Learning Outcomes based Curricular Framework

The Curriculum Book

Bachelor of Technology

(Computer Science & Engineering)

4-YEAR PROGRAMME

Choice Based Credit System
w. e. f. 2023-24

Scheme of Examination and Detailed Syllabus

(III - VIII Semester)

Faculty of Engineering and Technology
Chaudhary Devi Lal University
Sirsa-125055

Table 3(a): Courses' codes, titles, and credits (Group–A)

Course Code	Course Title	Workload/Credit			
	Semester I	Theory	Tutorial	Practical	Total
BSC/1-T BSC/1-T(i) BSC/1-T(iv)	Physics: Introduction to Electromagnetic Theory (ME) Oscillations, Waves and Optics (EE/ECE)	3/3	1/1	-	4/4
BSC/3-T	Mathematics-I	3/3	1/1	-	4/4
ESC/1-T	Basic Electrical Engineering	3/3	1/1	-	4/4
ESC/4-T	Workshop/Manufacturing Practices	3/3	-	-	3/3
BSC/1-P BSC/1-P(i) BSC/1-P(iv)	Physics Lab: Introduction to Electromagnetic Theory (ME) Oscillations, Waves and Optics (EE/ECE)	-	-	4/2	4/2
ESC/1-P	Basic Electrical Engineering Lab	-	-	2/1	2/1
ESC/4-P	Workshop/Manufacturing Practices Lab	-	-	4/2	4/2
MC/1	Induction Training	-	-	-	-
		12/12	**3/3**	**10/5**	**25/20**
	Semester II	Theory	Tutorial	Practical	Total
BSC/2-T	Chemistry	3/3	1/1	-	4/4
BSC/4-T	Mathematics-II	3/3	1/1	-	4/4
ESC/3-T	Programming for Problem Solving	4/4	-	-	4/4
HSMC/1-T	English	2/2	-	-	2/2
MC/2-T	Environmental Science	3/-	-	-	3/-
BSC/2-P	Chemistry Lab	-	-	4/2	4/2
ESC/2-P	Engineering Graphics and Design Lab	-	-	4/2	4/2
ESC/3-P	Programming for Problem Solving Lab	-	-	4/2	4/2
HSMC/1-P	English Lab	-	-	2/1	2/1
Total		**15/12**	**2/2**	**14/7**	**31/21**

Table 3(b): Courses' codes, titles, and credits (Group–B)

Course Code	Course Title	Workload/Credit			
	Semester I	Theory	Tutorial	Practical	Total
BSC/2-T	Chemistry	3/3	1/1	-	4/4
BSC/3-T BSC/5-T	Mathematics-I Mathematics-I (for CSE/IT/AI&ML)	3/3	1/1	-	4/4
ESC/3-T	Programming for Problem Solving	4/4	-	-	4/4
HSMC/1-T	English	2/2	-	-	2/2
BSC/2-P	Chemistry Lab	-	-	4/2	4/2
ESC/2-P	Engineering Graphics and Design Lab	-	-	4/2	4/2
ESC/3-P	Programming for Problem Solving Lab	-	-	4/2	4/2
HSMC/1-P	English Lab	-	-	2/1	2/1
MC/1	Induction Training	-	-	-	-
Total		**12/12**	**2/2**	**14/7**	**28/21**
	Semester II	Theory	Tutorial	Practical	Total
BSC/1-T BSC/1-T(ii) BSC/1-T(v)	Physics: Introduction to Mechanics (for CE) Semiconductor Physics (CSE/IT/AI &ML)	3/3	1/1	-	4/4
BSC/4-T BSC/6-T	Mathematics-II Mathematics-II (for CSE/IT/AI&ML)	3/3	1/1	-	4/4
ESC/1-T	Basic Electrical Engineering	3/3	1/1	-	4/4
ESC/4-T	Workshop/Manufacturing Practices	3/3	-	-	3/3
MC/3-T	Indian Constitution	3/-	-	-	3/-
BSC/1-P BSC/1-P(ii) BSC/1-P(v)	Physics Lab: Introduction to Mechanics (for CE) Semiconductor Physics (CSE/IT/AI&ML)	-	-	4/2	4/2
ESC/1-P	Basic Electrical Engineering Lab	-	-	2/1	2/1
ESC/4-P	Workshop/Manufacturing Practices Lab	-	-	4/2	4/2
Total		**15/12**	**3/3**	**10/5**	**28/20**

B.Tech. (Computer Science & Engineering) Credit Scheme – Semester III & IV

Semester	Basic Sciences' Courses BSC (BSC/X-T/P)		Engineering Sciences' Core/ Elective/ Open Courses ESC/ (PC/CSE/X-T/P)/ (PE/CSE/X-T/P)/ (OE/CSE/X-T/P)		Humanities, Social Sciences, Management Courses HSMC (HSMC/X-T/P)		Mandatory Courses (MC/X-T/P)		Grand Total Credit
	No. of Courses	Total Credits	No. of Courses	Total Credits	No. of Courses	Total Credits	No. of Courses	Total Credits	
III	01	03	07	18	00	00	01	00	21
IV	00	00	10	23	00	00	00	00	23

Courses codes, titles, and credits (Semester- III)

#	Course Code	Course Title	Workload/Credit			
			Theory	Tutorial	Practical	Total
1	BSC/7-T	Mathematics-III	3/3	-/-	-	3/3
2	PC/CSE/31-T	Data Structures and Algorithms	3/3	-/-	-	3/3
3	PC/CSE/32-T	Object Oriented Programming using C++	3/3	-/-	-	3/3
4	PC/CSE/33-T	Discrete Mathematics	3/3	-/-	-	3/3
5	PC/CSE/34-T	Computer Organisation and Architecture	3/3	-/-	-	3/3
6	ESC/5-T	Analog Electronic circuits	2/2	-/-	-	2/2
7	**MC/2-T	Environmental Science	3/-	-/-	-	3/-
8	PC/CSE/31-P	Data Structures and Algorithms using C/C++ Lab.	-/-	-/-	4/2	4/2
9	PC/CSE/32-P	Object Oriented Programming using C++ Lab.	-/-	-/-	4/2	4/2
		Total	**20/17**	**-/-**	**8/4**	**28/21**

Courses codes, titles, and credits (Semester- IV)

#	Course Code	Course Title	Workload/Credit			
			Theory	Tutorial	Practical	Total
1	PC/CSE/41-T	Microprocessor and Interfacing	3/3	-/-	-	3/3
2	PC/CSE/42-T	Computer Networks	3/3	-/-	-	3/3
3	PC/CSE/43-T	Database Management System	3/3	-/-	-	3/3
4	PC/CSE/44-T	Analysis and Design of Algorithms	3/3	-/-	-	3/3
5	PC/CSE/45-T	Software Engineering	3/3	-/-	-	3/3
6	PC/CSE/46-T	Java Programming	3/3	-/-	-	3/3
7	PC/CSE/41-P	Microprocessor and Interfacing Lab.	-/-	-/-	2/1	2/1
8	PC/CSE/42-P	Computer Networks Lab.	-/-	-/-	2/1	2/1
9	PC/CSE/43-P	Database Management System Lab.	-/-	-/-	2/1	2/1
10	PC/CSE/46-P	Java Programming Lab.	-/-	-/-	4/2	4/2
		Total	**18/18**	**-/-**	**10/5**	**28/23**
B.Tech. (CSE) student must undergo 6/8-weeks Summer Industrial Training after IV semester.						
1.	***EEC/CSE/51-P	Industrial Training/ Internship	-	-	4/2	4/2

**Non-credit qualifying mandatory course. The assessment will be completely internal.

***The students will have to undergo Industrial Training/ Internship for 6-8 weeks during summer vacations after the examination of IV semester which will be evaluated in V semester.

Note: Students will be allowed to use non-programmable scientific calculators only, however, sharing of calculator should not be permitted.

B.Tech. (Computer Science & Engineering) Credit Scheme – Semester V & VI

Semester	Basic Sciences' Courses BSC (BSC/xx-T/P)		Engineering Sciences' Core/ Elective/ Open Courses ESC/ (PC/CSE/xx-T/P)/ (PE/CSE/xx-T/P)/ (OE/CSE/xx-T/P)		Humanities, Social Sciences, Management Courses HSMC (HSMC/xx-T/P)		Mandatory Courses (MC/xx-T/P)		Industrial Training (EEC/CSE/ xx-P)		Grand Total Credit
	No. of Courses	Total Credits	No. of Courses	Total Credits	No. of Courses	Total Credits	No. of Courses	Total Credits	No. of Courses	Total Credits	
V	00	00	07	17	01	02	01	00	01	02	21
VI	00	00	09	22	01	02	00	00	00	00	23

Courses codes, titles, and credits (Semester V)

#	Course Code	Course Title	Workload/Credit			
			Theory	Tutorial	Practical	Total
1.	PC/CSE/51-T	Computer Graphics	3/3	-/-	-	3/3
2.	PC/CSE/52-T	Python Programming	3/3	-/-	-	3/3
3.	PC/CSE/53-T	High Speed Network Technologies	3/3	-/-	-	3/3
4.	PC/CSE/54-T	Cryptography and Network Security	3/3	-/-	-	3/3
5.	OE-I	Open Elective Course to be opted by Students from another branch	3/3	-/-	-	3/3
6.	HSMC/4-T	Economics for Engineers	2/2	-/-	-	2/2
7.	MC/4-T	Essence of Indian Traditional Knowledge	3/-	-/-	-	3/-
8.	PC/CSE/51-P	Computer Graphics Lab.	-/-	-/-	2/1	2/1
9.	PC/CSE/52-P	Python Programming Lab.	-/-	-/-	2/1	2/1
10.	***EEC/CSE/51-P	Industrial Training/ Internship	-/-	-/-	**4/2**	4/2
Total Credit			**20/17**	**-/-**	**8/4**	**28/21**
***The students will have to prepare and submit a Micro Project report of the Industrial Training/ Internship of 6-8 weeks done during summer vacations after the examination of IV semester under the supervision of faculty during V semester.						

