
5. Project Ideas on Electronics Hub - [Electronics Hub] (https://www.electronicshub.org/electronics-projects-ideas/)
6. Devpost - [Devpost Hackathons] (https://devpost.com/hackathons)
7. Hackathon.com- [Hackathon.com] (https://www.hackathon.com/)
8. Major League Hacking (MLH) - [MLH Hackathons] (https://mlh.io/)
9. HackerEarth - [HackerEarth Hackathons] (https://www.hackerearth.com/challenges/hackathon/)
10. TechGig - [TechGig Hackathons] (https://www.techgig.com/hackathon)

Course Code: BCE-C408
Course Name: Database Management System

MM: 100 **Sessional: 30**
Time: 3 Hr. **ESE: 70**
L T P **Credit : 3**
3 0 0

Prerequisites:	
Objectives:	The course, Database Management Systems, provides an introduction to the management of database systems. The course emphasizes the understanding of the fundamentals of relational systems including data models, database architectures, and database manipulations. The course also provides an understanding of new developments and trends such as Internet database environment and data warehousing. The course uses a problem-based approach to learning
Course Coordinator	Dr. Nishant Kumar

NOTE:	The question paper shall consist of two sections (Section-A and Section-B). Section-A shall contain Ten (10) short answer type questions of six (06) mark each and student shall be required to attempt any five (05) questions. Section-B shall contain eight (08)long answer type questions of ten (10) marks each and student shall be required to attempt any four questions. Questions shall be uniformly distributed from the entire syllabus

Module	Course Content	No. of Hours	POs mapped	PSOs mapped
Module-1	I**ntroduction**: An overview of Database Management System, Database System Vs File System, Database system concept and architecture, data models schema and interfaces, data definitions language, DML, Overall Database Structure. Data Modeling using the Entity Relationship Model: ER model concepts, notation for ER diagram, mapping constraints, keys, Concepts of Super Key, candidate key, primary key, Generalization, aggregation, reduction of an ER diagram to tables, extended ER model, relationship of higher degree.	**07**	1,2,3	1,2
Module-2	**Relational Data Model and Language:** Relational Data Model concepts, integrity constraints: entity integrity, referential integrity, Keys constraints, Domain Constraints, relational algebra, relational calculus, tuple and domain calculus. **Introduction to SQL:** Characteristics of SQL, Advantages of SQL, SQL data types and literals, Types of SQL commands, SQL operators and their procedure, Tables, views and indexes, Queries and subqueries, Aggregate functions, Insert, update and delete operations, Joins, Union, Intersection, Minus.	**09**	1,2,3,4	1,2
Module-3	**Data Base Design & Normalization:** Functional dependencies, normal forms, first, second, third normal forms, BCNF, inclusion dependencies, loss less join decomposition, normalization using FD, MVD and JDs, alternative approaches to database design.	**09**	1,3,4,5	1,2
Module-4	**Transaction Processing Concepts:** Transaction system, Testing of serializability, Serializability of schedules, conflict & view Serializable schedule, recoverability, Recovery from transaction failures, log-based recovery, deadlock handling.	**07**	1,2,3,11	1,2
Module-5	**Concurrency Control Techniques:** Concurrency Control, Locking Techniques for Concurrency control, Time stamping protocols for concurrency control, validation-based protocol, multiple granularities, multi-version schemes, Recovery with concurrent transaction, Transaction processing in Distributed system, Data fragmentation, Replication and allocation techniques for distributed system, overview of concurrency control and recovery in distributed database.	**08**	1,2,3,4	1,2
Total No. of Hours		**40**		