Courses codes, titles, and credits (Semester VI)

#	Course Code	Course Title	Workload/Credit			
			Theory	Tutorial	Practical	Total
1.	PC/CSE/61-T	Operating Systems	3/3	-/-	-	3/3
2.	PC/CSE/62-T	Formal Language and Automata Theory	3/3	-/-	-	3/3
3.	PC/CSE/63-T	Data Analytics using R	3/3	-/-	-	3/3
4.	PC/CSE/64-T	Machine Learning	3/3	-/-	-	3/3
5.	PE/CSE/61-T to PE/CSE/66-T	Professional/ Programme Elective Course-I tobe opted by students	3/3	-/-	-	3/3
6.	HSMC/3-T	Fundamentals of Management for Engineers	2/2	-/-	-	2/2
7.	OE-II	Open Elective Course to be opted by Students from another branch	3/3	-/-	-	3/3
8.	PC/CSE/61-P	Operating Systems Lab. (UNIX/LINUX)	-/-	-/-	2/1	2/1
9.	PC/CSE/63-P	Data Analytics using R Lab.	-/-	-/-	2/1	2/1
10.	PC/CSE/64-P	Machine Learning Lab.	-/-	-/-	2/1	2/1
Total Credit			20/20	-/-	6/3	26/23
***A Mini-Project/Training based on open-source tools.						

***The students will have to undergo Industrial Training/ Internship for 6-8 weeks during summer vacations after the examination of VI semester which will be evaluated in VII semester.

List of Professional/ Programme Elective Courses-I

1. PE/CSE/61-T: Embedded System Design
2. PE/CSE/62-T: Wireless and Mobile Communications
3. PE/CSE /63-T: Graph Theory
4. PE/CSE /64-T: Bioinformatics
5. PE/CSE /65-T: Component based software Engineering
6. PE/CSE /66-T: PHP Programming

B.Tech. (Computer Science & Engineering) Credit Scheme – Semester VII & VIII

Semester	Basic Sciences' Courses BSC (BSC/xx-T/P)		Engineering Sciences' Core/ Elective/ Open Courses ESC / (PC/CSE/xx-T/P)/ (PE/CSE/xx-T/P)/ (OE/CSE/xx-T/P)		Humanities, Social Sciences, Management Courses HSMC (HSMC/xx-T/P)		Mandatory Courses (MC/xx-T/P)		**Industrial Training** (EEC/CSE/xx-P)		Grand Total Credit
	No. of Courses	Total Credits	No. of Courses	Total Credits	No. of Courses	Total Credits	No. of Courses	Total Credits	No. of Courses	Total Credits	
VII	00	00	06	16	00	00	00	00	02	05	22
VIII	00	00	05	11	01	02	00	00	01	06	19

SEMESTER VII

#	**Course Code**	**Course Title**	**Workload/Credit**			
			Theory	Tutorial	Practical	Total
1.	PC/CSE/71-T	Compiler Design	3/3	-/-	-	3/3
2.	PC/CSE/72-T	Artificial Intelligence	3/3	-/-	-	3/3
3.	PE/CSE/71-T to PE/CSE/74-T	Professional/ Programme Elective Course- II to be opted by students	3/3	-/-	-	3/3
4.	PE/CSE/75-T to PE/CSE/79-T	Professional/ Programme Elective Course- III to be opted by students	3/3	-/-	-	3/3
5.	OE-III	Open Elective Course to be opted by Students from another branch	3/3	-/-	-	3/3
6.	PE/CSE/75-P to PE/CSE/79-P	Professional/ Programme Elective Course III Lab.	-/-	-/-	2/1	2/1
7.	EEC/CSE/71-P	Major Project-I	-/-	-/-	8/4	8/4
8.	*** EEC/CSE/72-P	Mini Project using open-source tools	-/-	-/-	4/2	4/2
		TOTAL CREDITS	15/15	-/-	14/7	29/22

***The students will have to prepare and submit a Mini Project report of the Industrial Training/ Internship of 6-8 weeks done during summer vacations after the examination of VI semester under the supervision of faculty during VII semester.

List of Professional/ Programme Elective Courses- II

1. PE/CSE/71-T: Software Project Management
2. PE/CSE/72-T: Soft Computing
3. PE/CSE/73-T: Distributed Operating Systems
4. PE/CSE/74-T: Cloud Computing

List of Professional/ Programme Elective Courses- III

1. PE/CSE/75-T: Mobile Application Development
2. PE/CSE/76-T: Multimedia Technologies
3. PE/CSE/77-T: Digital Image Processing
4. PE/CSE/78-T: Blockchain Technology
5. PE/CSE/79-T Natural Language Processing

List of Professional/ Programme Elective Courses- III (Labs)

1. PE/CSE/75-P: Mobile Application Development (Lab.)
2. PE/CSE/76-P: Multimedia Technologies (Lab.)
3. PE/CSE/77-P: Digital Image Processing (Lab.)
4. PE/CSE/78-P: Blockchain Technology (Lab.)
5. PE/CSE/79-P: Natural Language Processing (Lab.)

SEMESTER VIII

#	Course Code	Course Title	Workload/Credit			
			Theory	Tutorial	Practical	Total
1.	PC/CSE/81-T	Data Mining Techniques	3/3	-/-	-	3/3
2.	PE/CSE/81-T To PE/CSE/84-T	Professional/ Programme Elective Course tobe opted by students IV	3/3	-/-	-	3/3
3.	PE/CSE/85-T to PE/CSE/89-T	Professional/ Programme Elective Course tobe opted by students V	3/3	-/-	-	3/3
4.	PE/CSE/81-P to PE/CSE/84-P	Professional/ Programme Elective Course Lab. IV	-/-	-/-	2/1	2/1
5.	PE/CSE/85-P To PE/CSE/89-P	Professional/ Programme Elective Course Lab. V	-/-	-/-	2/1	2/1
6.	EEC/CSE/81-P	Major Project II	-/-	-/-	12/6	12/6
7.	HSMC/2-T	Human Values and Personality Development	2/2	-/-	-/-	2/2
Total Credit			11/11		16/8	27/19

List of Professional/ Programme Elective Courses- IV

1. PE/CSE/81-T: Internet of Things
2. PE/CSE/82-T: Network Administration and Management
3. PE/CSE/83-T: Software Testing and Quality Assurance
4. PE/CSE/84-T: Artificial Neural Network

List of Professional/ Programme Elective Courses- IV (Labs)

1. PE/CSE/81-P: Internet of Things (Lab.)
2. PE/CSE/82-P: Network Administration and Management (Lab.)
3. PE/CSE/83-P: Software Testing and Quality Assurance (Lab.)
4. PE/CSE/84-P: Artificial Neural Network (Lab.)

List of Professional/ Programme Elective Courses- V

1. PE/CSE/85-T: .NET using C#
2. PE/CSE/86-T: Big Data Analytics
3. PE/CSE/87-T: Web Development
4. PE/CSE/88-T: Statistical Computing
5. PE/CSE/89-T: Digital Forensics

List of Professional/ Programme Elective Courses- V (Labs)

1. PE/CSE/85-P: .NET using C# (Lab)
2. PE/CSE/86-P: Big Data Analytics (Lab)
3. PE/CSE/87-P: Web Development (Lab)
4. PE/CSE/88-P: Statistical Computing (Lab)
5. PE/CSE/89-P: Digital Forensics (Lab)

LIST OF OPEN ELECTIVES (OE) COURSES TO BE OFFERED BY CSE BRANCH/ DEPARTMENT TO THE STUDENTS OF OTHER BRANCH/ DEPARTMENT

OE-I: List of Open electives (For V semester):

1. OE/CSE/51-T: Internet & Application
2. OE/CSE/52-T: Introduction to Software Engineering
3. OE/CSE/53-T: Fundamental of Computer Networks
4. OE/CSE/54-T: Fundamentals of Python Programming

OE-II: List of Open electives (For VI semester):

1. OE/CSE/61-T: Basics of Digital Marketing
2. OE/CSE/62-T: Cyber Laws and IPR
3. OE/CSE/63-T: Fundamentals of Information Security
4. OE/CSE/64-T: Big Data
5. OE/CSE/65-T: Introduction to Data Science

OE-III: List of Open electives (For VII semester):

1. OE/CSE/71-T: Basics of Cloud computing
2. OE/CSE/72-T: Introduction to Software Project Management
3. OE/CSE/73-T: Cyber security
4. OE/CSE/74-T: Intelligent Systems
5. OE/CSE/75-T: Basics of Machine Learning

Scheme of Examination & Detailed Syllabus of B.Tech. (CSE) II Year

(III & IV Semester)

*Program Specific Outcomes (PSOs)

PSO1 **Developing Computational Systems**: Use principles of electronics and Micro-Processors, various programming languages, data structures, database management systems, computer algorithms, theory of computation and software engineering for designing and implementing computational systems.

PSO2 **Devising Networking Solutions**: Apply the knowledge of systems in the areas related to network technologies, mobile ad hoc and sensor networks, cloud computing, IoT and, information and web security for devising networking solutions.

PSO3 **Doing Data Analytics and Designing Intelligent Systems**: Utilize the approaches and tools of artificial intelligence and soft computing, data analytics and machine learning for designing and working with intelligent systems that can extract valuable information from large amount of data and learn from their environment.

* Programme Outcomes (POs) of Bachelor Programmes in Engineering & Technology have been specified in First Year common curriculum of B.Tech. Programmes.

Course Code	**Definition/ Category**
BSC	Basic Science Courses
ESC	Engineering Science Courses
HSMC	Humanities and Social Sciences including Management Courses
MC	Mandatory Audit Courses
PC	Program Core
PE	Program Elective Courses
OE	Open Elective Courses
EEC	Employability Enhancement Courses (Project work/ Summer Training/ Industrial Training/ Practical Training/ Internship/Seminar,etc.)

B.Tech. (Computer Science & Engineering) Credit Scheme – Semester III & IV

Semester	Basic Sciences’ Courses BSC (BSC/X-T/P)		Engineering Sciences’ Core/ Elective/ Open Courses ESC (PC/CSE/X-T/P)/ (PE/CSE/X-T/P)/ (OE/CSE/X-T/P)		Humanities, Social Sciences, Management Courses HSMC (HSMC/X-T/P)		Mandatory Courses (MC/X-T/P)		Grand Total Credit
	No. of Courses	Total Credits	No. of Courses	Total Credits	No. of Courses	Total Credits	No. of Courses	Total Credits	
III	01	03	07	18	00	00	01	00	21
IV	00	00	10	23	00	00	00	00	23

Courses codes, titles, and credits (Semester- III)

#	**Course Code**	**Course Title**	**Workload/Credit**			
			Theory	Tutorial	Practical	Total
1	BSC/7-T	Mathematics-III	3/3	-/-	-	3/3
2	PC/CSE/31-T	Data Structures and Algorithms	3/3	-/-	-	3/3
3	PC/CSE/32-T	Object Oriented Programming using C++	3/3	-/-	-	3/3
4	PC/CSE/33-T	Discrete Mathematics	3/3	-/-	-	3/3
5	PC/CSE/34-T	Computer Organisation and Architecture	3/3	-/-	-	3/3
6	ESC/5-T	Analog Electronic circuits	2/2	-/-	-	2/2
7	**MC/2-T	Environmental Science	3/-	-/-	-	3/-
8	PC/CSE/31-P	Data Structures and Algorithms using C/C++ Lab.	-/-	-/-	4/2	4/2
9	PC/CSE/32-P	Object Oriented Programming using C++ Lab.	-/-	-/-	4/2	4/2
		Total	**20/17**	**-/-**	**8/4**	**28/21**

Courses codes, titles, and credits (Semester- IV)

#	Course Code	Course Title	Workload/Credit			
			Theory	Tutorial	Practical	Total
1	PC/CSE/41-T	Microprocessor and Interfacing	3/3	-/-	-	3/3
2	PC/CSE/42-T	Computer Networks	3/3	-/-	-	3/3
3	PC/CSE/43-T	Database Management System	3/3	-/-	-	3/3
4	PC/CSE/44-T	Analysis and Design of Algorithms	3/3	-/-	-	3/3
5	PC/CSE/45-T	Software Engineering	3/3	-/-	-	3/3
6	PC/CSE/46-T	Java Programming	3/3	-/-	-	3/3
7	PC/CSE/41-P	Microprocessor and Interfacing Lab.	-/-	-/-	2/1	2/1
8	PC/CSE/42-P	Computer Networks Lab.	-/-	-/-	2/1	2/1
9	PC/CSE/43-P	Database Management System Lab.	-/-	-/-	2/1	2/1
10	PC/CSE/46-P	Java Programming Lab.	-/-	-/-	4/2	4/2
		Total	**18/18**	**-/-**	**10/5**	**28/23**
B.Tech.(CSE) student must undergo 6/8-week Summer Industrial Training after IV semester.						
1.	***EEC/CSE/51-P	Industrial Training/ Internship	-	-	4/2	4/2

**Non-credit qualifying mandatory course. The assessment will be completely internal.

***The students will have to undergo Industrial Training/ Internship for 6-8 weeks duringsummer vacations after the examination of IV semester which will be evaluated in V semester.

Note: Students will be allowed to use non-programmable scientific calculators only, however, sharing of calculator should not be permitted.

Detailed Syllabus of

B.Tech.(CSE)

III Semester

Mathematics III

General Course Information

Course Code: BSC/7-T Course Credits: 3 Type: Basic Sciences Contact Hours: 3 hours/week Mode: Lectures (L) Examination Duration: 3 hours	**Course Assessment Methods (internal: 30; external: 70)** Three minor examinations (20 marks), Class Performance measured through percentage of lectures attended (4 marks), assignments (6 marks), and the end- semester examination (70 marks). For the end semester examination, nine questions are to be set by the examiner. A candidate is required to attempt 5 questions in all. All questions carry equal marks. Question number 1 will be compulsory and based on the entire syllabus. It will contain seven parts of 2 marks each. Question numbers 2 to 9 will be given by setting two questions from each of the four units of the syllabus. A candidate is required to attempt the remaining four questions by selecting one question from each of the four units.

Pre-requisites: Mathematics I and Mathematics II

About the Course

This is an advanced mathematics course that offers the knowledge of Fourier Series, Fourier Transforms, Functions of Complex Variables. These concepts are essential for students to solve problems in image processing, digital signal processing and other related engineering fields.

Course Outcomes: By the end of the course students will be able to:

CO1. **define** concepts and terminology of Fourier Series and Fourier transforms, Functions ofcomplex variables and Power Series etc. (LOTS: Level 1: Remember)
CO2. **solve** problems using Fourier transforms in domains like digital electronics and imageprocessing. (LOTS: Level 3: Apply)
CO3. **apply** principles of functions of complex variables to solve computational problems.(LOTS: Level 3: Apply)
CO4. **compare** various concepts related to Fourier transforms and functions of complex variables. (LOTS: Level 4: Analyse)
CO5. **select** suitable method for given computational engineering problems and related domain. (LOTS: Level 4: Evaluate)
CO6. **integrate** the knowledge of Fourier Series and Fourier transforms, Functions of complex variables, and Power Series for solving real world problems. (LOTS: Level 6: Create)

Course Content

Unit I

Fourier Series and Fourier Transforms: Euler's formulae, conditions for a Fourier expansion, change of interval, Fourier expansion of odd and even functions, Fourier expansion of square wave, rectangular wave, saw-toothed wave, half and full rectified wave, half range sine and cosineseries.

Unit II

Fourier integrals, Fourier transforms, shifting theorem (both on time and frequency axes), Fourier transforms of derivatives, Fourier transforms of integrals, Convolution theorem, Fourier transform of Dirac delta function. Linear Programming Problem (LPP): Introduction; Formulation of linear programming problem (LPP); Graphical method for its solution; Standard form of LPP; Basic feasible solutions; SimplexMethod and Dual Simplex Method for solving LPP.

Unit III

Functions of Complex Variable: Definition, Exponential function, Trigonometric and Hyperbolic functions, Logarithmic functions. Limit and Continuity of a function, Differentiability and Analyticity. Cauchy-Riemann equations, necessary and sufficient conditions for a function to be analytic, polar form of the Cauchy-Riemann equations. Harmonic functions.

Unit IV

Complex integral, Cauchy Gaursat theorem (without proof), Cauchy integral formula (without proof), Power series, radius and circle of convergence, Taylor's Maclaurin's and Laurent's series. Zeroes and singularities of complex functions, Residues. Evaluation of real integrals using residues (around unit and semi-circle only).

Text and Reference Books:

1. F. Kreyszig, *Advanced Engineering Mathematics*, 10th edition, Wiley, 2015.
2. B. S. Grewal, *Higher Engineering Mathematics*, Khanna Publishers, 44th edition, 1965.
3. R. K. Jain, S.R.K. Iyenger. *Advance Engineering. Mathematics*, 4th edition, Narosa Publishing House, 2012.
4. Michael D. Greenberg, *Advanced Engineering Mathematics*, 2nd edition, Pearson Education, 2002.
5. Johnson and Miller *Probability and statistics for Engineers*, 8th edition, Pearson EducationIndia, 2015.

CO-PO Articulation Matrix Mathematics-III (BSC/7-T)

Course Outcomes	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 1 1	PO 12	PSO 13	PSO 14	PSO 15
CO1	1	--	-		-	-	-	-	-	-	-	-	2	2	2
CO2	2	2	2	2	-	-	-	-	-	-	-	-	3	2	2
CO3	2	2	2	2	-	-	-	-	-	-	-	-	3	2	3
CO4	3	3	2	3	-	-	-	-	-	-	-	-	3	2	3
CO5	3	3	2	3	-	-	-	-	-	-	-	-	3	2	3
CO6	3	3	2	3	-	-	-	-	-	-	-	-	2	2	3
3-High 2-Medium 1-Low															

Data Structures and Algorithms

General Course Information

Course Code: PC/CSE/31-T Course Credits: 3 Type: Professional Core Contact Hours: 3hours/week Mode: Lectures (L) Examination Duration: 3 hours	**Course Assessment Methods (internal: 30; external: 70)** Three minor examinations (20 marks), Class Performance measured through percentage of lectures attended (4 marks), assignments (6 marks), and the end- semester examination (70 marks). For the end semester examination, nine questions are to be set by the examiner. A candidate is required to attempt 5 questions in all. All questions carry equal marks. Question number 1 will be compulsory and based on the entire syllabus. It will contain seven parts of 2 marks each. Question numbers 2 to 9 will be given by setting two questions from each of the four units of the syllabus. A candidate is required to attempt the remaining four questions by selecting one question from each of the four units.

Pre-requisites: Programming in C

About the Course:
Data Structure and Algorithms is a core and an essential course for every graduate in Computer Science and Engineering. This course introduces data structures like arrays, linked lists, trees and graphs etc. and various operations to be implemented on these data structures for solving real world problems. It includes various sorting and searching algorithms as well. Further, it incorporates complexity analysis of algorithms implemented on various data structures.

Course Outcomes: By the end of the course students will be able to:
CO1. **describe** various types of data structures and operations that can be implemented onthese data structures. (LOTS: Level 1: Remember)
CO2. **demonstrate** the use of various data structures and their related operations. (LOTS:Level 2: Understand)
CO3. **apply** data structure to solve computational problems. (LOTS: Level 3: Apply)
CO4. **compare** the suitability of alternative data structures and prescribed operations forvarious problem situations. (LOTS: Level 4: Analyse).
CO5. **defend** solutions with respect to effective storage of data and efficiency of the required operations for solving real world problems. (LOTS: Level 5: Evaluate)

Course Content

Unit I

Introduction to data structures and their types, Abstract data types, Linear lists: Arrays and linked lists: memory representations, implementing operations like traversing, searching, inserting and deleting etc. Applications of arrays and linked lists. Representing sets and polynomials using linked lists.

Unit II

Stack and Queue: Static and linked implementations, Operations and Applications. Circular queues, Tress, Binary trees and related terminology, Tree traversals (Recursive), Threaded Binary Trees, Binary Search Trees implementation and operations, Priority queues.

Unit III

Height Balanced or AVL trees and B trees. Graph definitions and related terminology, memory representations and related operations (traversal, insertion, deletion, search), Path Matrix, Warshall's Shortest path algorithm Hashing, Hash tables, hash function and collision resolution.