Learning Outcomes:	**CO1 Knowledge and Comprehension:** Define and compare Database Management Systems (DBMS) with traditional File Systems, explaining the advantages and limitations of each. Describe the core components and architecture of a Database System, including data models, schemas, interfaces, and the overall structure. **CO2 Application and Analysis**: Analyze and apply the principles of the Entity Relationship (ER) model, including notation for ER diagrams, mapping constraints, and the concepts of Super Key, Candidate Key, and Primary Key. Apply data modeling techniques to reduce an ER diagram to relational tables and understand the extended ER model and relationships of a higher degree. **CO3 Synthesis and Evaluation:** Evaluate the concepts of the Relational Data Model, including integrity constraints such as entity integrity, referential integrity, keys constraints, and domain constraints. Synthesize knowledge of relational algebra, relational calculus, tuple and domain calculus to formulate complex queries and assess their correctness. **CO4 Analysis and Application:** Analyze the characteristics and advantages of SQL (Structured Query Language), including SQL data types, literals, and the different types of SQL commands. Apply SQL operators and procedures effectively to create, modify, and retrieve data in database tables, as well as handle queries, subqueries, and aggregate functions. **CO5 Evaluation and Creation:** Critically evaluate the concepts of database design and normalization, including functional dependencies, normal forms (1NF, 2NF, 3NF, BCNF), and inclusion dependencies. Create and optimize database designs through normalization techniques involving Functional Dependencies (FD), Multi-Valued Dependencies (MVD), and Join Dependencies (JD), while considering alternative approaches to database design. Examine recoverability and recovery techniques from transaction failures, including log-based recovery and deadlock handling.

Suggested books:

S. No.	Name of Authors /Books /Publisher
1.	Date C.J., An Introduction to Database System, Addision Wesley.
2.	Korth, Silbertz, Subaeshan, Database Concepts, McGraw Hill.
3.	Elmasri, Navathe, Fundamentals of Database Systems, Addision Wesley.
4.	Paul Beynon Davies, Database System, Palgrave Macmillan.

CO-PO/PSO MAPPING

Course Outcomes	Program Outcomes (POs)												Program Specific Outcomes (PSOs)	
(COs)	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	2	2								3		1	1
CO2	3		3								3		1	1
CO3	3	2	3								3		1	1
CO4	3		3	3							3		1	1
CO5	3		3	3	2						3		2	2

Course Code: BCE-C406
Course Name: Object-Oriented Programming using Java

MM: 100 **Sessional: 30**
Time: 3 Hr. **ESE: 70**
L T P **Credit : 3**
3 0 0

Prerequisites:	Any programming language
Objectives:	1. Learn, understand, and remember the basic concepts of object-oriented programming paradigm in Java programming. 2. Get a clear understanding of basics of java Programming. 3. To examine key aspects of java Standard API library 4. To learn java's exception handling mechanism, multithreading, packages, and interfaces 5. To learn and analyze concepts related to JDBC and java servlets 6. To develop applications and analyze solutions using java technologies.
Course Coordinator	Mr. Namit Khanduja
NOTE	The question paper shall consist of two sections (Section-A and Section-B). Section-A shall contain Ten (10) short answer type questions of six (06) mark each and student shall be required to attempt any five (05) questions. Section-B shall contain eight (08) long answer type questions of ten (10) marks each and student shall be required to attempt any four questions. Questions shall be uniformly distributed from the entire syllabus

UNIT	Module	Course Content	No. of Hours	POs mapped	PSOs mapped
UNIT-1	*Module-1*	**Introduction:** Creation of Java, the importance of byte code, OOP Principles, Encapsulation, Inheritance and Polymorphism, data types, variables, declaring variables, dynamic initialization, scope and lifetime of variables, arrays, operators, control statements, type conversion, and casting.	03	1,2	1
	Module-2	**Classes and Objects**: Concepts of classes and objects, class fundamentals Declaring objects, assigning object reference variables, introducing methods, constructors, usage of static with data and methods, usage of final with data, access control, this keyword, garbage collection, overloading methods and constructors, parameter passing – call by value, recursion, nested classes and inner classes, exploring the String class.	05	1,2	1
UNIT-2	*Module-3*	**Inheritance:** Basic concepts, member access rules, usage of super keyword, forms of inheritance, method overriding, abstract classes, dynamic method dispatch, using final with inheritance, the Object class.	04	1,2,3	1,2
	Module-4	**Packages and Interfaces:** Defining, Creating, and Accessing a Package, understanding class path, importing packages, differences between classes and interfaces, defining an interface, implementing an interface, applying interfaces, variables in interface, and extending interfaces.	03	1,2,3	1,2
UNIT-3	*Module-5*	**Exception Handling and Multithreading**: Concepts of Exception handling, types of exceptions, usage of try, catch, throw, throws, and finally keywords, Built-in exceptions, creating own exception sub-classes, Concepts of Multithreading, differences between process and thread, thread life cycle, creating multiple threads using Thread class, Runnable interface, Synchronization.	06	1,2,3,9,12	1,2
UNIT-4	*Module-6*	**Event Handling**: Events, Event sources, Event classes, Event Listeners, Delegation event model, handling mouse and keyboard events, Adapter classes	03	1,2,9,12	1,2