Unit IV

Sequential and binary search, Sorting algorithms: Bubble sort, Selection sort, Insertion sort, Quick sort, Merge sort, Count sort, Heap sort, Comparison of searching and sorting techniques based on their complexity analysis, Time and space complexity of algorithms: Asymptotic analysis, Big O, Omega, Theta notations.

Text and Reference Books:

1. Aho, A. V., Ullman, J. D., and Hopcroft, J. E., *Data Structures and Algorithms*, Addison-Wesley, 1983.
2. LangsamYedidyah, Augenstein J Moshe, Tenenbaum M Aaron, *Data Structures using C and C++*, 3rdedition, PHI, 2009.
3. Cormen, T. H., Leiserson, C. E., Rivest, R. L. and Stein, C., *Introduction to Algorithms*, MIT Press, 2009.
4. Robert L. Kruse, *Data Structure and Program Design in C*, Pearson Education India, 2007.
5. Weiss, M. A., *Data Structures and Algorithm Analysis in C++*, Addison-Wesley, 2007.
6. Sahni, S., *Data Structures, Algorithms, and Applications in C++*, WCB/McGraw-Hill, 2001.

CO-PO Articulation Matrix Data Structures and Algorithms Course (PC/CSE/31-T)

Course Outcomes	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 1 1	PO 12	PSO 13	PSO 14	PSO 15
CO1	1	-	-	-	-	-	-	-	-	-	-	-	3	-	-
CO2	1	-	-	-	-	-	-	-	-	-	-	-	3	-	-
CO3	2	2	-	-	2	-	-	-	-	-	-	-	3	2	2
CO4	2	2	-	-	-	-	-		-	-	-	-	3	2	2
CO5	3	3	-	1	-	-	-	-	-	-	-	-	3	2	2
3-High 2-Medium 1-Low															

Object Oriented Programming using C++

General Course Information

Course Code: PC/CSE/32-T Course Credits: 3 Type: Professional Core Contact Hours: 3 hours/week Mode: Lectures (L) Examination Duration: 3 hours	**Course Assessment Methods (internal: 30; external:70)** Three minor examinations (20 marks), Class Performance measured through percentage of lectures attended (4 marks), assignments (6 marks), and the end- semester examination (70 marks). For the end semester examination, nine questions are tobe set by the examiner. A candidate is required to attempt 5 questions in all. All questions carry equal marks. Question number 1 will be compulsory and based on the entire syllabus. It will contain seven parts of 2 marks each. Question numbers 2 to 9 will be given by setting two questions from each of the four units of the syllabus. A candidate is required to attempt the remaining four questions by selecting one question from each of the four units.

Pre-requisites: Knowledge of computer fundamentals and problem-solving using C programming

About the Course:
Objected Oriented Programming using C++ is an essential course for every graduate in Computer Science and Engineering. This course introduces the Object-Oriented concepts such as data encapsulation, data hiding, data abstraction, reusability, exception handling etc., and their implementation using C++.

Course Outcomes: By the end of the course students will be able to:
CO1. **List** the concepts related to object-oriented paradigms. (LOTS: Level 1: Remember)
CO2. **Distinguish** between structured and object-oriented approaches to programming.(LOTS: Level 2: Understand)
CO3. **Apply** object-oriented constructs for problem solving. (LOTS: Level 3: Apply)
CO4. **Detect** logical and run time errors and suggest appropriate modifications. (LOTS: Level4: Analyze)
CO5. **Justify** the design of a program for a given problem. (LOTS: Level 5: Evaluate)
CO6. **Design** solutions to programming problems using multiple object-oriented programming constructs together. (LOTS: Level 6: Create)

Course Content

Unit I

Introduction to object-oriented programming, C++ standard library, basics of a typical C++ environment, illustrative simple C++ programs, new features of ANSI C++ standard, OOPs concepts: Information hiding, encapsulation, data abstraction, access modifiers, controlling access to a class level, method, or variable (public, protected, private, block level, scope and mutable), other modifiers. Structure of class and struct in memory, accessing members of structures, Class scope and accessing class members, separating interface from implementation, pre-processors directives, macro programs, header files and namespaces, default constructors, chained constructor, default arguments with constructors, constant object and const member functions, object as member of class, use of destructors, virtual destructors, function overloading.

Unit II

Inline function, friend function and friend classes, using this pointer, dynamic memory allocation with new and delete, static class members, polymorphism concepts, overloading, overriding methods, abstract classes, reusability, class's behaviors, inheritance, base classes and derived classes, protected members, casting base-class pointers to derived-class pointers, using member functions, overriding base-class members in a derived-class, public, protected and private inheritance, using constructors and destructors in derived classes, implicit derived-class object to base- class object conversion, composition vs. inheritance.

Unit III

Virtual functions, abstract base classes and concrete classes, new classes and dynamic binding, virtual destructors, fundamentals of operator overloading, restrictions on operators overloading, operator functions as class members vs. as friend functions, overloading, <<, >> overloading unary operators, overloading binary operators. I/O Streams, files handling, creating a sequential access file, reading data from a sequential access file, updating sequential access files, random access files, creating a random-access file, writing data randomly to a random-access file.

Unit IV

Managing Console I/O, stream input/output classes and objects, stream output, stream input, unformatted I/O (with read and write), stream manipulators, exception handling, basics of C++ exception handling(try, throw, catch), rethrowing an exception, specific exception, processing unexpected exceptions, exception handling in constructors and destructors, inheritance with exception introduction to generic classes, function templates, overloading template functions, class template, non-type parameters.

Text and Reference Books:

1. H. M. Deitel and P. J. Deitel, *C++ How To Program*, 6th Ed., Prentice Hall, 2008.
2. Robert Lafore, *Object-Oriented Programming in C++*, 3rd Ed., Sams Publishing, 2001.
3. D. Ravichandran, *Programming with C++*, 3rd Ed., T.M.H, 2011.
4. E. Balagurusamy, *Object oriented Programming with C++*, 6th Ed., Tata McGraw Hill,2013.
5. Horstmann, *Computing Concepts with C++ Essentials*, 3rd Ed., John Wiley, 2003.
6. Herbert Schildt , *The Complete Reference in C++*, 5th Ed., TMH, 2012.

CO-PO Articulation Matrix Object Oriented Programming Using C++ Course (PC/CSE/32-T)

Course Outcomes	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO10	PO 1 1	PO 12	PSO 13	PSO 14	PSO 15
CO1	1	1	-	-	-	-	-	-	-	-	-	-	2	-	-
CO2	1	1	-	-	-	-	-	-	-	-	-	-	3	-	-
CO3	2	1	-	-	2	-	-	-	-	-	-	-	3	-	-
CO4	2	2	-	-	-	-	-	-	-	-	-	-	3	-	-
CO5	2	3	-	-	-	-	-	-	1	-	-	-	3	-	-
CO6	3	3	1	-	2	-	-	-	1	-	-	-	3	-	-
3-High 2-Medium 1-Low															

Discrete Mathematics

General Course Information

Course Code: PC/CSE/33-T Course Credits: 3 Type: Professional Core Contact Hours: 3 hours/week Mode: Lectures Examination Duration: 3 hours	**Course Assessment Methods (internal: 30; external: 70)** Three minor examinations (20 marks), Class Performance measured through percentage of lectures attended (4 marks), assignments (6 marks), and the end- semester examination (70 marks). For the end semester examination, nine questions are to be set by the examiner. A candidate is required to attempt 5 questions in all. All questions carry equal marks. Question number 1 will be compulsory and based on the entire syllabus. It will contain seven parts of 2 marks each. Question numbers 2 to 9 will be given by setting two questions from each of the four units of the syllabus. A candidate is required to attempt the remaining four questions by selecting one question from each of the four units.

Pre-requisites: Basic knowledge of Number Theory, Calculus and Algebra

About the Course:

Discrete Mathematics is a core and an essential course for every graduate in Computer Science and Engineering. This branch of mathematics mainly deals with discrete objects (as computer runs on discrete steps). It provides a mathematical language for computer science to resolve many real-world problems by incorporating different methods applicable to various discrete structures. This course introduces set theory, propositional calculus, algebraic structures, recurrence relations and graph theory.

Course Outcomes: By the end of the course a student would be able to:

CO1. **outline** various discrete structures and the related operations. (LOTS: Level 1:Remember)

CO2. **illustrate** different discrete structures with the help of examples. (LOTS: Level 2:Understand)

CO3. **apply** appropriate techniques to solve problems related to discrete structures. (LOTS:Level 3: Apply)

CO4. **justify** the solutions with the help of proofs. (LOTS: Level 5: Evaluate)

CO5. **combine** techniques related to discrete structures for solving real world problems.(LOTS: Level 6: Create)

Course Content

Unit I

Set Theory: Introduction to Set Theory, Venn Diagrams, Set Operations, Algebra of Sets, Duality, Finite, Infinite Sets and Counting Principle, Classes of Sets, Power Sets, Partitions, Multi Sets, Relations: Cartesian Product, Representation of Relations, Types of Relation, Equivalence Relations and Partitions, Partial Ordering Relations, Functions: Definition, Types of Functions, Composition of Functions, Inverse Function, Recursively Defined Functions.

Unit II

Logic and Propositional Calculus: Introduction, Propositions and Compound Propositions, Basic Logical Operations, Propositions and Truth Tables, Tautologies and Contradictions, Logical Equivalence, Algebra of Propositions, Conditional and Bi-conditional Statements, Algebraic Structures: Group Axioms, Monoid, Semi-Groups, Subgroups, Abelian Group, Cosets, Normal Subgroup, Cyclic Group, Permutation Group, Lagrange's Theorem, Homomorphism, Isomorphism, Automorphism, Rings, Integral Domains and Fields (Also, some basic and standard results related to Groups, Rings, ID and Fields).

Unit III

Recursion and Recurrence Relation: Polynomials and their evaluation, Sequences, Introductionto AP, GP and AG Series, Partial Fractions, Recurrence Relation, Linear Recurrence Relations with Constant Coefficients, Linear Homogeneous Recurrence Relations with Constant Coefficients, Particular Solution- Homogeneous Linear Difference Equations, Non- Homogeneous Linear Difference Equations, Total Solution, Generating Functions.

Unit IV

Graphs Theory: Introduction to Graphs, Multi Graph, Directed and Undirected Graphs, Subgraphs, Bipartite Graphs, Regular Graphs, Connected Graphs, Homomorphic and IsomorphicGraphs, Cut points and Bridges, Paths and Circuits, Euler Graph, Hamiltonian Graph, Planar Graph, Euler Formula, Weighted Graphs, Dijkstra's Shortest Path Algorithm for Weighted Graphs, Trees, Spanning Trees, Minimum Spanning Tree (Prim's and Kruskal's Algorithm).

T**ext and Reference Books:**

1. J.P. Trembley and R. Manohar, *Discrete Mathematical Structures with Applications to Computer Science*, Tata McGraw Hill – 13th reprint, 2012.
2. Kenneth H. Rosen, *Discrete Mathematics and its applications*, 6th Edition, Tata McGraw Hill, 2011.
3. Richard Johnsonbaugh, *Discrete Mathematics*, 6th Edition, Pearson Education Asia, 2011.
4. S. Lipschutz and M. Lipson, *Discrete Mathematics*, Tata McGraw Hill, 3rd Edition, 2010.
5. B. Kolman, R. C. Busby and S. C. Ross, *Discrete Mathematical structures*, 6th Edition, PHI, 2010.
6. C. L. Liu, *Elements of Discrete Mathematics*, Tata McGraw Hill, 3rd Edition, 2008.

CO-PO Articulation Matrix Discrete Mathematics Course (PC/CSE/33-T)

Course Outcomes	**PO 1**	**PO 2**	**PO 3**	**PO 4**	**PO 5**	**PO 6**	**PO 7**	**PO 8**	**PO 9**	**PO10**	**PO 11**	**PO 12**	**PSO 13**	**PSO 14**	**PSO 15**
CO1	1	--	--	--	--	--	--	--	--	--	--	--	1	1	1
CO2	1	--	--	--	--	--	--	--	--	--	--	--	1	2	1
CO3	2	--	--	--	1	--	--	--	--	--	--	--	2	2	--
CO4	3	1	--	--	2	--	--	--	--	--	--	--	3	--	--
CO5	3	2	--	--	2	--	--	--	1	--	--	1	3	--	--
3-High 2-Medium 1-Low															

Computer Organization and Architecture

General Course Information

Course Code: PC/CSE/34-T Course Credits: 3 Type: Professional Core Contact Hours: 3 hours/week Mode: Lectures Examination Duration: 3 hours	**Course Assessment Methods (internal: 30; external: 70)** Three minor examinations each of 20 marks, Class Performance measured through percentage of lectures attended (4 marks) Assignment and quiz (6 marks), andend semester examination of 70 marks. For the end semester examination, nine questions are to be set by the examiner. Question number one will be compulsory and based on the entire syllabus. It will contain seven short answers type questions each of marks 2. Rest of the eight questions are to be given by setting two questions from each of the four units of thesyllabus. A candidate is required to attempt any other four questions selecting one from each of the remaining four units. All questions carry equal marks.

Pre-requisites: Digital Electronics and computer systems.

About the Course:
Computer Architecture and organization describes the role of instruction set architecture in digital computer, main memory, and input/output devices. It illustrates the simple data path and control design for processors. It helps to understand the different operations and concept of instructions. It would enable the students to learn the basic function and architecture of modern computer systems.

Course Outcomes: By the end of the course students will be able to:

CO1. **outline** the general concepts of digital electronics and computer organisation and architecture. (LOTS: Level 1: Remember)

CO2. **discuss** the basic components and their interfacing. (LOTS: Level 2: Understand)

CO3. **apply** instructions for performing different operations. (LOTS: Level 3: Apply)

CO4. **analyse** the effect of addressing modes on the execution time of a program. (LOTS: Level 4: Analyse)

CO5. **contrast** different types of memory. (LOTS:Level 5: Evaluate)

CO6. **Design of** simple computer with different instruction sets. (LOTS: Level 6: Create)

Course Content

Unit I

Basic Principles: Boolean algebra and Logic gates, Combinational logic blocks (Adders, Subtractors, Multiplexers, Encoders, decoders, demultiplexers, K-Maps), Sequential logic blocks (Flip-Flops, Registers); Flynn's classification of computers (SISD, MISD, MIMD); CPU Architecture types: computer register, (accumulator, register, stack, memory/ register).

Unit II

Computer Organization: Store program control concept, Instruction codes, instruction cycle; type of instructions: memory reference, register reference, I/O reference; Basics of Logic Design, accumulator logic, micro-instruction formats.

Unit III

Instruction Set Architecture & Parallelism: Instruction set based classification of processors (RISC, CISC, and their comparison); Stack Organization, Instruction Formats; addressing modes: register, immediate, direct, indirect, indexed, Types of interrupts; Introduction to Parallelism: Goals of parallelism, Instruction level parallelism (pipelining, super scaling –basic features); Processor level parallelism.

Unit IV

Memory Hierarchy & I/O Techniques: The need for a memory hierarchy, Cache, main memory and secondary memory, Main memory (Semiconductor RAM & ROM organization, memory expansion, Static & dynamic memory types); Cache memory (Associative& direct mapped cache organizations, mode of transfer, DMA (Direct memory transfer).

Text and Reference Books:

1. Mano, M. Morris, *Digital Logic and Computer Design*, Prentice Hall of India Pvt. Ltd., 1981.
2. M. Morris Mano, *Computer System Architecture*, Prentice Hall of India Pvt. Ltd., 1993.
3. Milles J. Murdocca, Vincent P. Heuring, *Computer Architecture and Organization, An Integrated Approach*, JohnWiley & Sons Inc., 2007.
4. William Stallings, 10th edition, *Computer Organization and Architecture*, Prentice Hall, 2016.
5. Heuring, V.P., Jordan, H.F., *Computer Systems Design and Architecture*, Addison Wesley,1997.
6. R.P Jain, *Modern Digital Electronics*, 3rd Edition, Tata McGraw Hill, 2003.

CO-PO Articulation Matrix Computer Organization and Architecture Course (PC/CSE/34-T)

Course Outcomes	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 13	PSO 14	PSO 15
CO1	1	-	-	-	-	-	-	-	-	-	-	-	2	-	-
CO2	1	-	-	-	-	-	-	-	-	-	-	-	3	-	-
CO3	2	-	-	-	-	-	-	-	-	-	-	-	3	-	-
CO4	2	2	-	1	-	-	-	-	-	-	-	1	3	-	-
CO5	2	2	-	1	-	-	-	-	-	-	-	1	3	-	-
CO6	3	2	-	-	2	-	-	-	-	-	-	-	3	-	-
3-High 2-Medium 1-Low															

Analog Electronic circuits

General Course Information

Course Code: ESC/5-T Course Credits: 2 Type: Professional Core Contact Hours: 2 hours/week Mode: Lectures Examination Duration: 3 hours	**Course Assessment Methods (internal: 30; external: 70)** Three minor examinations each of 20 marks, Class Performance measured through percentage of lectures attended (4 marks) Assignment and quiz (6 marks), andend semester examination of 70 marks. For the end semester examination, nine questions are to be set by the examiner. Question number one will be compulsory and based on the entire syllabus. It will contain seven short answers type questions each of marks 2. Rest of the eight questions are to be given by setting two questions from each of the four units of thesyllabus. A candidate is required to attempt any other four questions selecting one from each of the remaining four units. All questions carry equal marks.

Pre-requisites: Digital Electronics and computer systems.

About the Course:
Computer Architecture and organization describes the role of instruction set architecture in digital computer, main memory, and input/output devices. It illustrates the simple data path and control design for processors. It helps to understand the different operations and concept of instructions. It would enable the students to learn the basic function and architecture of modern computer systems.

Course Outcomes: By the end of the course students will be able to:

CO1. Students will be able to define the behavior of semiconductor devices. (LOTS: Level 1: Remember)
CO2. describe the current flow of a bipolar transistor in CB, CE and CCconfigurations. (LOTS: Level 2: Understand)
CO3. illustrate the biasing of transistors. (LOTS: Level 3: Apply)
CO4. solve the problems using the basic knowledge gained on electronic systems. (LOTS: Level 4: Analyse)
CO5. examine simple oscillator circuits and OP-AMP. (LOTS:Level 5: Evaluate)

Course Content

Unit I

Semi-Conductors and Diodes: Introduction, Insulators, semiconductors and metals, Mobility and conductivity, Intrinsic and extrinsic semiconductors, Charge density, PN junction diode-Characteristics and analysis, Rectifiers: Half waverectifier, Full wave rectifier, bridge rectifier and their analysis, Types of diodes- Zener Diode, LED, varactor diode.

Unit II

Transistors: Construction and characteristics of BJT, Transistor configuration: CB, CE, CC configuration, Transistor biasing and bias stabilization: Operating point, Stability factor, Analysis of fixed bias, collectorto base bias, Emitter resistance bias circuit and self-bias circuit.

Unit III

OSCILLATORS: Introduction, Types of Oscillators, Barkhausen criterion, Hartley oscillator, Colpittoscillator, RC-phase shift oscillator, Wein bridge oscillator.

REGULATED POWER SUPPLIES: Series and shunt voltage regulators, three terminal fixed IC voltage regulator (78xx/79xx), adjustable voltage regulator (LM 317), SMPS.

Unit IV

OP-AMP: Block diagram, Op-Amp equivalent circuit and its analysis, Non-Inverting/Inverting op-amp, OP-AMP characteristics, integrator and differentiator, summing amplifier.

T**ext and Reference Books:**

1. Integrated devices & Circuits by Millman & Halkias, McGraw Hill.
2. Electronics Devices and Circuit Theory by Robert L. Boylestad, Pearson.
3. Electronics Devices and Circuits-II by A.P.Godre& U.A. Bakshi.
4. Electronics Devices and Circuit by G.K. Mithal.