	Module-7	**JDBC**: The connectivity Model, JDBC/ODBC Bridge, java.sql package, connectivity to remote Database, navigating through multiple rows retrieved from a database, selection, insertion, updating and deletion in database using JDBC.	07	1,2,9,12	1
UNIT-5	*Module-8*	**Networking and Java Library**: Basics of Networking, TCP/IP sockets, datagrams, using sockets and datagram sockets to transfer data.	04	1,2,3,4,5,9 ,12	1,2
	Module-9	**Servlets:** Background, Life cycle of a servlet, Reading servlet parameters, Database handling using servlets.	05	1,2,3,4,5,9 ,12	1
Total No. of Hours			**40**		

Learning Outcomes:	● Able to *define* and *relate* object-oriented programming features and concepts for solving given problems. *(Remember L1)* ● Able to *demonstrate* and *extend* the learned concepts for problem-solving. (*Understand L2)* ● *Analyze* and *develop* solutions for real-world problems.(Apply, Analyze L3, L4) ● Discover requirements and Apply concepts for networking and database connectivity for solving real-life problems. (L3,L4) ● *Recommend and Select* solutions for problems using Java web technology. (L5)

Suggested books:

S. No.	Name of Authors /Books /Publisher
1.	Herbert Schildt, The Complete Reference Java J2SE 5th Edition, TMH Publishing Company Ltd.
2.	H.M.Dietel and P.J.Dietel, Java How to Program, Pearson Education/PHI
3.	Cay.S.Horstmann and Gary Cornell, Core Java 2, Vol 1, Fundamentals, Pearson Education.
4.	Cay.S.Horstmann and Gary Cornell, Core Java 2- Advanced Features, Pearson Education.
5.	Iver Horton, Beginning in Java 2, Wrox Publications.
6.	Marty and Hall, Core Servlets and JSP, Prentice Hall and Sun Microsystems Press.
7.	Deiltel & Deitel, Advanced Java, TMH

CO-PO/PSO MAPPING

Course Outcomes	Program Outcomes (POs)												Program Specific Outcomes (PSOs)	
(COs)	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	1											1	1
CO2	3	1	1		1								1	1
CO3	3	2	1	1									1	1
CO4	3	2	1	1	1				1			1	1	1
CO5	3	2	2	2	2				1			1	2	2

Course Code: BCE-C407
Course Name: OPERATING SYSTEM

MM: 100 **Sessional: 30**
Time: 3 Hr. **ESE: 70**
L T P **Credit : 3**
3 1 0

Prerequisites:	Basic knowledge of Data Structures and Computer Organization
Objectives:	1. Students will learn how Operating System is Important for Computer System. 2. To make aware of different types of Operating System and their services. 3. To learn different process scheduling algorithms and synchronization techniques to achieve better performance of a computer system. 4. To know virtual memory concepts. 5. To learn secondary memory management
Course Coordinator	Dr.Mayank Aggarwal

NOTE:	The question paper shall consist of two sections (Section-A and Section-B). Section-A shall contain Ten (10) short answer type questions of six (06) mark each and student shall be required to attempt any five (05) questions. Section-B shall contain eight (08) long answer type questions of ten (10) marks each and student shall be required to attempt any four questions. Questions shall be uniformly distributed from the entire syllabus