CO-PO Articulation Matrix Computer Organization and Architecture Course (ESC/5-T)

Course Outcomes	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 1 1	PO 12	PSO 13	PSO 14	PSO 15
CO1	3	1	1	1	---	---	2	---	---	---	---	2	---	2	1
CO2	3	---	2	2	---	1	2	1	1	---	1	2	---	2	1
CO3	2	3	2	1	---	1	2	---	1	1	1	2	---	2	1
CO4	2	3	3	3	3	2	1	1	2	1	1	2	---	2	1
CO5	2	3	3	3	3	2	1	1	2	1	1	2	---	2	1
3-High 2-Medium 1-Low															

Environmental Science

General Course Information

Course Code: MC/2-T Course Credits: 0 Type: Mandatory Course Contact Hours: 3 hours/week Mode: Lectures (L) Examination Duration: 3 hours	**Course Assessment Methods (internal: 30; external: 70)** Three minor examinations (20 marks), Class Performance measured through percentage of lectures attended (4 marks), assignments (6 marks), and the end- semester examination (70 marks). For the end semester examination, nine questions are to be set by the examiner. A candidate is required to attempt 5 questions in all. All questions carry equal marks. Question number 1 will be compulsory and based on the entire syllabus. It will contain seven parts of 2 marks each. Question numbers 2 to 9 will be given by setting two questions from each of the four units of the syllabus. A candidate is required to attempt the remaining four questions by selecting one question from each of the four units.

Pre-requisites: None

About the Course and its Outcomes:
This is a mandatory course to enhance the knowledge, skills and attitude of the graduating engineers to the environment. By studying this course students will understand our natural environment and its relationship with human activities.

Course outcomes: By the end of the course a student will be able to:

CO1. **state** the environment related issues and challenges in sustainable development

CO2. **demonstrate** the understanding of various environment hazards and means of protection against these hazards. (LOTS: Level 2: Understand)

CO3. **apply** irreplaceable tool to provide first-hand knowledge on various environmental aspects in the entire learning process. (LOTS: Level 3: Apply)

CO4. **analyze** impacts of human business and developmental activities on the environment. (LOTS: Level 4: analyze)

CO5. **design** and evaluate strategies for sustainable management of environmental eco-systems. (LOTS: Level 6: design)

Course content

Unit-I

Multidisciplinary nature of Environmental studies: Definition, scope and importance, need for public awareness; Concept, Structure and function of an ecosystem: Producers, consumers and decomposers, Energy flow in the ecosystem ,Ecological succession ,Food chains, Food webs and ecological pyramids; Introduction, types, characteristics features, structure and function of Forest ecosystem, Grassland ecosystem ,Desert ecosystem, Aquatic ecosystem (Ponds, Stream, lakes, rivers, oceans, estuaries); Biodiversity: Introduction, Definition: genetic, species and ecosystem diversity, Bio-geographical classification of India, Value of biodiversity: consumptive use, productive use, social ethical, aesthetic and option values; Biodiversity at global, national and local level, India as a mega-diversity nation, Hot-spot of biodiversity, Threats to biodiversity:

habitat loss, poaching of wildlife, man-wildlife conflicts, Endangered and endemic species of India, Conservation of biodiversity: In-situ and Ex-situ conservation of biodiversity.

Unit-II

Renewable and non-renewable resources, Natural resources and associated problems ,Forest resources: Use and over-exploitation, deforestation, case studies, Timber extraction, mining, dams and their effects on forests and tribal people; Water resources: Use and over utilization of surface and ground water, floods, droughts conflicts over water, dams benefits and problems; Mineral resources: Use and exploitation, environmental effects of extracting and mineral resources; Food resources: World food problem, changes caused by agriculture and overgrazing, effects of modern agriculture, fertilizer-pesticide problems, water logging, salinity; Energy resources: Growing energy needs, renewable and non-renewable energy sources, use of alternate energy sources, case studies; Land resources: Land as a resource, land degradation, main induced landslides, soil erosion and desertification, Role of an individual in conservation of natural resources, Equitable use of resources for suitable lifestyle.

Unit-III

Definition of Environment Pollution; Causes, effects and control measures of: Air Pollution, Water Pollution, Soil pollution, Marine pollution, Noise pollution, Thermal pollution, Nuclear hazards; Solid waste Management: Causes effects and control measures of urban and industrial wastes; Role of and individual in prevention of pollution, Pollution case studies; Disaster management: floods, earthquake, cyclone and landslides; Climate change, global warming, acid rain, ozone layer depletion, nuclear accidents and holocaust, Case studies; different laws related to environment: Environment Protection Act, Air (Prevention and Control of Pollution) Act, Water (Prevention and Control of Pollution) Act, Wildlife Protection Act, Forest Conservation Act.; Issues involved in enforcement of environmental legislation, Public awareness

Unit-IV

Social issues and the Environment: From unsustainable to Sustainable development, Urban problems related to energy; Water conservation, rain water harvesting, watershed management; Resettlement and rehabilitation of people; its problem and concern, case studies; Environment ethics: Issues and possible solutions; Wasteland reclamation; Consumerism and waste products; Human Population growth, variation among nation, Population explosion- Family Welfare Programme, Environment and human health , Human Rights, Value Education, HIV/AIDS, Women and Child Welfare, Role of Information Technology in Environment and human health, Case Studies.
Field Work: Visit to a local area to document environmental assets- river/forest/ grassland/hill/mountain; Study of simple ecosystems – ponds, river, hill slopes etc; Study of common plants, insects, birds; Visit to a local polluted site- Urban/Rural/Industrial/Agricultural.

T**ext and Reference Books:**

1. Erach Bharucha, *Environmental Studies for Undergraduate Courses*, University press pvt. Ltd. (India), 2005.
2. Dr. D. D. Mishra, *Fundamental concepts in Environmental studies*, S. Chand publications, 2008.

3. Dr. S. V.S. Rana, *Essentials of Ecology and Environmental Science*, PHI Learning Pvt.Ltd Delhi, 2013.
4. Anil Kumar De, *Environmental Chemistry*, Wiley Eastern Limited, 1994.
5. T. G. Miller, *Environmental Science,* Wadsworth Publishing Co, 13th4edition, 2013.
6. P. D. Sharma, *Ecology and Environment*, Rastogi publications, 13th edition, 2003.

CO-PO Articulation Matrix Environmental Studies (MC/2-T)

Course Outcomes	**PO 1**	**PO 2**	**PO 3**	**PO 4**	**PO 5**	**PO 6**	**PO 7**	**PO 8**	**PO 9**	**PO 10**	**PO1 11**	**PO 12**	**PSO 13**	**PSO 14**	**PSO 15**
CO1	3	1	1	1	---	---	2	---	---	---	---	2	---	2	1
CO2	3	---	2	2	---	1	2	1	1	---	1	2	---	2	1
CO3	2	3	2	1	---	1	2	---	1	1	1	2	---	2	1
CO4	2	3	3	3	3	2	1	1	2	1	1	2	---	2	1
CO5	2	3	3	3	3	2	1	1	2	1	1	2	---	2	1
3-High 2-Medium 1-Low															

Data Structures and Algorithms using C/C++Lab.

General Course Information

Course Code: PC/CSE/31-P Course Credits: 2 Type: Professional Core Lab. Course Contact Hours: 4 hours/week Mode: Lab practice and assignments	**Course Assessment Methods (internal: 50; external: 50)** The internal and external assessment is based on thelevel of participation in lab. Sessions and the timely submission of lab experiments/assignments, the quality of solutions designed for the assignments, the performance in VIVA-VOCE, the quality of lab. file and ethical practices followed. The internal examination is conducted by the course coordinator. The external examination is conducted by external examiner appointed by the Controller of Examination in association with the internal examiner appointed by the Chairperson of the Department.

Pre-requisites: Programming in C language.

About the Course:
This lab. course involves implementation of basic and advance data structures and various operations on these data structures. The objective of the lab course is to train the students to solve the problems related to data structures and choose the appropriate data structure for solving computational problem efficiently.

Course Outcomes: By the end of the lab course a student would be able to:

CO1. **Implement** various data structures and the related operations. (LOTS: Levels 3: Apply)

CO2. **Analyse** space and time complexity of algorithms. (LOTS: Level 4: Analyse)

CO3. **Compare** solutions on the basis of the appropriateness of data structure used and the efficiency of the operations implemented. (LOTS: Level 5: Evaluate)

CO4. **Integrate** knowledge of data structures to solve real world problems related to data structure and algorithms. (LOTS: Level 6: Create)

CO5. **Create** written records for the given assignments with problem definition, design of solution and conclusions. (LOTS: Level 6: Create)

CO6. **Demonstrate** ethical practices while solving problems individually or in groups (LOTS: Level 3: Apply).

List of experiments/assignments

1. Two assignments related to creating and manipulating matrices and linear lists.
2. Two assignments associated with linked list, operations on linked lists and their applications.
3. Two assignments on array and linked implementation of stacks and queues.
4. Two assignments on trees and their applications.
5. Two assignments on graphs and their applications.
6. Two assignments on different searching and sorting methods along with their complexity analysis.
7. One assignment on challenging problems on data structures to be given in groups.

Note:

The actual experiments/assignments will be designed by the course coordinator. One assignment should be designed to be done in groups of two or three students. The assignments must meet the objective of the course and the levels of the given course outcomes. The list of assignments and schedule of submission will be prepared by the course coordinator at the beginning of the semester.

CO-PO Articulation Matrix Data Structures and Algorithms Lab. Course (PC/CSE/31-P)

Course Outcomes	**PO 1**	**PO 2**	**PO 3**	**PO 4**	**PO 5**	**PO 6**	**PO 7**	**PO 8**	**PO 9**	**PO1 0**	**PO 1 1**	**PO 12**	**PSO 13**	**PSO 14**	**PSO 15**
CO1	2	-	-	-	1	-	-	-	2	-	-	-	3	-	-
CO2	2	2	-	-	1	-	-	-	1	-	-	-	3	-	-
CO3	2	2	-	-	1	-	-	-	1	-	-	-	3	-	-
CO4	3	2	3	-	-	-	-	-	3	-	-	-	3	-	-
CO5	-		-	-	-	-	-	-	-	3	-	-	-	-	-
CO6	-		-	-	-	-	-	3	-	-	-	3	-	-	-
3-High 2-Medium 1-Low															

Object Oriented Programming using C++ Lab.