UNIT	Module	Course Content	No. of Hours	POs mapped	PSOs mapped
UNIT-1	*Module-1*	**Introduction**: Operating Systems, Single Processor systems, Multiprocessor Systems, Clustered Systems, Mainframe Systems, Desktop Systems, Distributed Systems, Real-Time Systems, System Components, Handheld Systems, Operating System Services, System Calls, System Programs, System Structure, Operating System Design and Implementation.	**09**	1,2	1,2
UNIT-2	*Module-2*	**Process Management**: Process Concept, Process Scheduling, Cooperating Processes, Inter-process Communication, Threads, Overview of Multithreading Models, CPU Scheduling, Basic Concepts, Scheduling Criteria, Scheduling Algorithms, Multiple Processor Scheduling, Real-Time Scheduling, Algorithm Evaluation.	**07**	1,2	1,2
UNIT-3	*Module-3*	**Process Synchronization & Deadlocks**: The Critical Section Problem, Synchronization Hardware, Semaphores, Classical Problems of Synchronization, Deadlocks, System Model, Deadlock Characterization, Methods for handling Deadlocks, Deadlock Prevention, Deadlock Avoidance, Deadlock Detection, Recovery from Deadlock.	**08**	1,2,3,4,5, 9,12	1,2
UNIT-4	*Module-4*	**Memory Management & Virtual Memory**: Background, Swapping, Contiguous Memory Allocation, Paging, Segmentation, Virtual Memory, Demand paging, Page Replacement, Thrashing, Allocation of Frames	**09**	1,2,3,4,5, 9,12	1,2
UNIT-5	*Module-5*	**File System & Secondary Storage Structure**: File Concepts, Access Methods, Directory Structure, File System Mounting, File Sharing, Protection, File System Structure, File System Implementation, Directory Implementation, Allocation Methods, Free Space Management, Recovery, Disk Structure, Disk Scheduling, Disk Management, Swap Space management.	**07**	1,2,3,4,5, 9,12	1,2
Total No. of Hours			**40**		

Learning Outcomes:	**CO1: Knowledge and Comprehension** Explain the key components and functions of various computer systems, including Single Processor, Multiprocessor, Clustered, Mainframe, Desktop, Distributed, Real-Time, and Handheld Systems. **CO2: Application and Analysis** Analyze the concepts of process management, process scheduling, and CPU scheduling in operating systems, comparing and contrasting various scheduling algorithms. **CO3: Synthesis and Evaluation:** Evaluate the principles of process synchronization and deadlock handling, distinguishing between deadlock prevention, deadlock avoidance, deadlock detection, and recovery strategies. **CO4: Application and Analysis:** Outcome: Apply memory management techniques, including paging, segmentation, and virtual memory, to address issues like thrashing, page replacement, and allocation of frames in an operating system. **CO5: Synthesis and Evaluation** Analyze the file system and secondary storage structures, including file concepts, directory implementation, allocation methods, and disk management strategies, and evaluate their impact on system performance and reliability.

Suggested books:

S. No.	Name of Authors /Books /Publisher
1.	Silberschatz, Galvin, Gagane, Operating System Concepts. Wiley India Edition.
2.	William Stallings, Operating System, Pearson Prentice Hall
3.	D.M.Dhamdhere, Operating Systems, TMH.

CO-PO/PSO MAPPING

Course Outcomes	Program Outcomes (POs)												Program Specific Outcomes (PSOs)	
(COs)	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	1											1	1
CO2	3	1	1										1	1
CO3	3	2	1							1		1	1	1
CO4	3	2	1		1					1		1	1	1
CO5	3	2	1	1	1					1		1	2	2

Course Code: BET-C418
Course Name: Microprocessor and Interfacing

MM: 100 **Sessional: 30**
Time: 3 Hr. **ESE: 70**
L T P **Credit : 3**
3 0 0

Prerequisites:	Digital System Design
Objectives:	Students will learn about architecture, as well as how to obtain data and instructions from memory for processing. The ability to write programmes using an instruction set and control external devices via an I/O interface.
Course Coordinator	Ashish Nainwal

NOTE:	The question paper shall consist of two sections (Section-A and Section-B). Section-A shall contain of ten (10) short answer type questions of six (06) mark each and student shall be required to attempt any five (05) questions. Section-B shall contain eight (08) long answer type questions of ten (10) marks each and student shall be required to attempt any four questions. Questions shall be uniformly distributed from the entire syllabus

UNIT	Module	Course Content	No. of Hours	POs mapped	PSOs mapped
UNIT-1	*Module-1*	Introduction to Microprocessors and assembly language, 8085 architectures, addressing modes of 8085	**5**	PO1/PO2/PO3	PSO1/ PSO2
	Module-2	8085 instruction set and programming techniques, timing diagrams, Counters & time delays	**5**	PO1/PO2/PO3	PSO1/ PSO2
UNIT-2	*Module-3*	Stacks and subroutines, basics of memory interfacing. Interfacing I/O Devices	**4**	PO1/PO3	PSO1/ PSO2
	Module-4	Programming of basic arithmetic operations: addition, subtraction, multiplication, division, code conversion etc, Interrupts	**4**	PO1/PO2/PO4	PSO1/ PSO2
UNIT-3	*Module-5*	Programmable Peripheral Interface (PPI) (8255), Programmable Interval Timer (8254), Programmable interrupt controller (8259), DMA & DMA controller (8237), ADC / DAC interfacing	**8**	PO1/PO3	PSO1/ PSO2
UNIT-4	*Module-6*	8086 Processor: 8086 architectures, Pin configuration, 8086 in min/max mode	**4**	PO1/PO2	PSO1/ PSO2
	Module-7	Addressing modes, Instruction set of 8086, Assembler directives, basic assembly language programming	**4**	PO1/PO2	PSO1/ PSO2
UNIT-5	*Module-8*	Introduction to Pentium and Pentium Processor, cache structure, superscalar architecture, Introduction to Pentium II, III, IV & Core 2 microprocessor.	**6**	PO1/PO3/PO4/PO5	PSO1/ PSO2
Total No. of Hours			**40**		

Learning Outcomes:	• Define architectures of microprocessors. • Interpret basic assembly language programs. • Experiment with interfacing design of peripherals like I/O, memory etc. • Explain the peripheral devices and interfacing with processor for task sharing • Analyze the functionality of advanced version processors.

Suggested books:

S. No.	Name of Authors /Books /Publisher	Year of Publication
1.	Microprocessor, architecture, programming and applications with 8085 R.S Gaonkar, Publisher-Penram International Publishing ,ISBN-978-8187972884	2013
2.	Microprocessors and interfacing Douglas hall, Publisher: McGraw Hill Education; 3rd edition, ISBN-978-1259006159	2017
3.	8086 microprocessor: programming and interfacing the PC, K.J Ayala Publisher-Delmar Cengage Learning; Deluxe Education edition ISBN-978-0314012425	1995
4.	Barry B. Brey, The Intel Microprocessors 8086/8088, 80186/80188, 80286, 80386, Pentium, Pentium Pro Processor, Pentium II, Pentium III, Pentium 4 and Core 2 with 64-bit Extensions, 9/e, Pearson Education.	2013

	CO-PO/PSO MAPPING													
Course Outcomes (COs)	**Program Outcomes (POs)**												**Program Specific Outcomes (PSOs)**	
	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**	**PSO1**	**PSO2**
CO1	**3**	**0**	**0**	**0**	**0**								**3**	**2**
CO2	**3**	**3**	**2**	**1**	**0**								**3**	**3**
CO3	**3**	**2**	**1**	**0**	**0**								**2**	**1**
CO4	**3**	**2**	**0**	**1**	**0**								**1**	**2**
CO5	**3**	**0**	**0**	**0**	**3**								**2**	**2**

Course Code: BEM-C403
Course name: Discrete Mathematics

MM: 100 **Sessional Examination: 30**
Time: 3 Hr. **End Semester Examination: 70**
L T P **Credit : 4**
3 1 0

Prerequisites:	**Algebra**
Objectives:	This course provides an introduction to the basic concepts and techniques to 1. Acquire Knowledge of sets and mathematical induction 2. Understand the concepts of relations, and functions and perform the operations associated with functions, and relations. 3. Apply graph theory concepts in computer science. 4. Utilize the concepts and properties of trees and cut sets. 5. Solve generating functions and recurrence relations.
Course Coordinator	Dr. Lokesh Kumar Joshi
Course Faculty	Dr. Lokesh Kumar Joshi, Dr. Vivek Goel
Lectures	40 Hours

NOTE:	The question paper shall consist of two sections (Section-A and Section-B). Section-A shall contain ten (10) short answer type questions of six (06) mark each and student shall be required to attempt any five (05) questions. Section-B shall contain eight (08) long answer type questions of ten (10) marks each and student shall be required to attempt any four questions. Questions shall be uniformly distributed from the entire syllabus