General Course Information

Course Code: PC/CSE/32-P Course Credits: 2 Type: Professional Core Lab.Course Contact Hours: 4hours/week Mode: Lab practice andassignments	**Course Assessment Methods (internal: 50; external: 50)** The internal and external assessment is based on the level of participation in lab. Sessions and the timely submission of lab experiments/assignments, the quality of solutions designed for the assignments, the performance in VIVA-VOCE, the quality of lab. file and ethical practices followed. The internal examination is conducted by the course coordinator. The external examination is conducted by external examiner appointed by the Controller of Examination in association with the internal examiner appointed by the Chairperson of the Department.

Pre-requisites: Problem solving using C Lab.

About the course:
The lab course provides the opportunity to students to solve problems using Object Oriented Framework in C++ language. This includes implementing the concepts of data abstraction, data hiding, and encapsulation, reuse of code and, compile and runtime polymorphism.

Course Outcomes: By the end of the course students will be able to:

CO1. **implement** problems with object-oriented framework. (LOTS: Level 3: Apply)
CO2. **analyse** the structure of programs for modular design. (LOTS: Level 4: Analyse)
CO3. **evaluate** robustness of a program by testing it on test/use cases. (LOTS: Level 5: Evaluate)
CO4. **design** class hierarchies for implementing inheritance/polymorphism. (LOTS: Level6: Create)
CO5. **create** a lab record of assignments including problem definitions, design of solutions and conclusions. (LOTS: Level 6: Create)
CO6. **demonstrate** ethical practices and solve problems individually or in a group. (LOTS: Level 3: Apply)

List of assignments

1. A CPP using Static data member and static member function to record the occurrences of the entire object.
2. A CPP to calculate square and cube of a number using inline functions and macros. (Demonstrate the use of inline functions compared to macros).
3. A CPP to find the area of a rectangle, a triangle and surface area of a sphere using function overloading.
4. A CPP to show that "for each object constructors is called separately" and read the values through keyboard (Use Constructor).
5. A CPP to implement multiple inheritances for multiplication of two numbers.
6. A CPP to overload unary and binary operator using operator function with friend function.
7. A CPP to write and read text in a file. Also show the Use of ofstream and ifstream classes.
8. A CPP using Constructor in Derived classes to initialize alpha, beta and gamma and display corresponding values

9. A CPP to display roll number, marks obtained of students in two subjects, sports weight, and total score of student using Virtual base class
10. A CPP for invoking function that generates Exception, rethrows the exception, have multiple catch blocks.
11. A CPP to use Multiple Constructor in a class for displaying complex value.
12. A CPP to illustrate the use of a Vector Class Template for performing the scalar product of int type vector and float type vector.
13. A CPP to implement runtime polymorphism.

Note:

The experiments/assignments may vary from session to session and will be designed by the course coordinator. The assignments must meet the objective of the course and the levels of the given course outcomes. The course coordinator will provide the schedule for submission of the assignment.

CO-PO Articulation Matrix Object Oriented Programming using C++ Lab. (PC/CSE/32-P)

Course Outcomes	**PO 1**	**PO 2**	**PO 3**	**PO 4**	**PO 5**	**PO 6**	**PO 7**	**PO 8**	**PO 9**	**PO1 0**	**PO 11**	**PO 12**	**PSO 13**	**PSO 14**	**PSO 15**
CO1	2	2	-	-	1	-	-		2	-	-	2	3	-	-
CO2	2	2	-	-	2	-	-	-	-	-	-	-	3	-	-
CO3	2	2	-	-	2	-	-	-	-	-	-	-	3	-	-
CO4	3	-	1	-	2	-	-	-	-	-	-	2	3	-	-
CO5	-	-	-	-	-	-	-		-	3	-	-	-	-	-
CO6	-	-	-	-	-	-	-	3	3	-	-	3	-	-	-
3-High 2-Medium 1-Low															

Detailed Syllabus of

B.Tech.(CSE)

IV Semester

Microprocessors and Interfacing

General Course Information:

Course Code: PC/CSE/41-T Course Credits: 3 Type: Professional Core Contact Hours: 3 Mode: Lecture (L) Examination Duration: 3 Hours	**Course Assessment Methods (internal: 30; external: 70)** Three minor examinations (20 marks), Class Performance measured through percentage of lectures attended (4 marks), assignments (6 marks), and the end-semester examination (70 marks). For the end semester examination, nine questions are to be set by the examiner. A candidate is required to attempt 5 questions in all. All questions carry equal marks. Question number 1 will be compulsory and based on the entire syllabus. It will contain seven parts of 2 marks each. Question numbers 2 to 9 will be given by setting two questions from each of the four units of the syllabus. A candidate is required to attempt the remaining four questions by selecting one question from each of the four units.

Pre-requisites: The students are expected to have a strong background in the Computer Organization Digital System Design.

About the Course

By the end of the course students will be able to:

CO1. **Outline** the architecture of 8085 and 8086 Microprocessor. (LOTS: Level 1:Remember)

CO2. **Discuss** the basic principles of addressing modes, pin diagrams. (LOTS: Level 2: Understand)

CO3. **Describe** the functionality of various peripheral chip (LOTS: Level 2: Understand)

CO4. **Apply** the concepts of interfacing of Memory, Input/output with Microprocessor. (LOTS: Level 3: Apply)

CO5. **Compare** and **contrast** the working of 8085 and 8086 microprocessors. (LOTS: Level5: Evaluate)

CO6. **Develop** Assembly Language programs for 8085 and 8086 microprocessors. (LOTS:Level 6: Create)

Course Contents

Unit-I

Introduction to microprocessor, 8085 microprocessor architecture, instruction set, interrupt structure, Architecture of 8086, block diagram of 8086, details of sub-blocks such as EU, BIU; memory segmentation and physical address computations, program relocation.

Unit II

Addressing modes, instruction formats, pin diagram and description of various signals, Instruction execution timing, assembler instruction format, data transfer instructions, arithmetic instructions, branch instructions, looping instructions, NOP and HLT instructions, flag manipulation instructions, logical instructions, shift and rotate instructions, directives and operators.

Unit III

Assembler directives, Programming with an assembler, Programming examples, coding style, the art of assembly language programming. Interrupts, Introduction to Stack, Stack Structure of 8086, Introduction to Subroutines, BIOS (Basic Input/Output System).

Unit IV

The 8255 PPI chip: Architecture, control words, modes and examples.Introduction to DMA process, 8237 DMA controller.

T**ext and Reference Books:**

1. Ramesh S Gaonkar; *Microprocessor Architecture, Programming & Applications with8085*, Wiley Eastern Ltd., 5th edition, 2002.
2. Brey, *The Intel Microprocessors 8086- Pentium processor*, PHI, 8th edition, 2009.
3. Douglas V Hall; *Microprocessors and Interfacing*, TMH, 2000.
4. Triebel & Singh; *The 8088 & 8086 Microprocessors-Programming, interfacing, Hardware & Applications*, PHI, 4th edition, 2003.
5. Yu-Chang Liu & Glenn A Gibson; *Microcomputer systems: the 8086/8088 Family: architecture, Programming & Design,* PHI, 1986.

CO-PO Articulation Microprocessor and Interfacing Course (PC/CSE/41-T)

Course Outcomes	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 1 1	PO 12	PSO 13	PSO 14	PSO 15
CO1	1	--	--	--	--	--	--	--	--	--	--	--	3	--	--
CO2	2	--	--	--	--	--	--	--	--	--	--	--	3	--	--
CO3	2	1	--	--	--	--	--	--	--	--	--	--	3	--	--
CO4	2	1	--	--	--	--	--	--	--	--	--	--	3	--	--
CO5	2	--	1	1	2	--	--	--	--	--	--	1	3	--	--
CO6	3	2	2	--	2	--	--	--	1	--	--	1	3	--	--
3-High 2-Medium 1-Low															

Computer Networks

General Course Information

Course Code: PC/CSE/42-T Course Credits: 3 Type: Professional Core Contact Hours: 3 hours/week Mode: Lectures (L) Examination Duration: 3 hours	**Course Assessment Methods (internal: 30; external: 70)** Three minor examinations (20 marks), Class Performance measured through percentage of lectures attended (4 marks), assignments (6 marks), and the end- semester examination (70 marks). For the end semester examination, nine questions are to be set by the examiner. A candidate is required to attempt 5 questions in all. All questions carry equal marks. Question number 1 will be compulsory and based on the entire syllabus. It will contain seven parts of 2 marks each. Question numbers 2 to 9 will be given by setting two questions from each of the four units of the syllabus. A candidate is required to attempt the remaining four questions by selecting one question from each of the four units.

Pre-requisites: Basic knowledge of Digital and Analog Communication.

About the Course:
This course has been designed with an aim to provide students with an overview of the conceptsand fundamentals of data communication and computer networks. The learner is given an opportunity to grasp various algorithms for routing of data, forwarding data and switching the data from hop to hop. Layered Architecture adds value to the subject contents.

Course Outcomes: By the end of the course students will be able to:
CO1. **outline** various models, topologies and devices of Computer Networks. (LOTS: Level1: Remember)
CO2. **explain** the functions of various layers in Network Reference Model. (LOTS: Level 2: Understand)
CO3. **apply** different network concepts in various network communication protocols. (LOTS:Level 3: Apply)
CO4. **analyse** performance of various protocols in different scenarios. (LOTS: Level 4:Analyse)
CO5. **design** network for an organisation. (LOTS: Level 6: Create)

Course content

Unit I

Data communication: Components, Data representation and Data flow; Network: Uses, Topologies, Network Services, OSI and TCP/IP Reference Models; Network categories: LAN, MAN, WAN, Wireless Transmission Media, Switching Techniques: Circuit Switching, Packet Switching, Message Switching, Networking Devices**:** Hubs, Repeaters, Bridges, Modems, Switches, Routers, and Gateways.

Unit II

Data Link Layer-design issues, Framing & Error Handling: Framing Protocols, Error detection and correction mechanisms; Flow Control Protocols: Stop-and-wait, Sliding Window protocols: Go-back-N and Selective Repeat; Medium Access sub layer: Channel allocation methods, Multiple Access Communication: Random Access-ALOHA, Slotted-ALOHA, CSMA, CSMA-CD, LAN Standards: Ethernet, Fast Ethernet & Gigabit Ethernet.

Unit III

Network Layer-Design issues, store and forward packet switching connection less and connection-oriented networks, Routing algorithms: shortest path, flooding, Distance Vector Routing, link state Routing.