Course Handout cum Lecture Plan

UNIT	Course Content	No. of Hours	POS Mapped
UNIT-1	**Sets and Propositions:** Review of set theory, Combination of sets, Finite and infinite sets, Uncountably infinite sets, Mathematical induction, Principle of inclusion and exclusion. Propositions.	8	PO1/PO2/PO3/PO4/ PO5/PO6/PO7,PO09 , PO11/PO12
UNIT-2	**Relations and Functions:** Relation, Properties of primary relations, Equivalence relations and partitions, Partial ordering relations and lattices. Functions and the pigeonhole principle.	8	PO1/PO2/PO3/PO4/ PO5/PO6/PO7,PO09 , PO11/PO12
UNIT-3	**Graphs and Planar Graphs:** Basic terminology, Multigraphs and weighted graphs, Paths and circuits, Shortest paths in weighted graphs. Eulerian Paths and circuits, Hamiltonian paths and circuits, Planar graphs.	8	PO1/PO2/PO3/PO4/ PO5/PO6/PO7,PO09 , PO11/PO12
UNIT-4	**Trees and Cut Sets:** Trees, rooted trees, Path lengths in rooted trees, Prefix codes, Spanning trees and cut sets. Minimum spanning trees. .	8	PO1/PO2/PO3/PO4/ PO5/PO6/PO7,PO09 , PO11/PO12
UNIT-5	**Generating Functions and Recurrence Relations:** Introduction, Manipulation of numeric Functions, Generating functions, Recurrence relations, Linear Recurrence relations with constant coefficients. Homogeneous solutions, Particular solutions, Total solutions. Solution by the method of generating functions.	08	PO1/PO2/PO3/PO4/ PO5/PO6/PO7,PO09 , PO11/PO12
	Total	40	

Course Outcomes:	On completion of this course, the students will be able to 1. Solve problems related to mathematical induction, counting principles, permutation and combination. (L1, L3) 2. apply the concepts of relations and functions in the context of various fields of computer science e.g. Database, Automata, Compiler etc. (L1, L3, L5) 3. apply graph theory concepts for designing solutions of various computing problems e.g. shortest path, graph, job Sequencing etc. (L3, L4, L6) 4. model and solve real world problems using trees (L3, L6) 5. formulate problems and solve recurrence relations (L3, L4)

Suggested books:(According to the reference style decided by departmental Board of Studies)

S. No.	**Name of Authors /Books /Publisher**	**Year of Publication**
1.	Rosen, K. H., Discrete Mathematics and Its Applications with Combinatorics and Graph Theory, Tata McGraw-Hill.	2008
2.	Liu, C. L., Elements of Discrete Mathematics, Tata McGraw-Hill	2008
3.	Kolman B, & Busby Robert C, (3/e) Discrete Mathematical Structures for Computer Science, PHI	2001
4.	Lipschutz, S. and Lipson, Discrete Mathematics, Tata McGraw-Hill	2009

L1 – Remember, L2 – Understand, L3 – Apply, L4 – Analyze, L5 – Evaluate, L6 – Create

Scheme of Evaluation

- Attendance required: 75 %
- End semester exam: 70 marks (complete syllabus)
- Sessional Exam: 20 marks
- Assignment/seminar/tutorial: 10 marks (Each student in small groups will apply these concepts to solve practical problems)

Course Outcomes	**Program Outcomes (POs)**											
(COs)	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**
CO1	**3**	**3**	**2**	**3**	**2**	**2**	**2**	**-**	**1**	**-**	**3**	**3**
CO2	**3**	**3**	**3**	**2**	**2**	**3**	**2**	**-**	**1**	**-**	**1**	**2**
CO3	**2**	**3**	**3**	**3**	**2**	**2**	**2**	**-**	**1**	**-**	**2**	**2**
CO4	**3**	**2**	**3**	**3**	**3**	**3**	**2**	**-**	**1**	**-**	**2**	**2**
CO5	**2**	**2**	**2**	**2**	**2**	**2**	**2**	**-**	**1**	**-**	**3**	**3**

Course Code: BCE-C455
Course Name: Database Management System Lab

MM: 50 **Sessional: 15**
Time: 3 Hr. **ESE: 35**
L T P **Credit: 01**
0 0 2

Objectives:	1. This lab enables the students to practice the concepts learnt in the subject DBMS by developing a database. 2. The student is expected to practice the designing, developing and querying a database
Course Coordinator	Dr. Nishant Kumar

NOTE:	1. In practical examination the student shall be required to perform one experiment. 2. A teacher shall be assigned 20 students for daily practical work in laboratory. 3. No batch for practical class shall consist of more than 20 students. 4. The number of students in a batch allotted to an examiner for practical examination shall not exceed 20 students. **5.** Addition/deletion in above list may be made in accordance with the facilities available with the approval of H.O.D./Dean

LIST OF EXPERIMENTS	No. of Hours /week	POs mapped	PSOs mapped
1. Create a table using SQL commands.	**02**		1,2
2. Perform insertion, updation and deletion on tables.			1,2
3. Perform select queries on table.			1,2
4. Perform primary key, Candidate key and not null constraints.		1,2,3,4,5	1,2
5. Perform joins (Outer Joins).			1,2
6. Nested Queries.			1,2
7. Union, Intersection and except operations.			1,2
8. Foreign Key and Referential Integrity Constraints.			1,2
9. Create View of tables.			1,2
10. Grant and revoke permissions on tables.			1,2

Learning Outcomes:	● Create table using SQL commands and view of tables ● Apply primary key, Candidate key, not null, Foreign Key and Referential Integrity Constraints on tables ● Formulate select queries on table and joins (Outer Joins) ● Construct Nested Queries ● Evaluate Union, Intersection and except operations

CO-PO/PSO MAPPING

Course Outcomes	Program Outcomes (POs)												Program Specific Outcomes (PSOs)	
(COs)	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**	**PSO1**	**PSO2**
CO1	3	2			1								1	1
CO2	3	2			1								1	1
CO3	3	2	1		1								1	1
CO4	3	1	2	2	1								1	1
CO5	3	1	2	2	1								1	1

Course Code: BCE-C456
Course Name: Object Oriented Programming with Java Programming Lab

MM: 50 **Sessional: 15**
Time: 3 Hr. **ESE: 35**
L T P **Credit: 01**
0 0 2

Objectives:	1. To experiment with the syntax and semantics of java language and gain experience with java programming 2. Learn to use object orientation to solve problems and use java language to implement them.
Course Coordinator	Mr. Namit Khanduja

NOTE:	1. In practical examination the student shall be required to perform one experiment. 2. A teacher shall be assigned 20 students for daily practical work in the laboratory. 3. No batch for a practical class shall consist of more than 20 students. 4. The number of students in a batch allotted to an examiner for practical examination shall not exceed 20 students. 5. Addition/deletion in the list may be made following the facilities available with the approval of H.O.D./Dean

LIST OF EXPERIMENTS	**No. of Hours /week**	**POs mapped**	**PSOs mapped**
1. Classes and Objects: Programs to illustrate the concept of objects and classes. 2. Inheritance packages and interface: Programs to illustrate the concepts of Inheritance, packages, and interfaces. 3. Multithreading: programs to illustrate concepts of multithreading in Java. 4. Event Handling: programs in Java to handle Mouse and Keyboard events. 5. Java Database Connectivity: Programs to connect, control, and manipulate databases. 6. Program to create a database application in Servlets. 7. Program for connection-less and connection-oriented communication.	**02**	1,2,3,4, 5,9,12	1,2

Learning Outcomes:	● Illustrate the concept of objects and classes via Java program(L2) ● Illustrate the concepts of Inheritance, packages and interfaces via java program(L2) ● Design program in Java to handle Mouse and Keyboard events(L6) ● Apply write, read data using different types of communication modes.(L3) ● Create a database application in Servlets via java program(L6)

CO-PO/PSO MAPPING

Course Outcomes	**Program Outcomes (POs)**												**Program Specific Outcomes (PSOs)**	
(COs)	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**	**PSO1**	**PSO2**
CO1	3	1											1	1
CO2	3	2	2										1	1
CO3	3	2	1	1	1								1	1
CO4	2	2	1	1	1				1			1	1	1
CO5	2	2	1	1	1				1			1	1	1

Course Code: BET-C461
Course Name: Microprocessor Lab

MM: 50 **Sessional: 15**
Time: 3 Hr. **ESE: 35**
L T P **Credit : 1**
0 0 2

Prerequisites:	**Digital System Design**
Objectives:	Students will perform assembly level program in 8085 kit and 8086 kit.
Course Coordinator	Dr. Ashish Nainwal
Notes	1. In practical examination the student shall be required to perform one experiment. 2. A teacher shall be assigned 20 students for daily practical work in laboratory. 3. No batch for practical class shall consist of more than 20 students. 4. The number of students in a batch allotted to an examiner for practical examination shall not exceed 20 students. 5. Addition/deletion in above list may be made in accordance with the facilities available with the approval of H.O.D./Dean.

LIST OF EXPERIMENTS:

Microprocessor 8085:

1. Write a program to add two 8 bit hexadecimal numbers Stored at consecutive memory location.
2. Write a program to find 1's and 2's complement of a hexadecimal number.
3. Write a program to add 'n' 8 bit hexadecimal numbers series starting from 2301H (neglecting the carry generated). The number of data bytes to be added is stored in 2300H.
4. Write a program to find maximum number in given data series.
5. Write a program to check parity of a hexadecimal number stored in memory location 2020H.If the parity is odd, store 00H in memory location 2041H, else store EEH.
6. Write a program to move to data block from 3000H to 3005H to memory location 3050H to 3055H.
7. Write a Program to Multiply Two 8 bit Hexadecimal Numbers (with Carry).
8. Write a program to add two 16 bit hexadecimal numbers.
9. Write a program to generate a Ramp and Square waveform at the O/P of DAC 0800 the address of DAC is A0 (Use CN-03)
10. Write a program to display '2' in seven segment display using 8255 PPI.
11. Write a program to turn on LEDs using 8255 PPI.

Microprocessor 8086:

1. To add two binary numbers each 8-byte long.
2. To find the maximum No. in a given string (16-byte long) and store it in location 0310.
3. To sort a string of a No. of byte in descending order.
4. To multiply an ASCII string of eight number by a single ASCII digit. The result is a sting of unpacked BCD digits.

Course Outcomes:		**Bloom's Knowledge Level**
CO1	Understand basic arithmetic operations in assembly language.	L2
CO2	Analyze the concept of parity checking for error detection.	L4
CO3	Understand to manage memory allocation for data storage.	L2
CO4	Analyze to control output waveforms using conditional branching.	L4
CO5	Evaluate the logic and algorithm required to find the maximum number.	L5

		CO-PO/PSO MAPPING													
Course Outcomes (COs)		**Program Outcomes (POs)**												**Program Specific Outcomes (PSOs)**	
		PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**	**PSO1**	**PSO2**
CO1	**L1**	**3**												**3**	**3**
CO2	**L2**	**3**	**2**	**2**										**3**	**3**
CO3	**L2**	**3**	**2**	**2**	**2**									**2**	**2**
CO4	**L3**	**3**	**3**	**3**	**3**									**2**	**3**
CO5	**L4**	**3**	**3**	**2**	**2**									**3**	**3**

Course Code: BET-C460
Course Name: Project-II

MM: 50 **Sessional: 15**
Time: 3 Hr. **ESE: 35**
L T P **Credit : 3**
0 0 2

The project is to be done by students in batches with maximum number of students four. A single student is not allowed to do the project. Project must focus on solving some problem and demonstrate the skills learned till fourth semester. Examples of projects can be taken from various hackathon conducted from time to time by different organizations/companies.

Here are some websites that can be referred:

1. GitHub - [GitHub Topics](https://github.com/topics)
2. IEEE Xplore - [IEEE Project Ideas](https://ieeexplore.ieee.org)
3. Hackster.io - [Hackster.io Projects](https://www.hackster.io/projects)
4. Instructables - [Instructables Technology Projects](https://www.instructables.com/technology/projects/)
5. Project Ideas on Electronics Hub - [Electronics Hub](https://www.electronicshub.org/electronics-projects-ideas/)
6. Devpost - [Devpost Hackathons](https://devpost.com/hackathons)
7. Hackathon.com- [Hackathon.com](https://www.hackathon.com/)
8. Major League Hacking (MLH) - [MLH Hackathons](https://mlh.io/)
9. HackerEarth - [HackerEarth Hackathons](https://www.hackerearth.com/challenges/hackathon/)
10. TechGig - [TechGig Hackathons](https://www.techgig.com/hackathon)