Internetworking: IPV4 and IPV6, IP Addressing (Classful Addressing, Classless Addressing, Sub-netting), ARP, RARP, ICMP.

Unit IV

Transport Layer: Transport layer Services: Addressing, Multiplexing, Flow control, Buffering and Error control. Internet Transport Protocols: UDP, TCP, TCP Segment, TCP Connection.

Application Layer: Introduction to DNS, FTP, TELNET, HTTP, SMTP, Electronic Mail, WWW and Multimedia.

Text and Reference Books:

1. Andrew S Tanenbaum, *Computer Networks*, 5th Edition, Pearson publications, 2010.
2. Forouzan, *Data Communication and networking* ,5th Edition, Tata McGrawHill, 2012.
3. William Stalling, *Data & Computer Communication* 6th edition, LPE Pearson Education, 2013.
4. Todd Lammle, *CCNA Study Guide*, 6th Edition, 2013.
5. RFCs and Internet Drafts available from Internet Engineering Task Force.

CO-PO Articulation Matrix Computer Networks Course (PC/CSE/42-T)

Course Outcomes	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO10	PO 11	PO 12	PSO 13	PSO 14	PSO 15
CO1	1	-	-	-	-	-	-	-	-	-	-	-	-	3	-
CO2	1	-	-	-	-	-	-	-	-	-	-	-	-	3	-
CO3	2	1	-	-	2	-	-	-	-	-	-	-	-	3	-
CO4	2	2	2	1	2	-	-	-	-	-	-	-	-	3	-
CO5	3	2	2	-	2	-	-	-	-	-	-	-	-	3	-
3-High 2-Medium 1-Low															

Database Management System

General Course Information

Course Code: PC/CSE/43-T Course Credits: 3 Type: Professional Core Contact Hours: 3 hours/week Mode: Lectures (L) Exam Duration: 3 hours	**Course Assessment Methods (internal: 30; external: 70)** Three minor examinations (20 marks), Class Performance measured through percentage of lectures attended (4 marks), assignments (6 marks), and the end- semester examination (70 marks). For the end semester examination, nine questions are to be set by the examiner. A candidate is required to attempt 5 questions in all. All questions carry equal marks. Question number 1 will be compulsory and based on the entire syllabus. It will contain seven parts of 2 marks each. Question numbers 2 to 9 will be given by setting two questions from each of the four units of the syllabus. A candidate is required to attempt the remaining four questions by selecting one question from each of the four units.

Prerequisite: Knowledge of UNIX, Windows, a programming language and data structures

About the Course:
This course includes a detailed coverage of principles of database design and models. Students learn querying a database using SQL, normalization techniques, transaction processing etc.

Course Outcomes: By the end of the course students will be able to:

CO1. **describe** fundamental elements of Database Management System. (LOTS: Level 1: Remember)

CO2. **discuss** principles of relational Database modelling. (LOTS: Level 2: Understanding)

CO3. **apply** SQL for designing queries for Relational Databases. (LOTS: Level 3: Apply)

CO4. **contrast** various concurrency control and recovery techniques with concurrent transactions in DBMS. (LOTS: Level 5: Evaluate)

CO5. **design** models of databases using ER modelling and normalization for real life applications. (LOTS: Level 6: Create)

Course Content

Unit – 1

Overview: Overview of File Systems and Database Systems, Characteristics of the Data Base Approach, Database users, Advantages and Disadvantages of a DBMS, Responsibility of Database Administrator.
Data Base Systems Concepts and Architecture: DBMS architecture and various views of Data, Data Independence, Database languages, Data Models: Relational Database Model, Hierarchical Data Model, Network Data Model, Schemas and Instances.

Unit – 2

E-R Model: Entity Types, Attributes & Keys, Relationships, Roles and Structural Constraints, E-R Diagrams, Reduction of an E-R Diagram to Tables. Relational Model and Query Language: Overview of Relational Database, Key Integrity Constraints, Relational Algebra, Relational

Calculus, SQL fundamentals, Basic Operators, Missing information and NULL values.

Unit - 3

Relational Database Design: Overview of normalization, Database Anomalies, Candidate and Super Key, Functional Dependencies, Integrity Constraints, Decomposition, Normal forms: First, Second, Third Normal, Boyce Codd, Normal Form, Multi-valued Functional Dependencies and Fourth Normal Form, Join Dependencies and Fifth Normal Form, Denormalization.

Unit - 4

Concurrency Control Techniques: Overview of database Transactions, Transaction states, ACID properties of a Transaction, Transaction Recovery, Serializability, Concurrency Control, Locking Techniques, Time-stamp ordering, Multi-version Techniques, Deadlock, Recovery Techniques in centralized DBMS.

Text and Reference Books:

1. Elmasri, R., and Navathe, S. B., *Fundamentals of Database Systems*, 3rd Edition, AddisonWesley, 2002.
2. Silberschatz, A., Korth, H. F., and Sudarshan, S., Database *System Concepts,* McGrawHill, 2011.
3. Pannerselvam R., *Database Management Systems*, 2nd Edition, PHI Learning, 2011.
4. Desai, B. C., *An Introduction to Database System*, Galgotia Publication, 2010.
5. Leon, A., and Leon, M., *Database Management Systems*, Ist Edition, Vikas Publishing,2009.
6. Mata-Toledo, R., Cushman, P., Sahoo, D., *Database Management Systems*, Schaums'Outline series, TMH, 2007.

CO-PO Articulation Matrix Database Management System Course (PC/CSE/43-T)

Course Outcomes	**PO 1**	**PO 2**	**PO 3**	**PO 4**	**PO 5**	**PO 6**	**PO 7**	**PO 8**	**PO 9**	**PO10**	**PO 1 1**	**PO 12**	**PSO 13**	**PSO 14**	**PSO 15**
CO1	1	--	--	--	--	--	--	--	--	--	--	--	3	--	--
CO2	1	--	--	--	--	--	--	--	--	--	--	--	3	--	--
CO3	1	--	--	_	2	--	--	--	--	--	--	--	3	--	--
CO4	1	2	--	--	--	--	--	--	--	--	--	--	3	--	--
CO5	3	2	3	1	2	--	--	--	--	--	--	--	3	--	--
3-High 2-Medium 1-Low															

Analysis and Design of Algorithms

General Course Information

Course Code: PC/CSE/44-T Course Credits: 3 Type: Professional Core Contact Hours: 3 hours/week Mode: Lectures (L) Examination Duration: 3 hours	**Course Assessment Methods (internal: 30; external: 70)** Three minor examinations (20 marks), Class Performance measured through percentage of lectures attended (4 marks), assignments (6 marks), and the end-semester examination (70 marks). For the end semester examination, nine questions are to be set by the examiner. A candidate is required to attempt 5 questions in all. All questions carry equal marks. Question number 1 will be compulsory and based on the entire syllabus. It will contain seven parts of 2 marks each. Question numbers 2 to 9 will be given by setting two questions from each of the four units of the syllabus. A candidate is required to attempt the remaining four questions by selecting one question from each of the four units.

Pre-requisites: Knowledge of Data Structure and a Programming Language

About the Course:
This Course focus on effective and efficient design of algorithms. In this course various algorithm design techniques and their analysis is to be studied. After studying this course, a student is expected to apply better techniques for solving computational problems efficiently and prove it analytically.

Course Outcomes: By the end of the course students will be able to:
CO1. **state** terminology and concepts algorithmic techniques. (LOTS: Level 1:Remember)
CO2. **discuss** various algorithmic techniques. (LOTS: Level 2: Understand)
CO3. **apply** appropriate algorithmic techniques to solve computational problems.(LOTS: Level 3: Apply)
CO4. **analysing** algorithms for their efficiency by determining their complexity.(LOTS: Level 4: Analyse)
CO5. **compare** the pros and cons of applying the different algorithmic techniquesto solve problems. (LOTS: Level 5: Evaluate)
CO6. **formulate** efficient and effective algorithmic solutions for different real-world problems. (LOTS: Level: 6 Create)

Course Content

Unit I

Algorithms, Algorithms as a technology, Insertion sort, analyzing algorithms, asymptotic notations, Divide and Conquer: General method, binary search, merge sort, quick sort, Strassen‟s matrix multiplication algorithms and analysis of algorithms for these problems.

Unit II

Sorting and Data Structures: Heapsort, Hash Tables, Red and Black Trees, Greedy Method: General method, knapsack problem, minimum spanning trees, single source paths and analysis of these problems.

Unit III

Dynamic Programming: General method, matrix chain multiplication, longest common subsequence, Back Tracking: General method, 8 queen's problem, graph colouring, Hamiltonian cycles, Analysis of these problems.

Unit IV

Branch and Bound: Method, O/I knapsack and traveling salesperson problem, NP Completeness: Polynomial time, NP-complete problems.

Text and Reference Books:

1. Thomas H. Cormen, Charles E. Leiserson, Ronalde L. Rivest, Clifford Stein, *Introduction to Algorithms*, MIT press, 3rd Edition, 2009.
2. Ellis Horowitz, Satraj Sahni, Sanguthevar Rajasekaran, *Fundamental of Computer Algorithms*, Galgotia publication Pvt. Ltd., 1999.
3. S. Dasgupta, C. Papadimitriou, and U. Vazirani, *Algorithms*, McGraw-Hill Higher Education, 2006.

CO-PO Articulation Matrix Analysis and Design of AlgorithmsCourse (PC/CSE/44-T)

Course Outcomes	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO1 0	PO 1 1	PO 12	PSO 13	PSO 14	PSO 15
CO1	1	--	--	--	--	--	--	--	--	--	--	--	2	--	--
CO2	1	--	--	--	--	--	--	--	--	--	--	--	3	--	--
CO3	2	--	1	--	--	--	--	--	--	--	--	--	3	2	2
CO4	3	2	1	--	2	--	--	--	--	--	--	--	3	2	2
CO5	3	2	1	--	--	--	--	--	--	--	--	--	3	2	2
CO6	3	3	2	2	--	--	--	--	--	--	--	--	3	2	2
3-High 2-Medium 1-Low															

Software Engineering

General Course Information

Course Code: PC/CSE/45-T Course Credits: 3 Type: Professional Core Contact Hours: 3hours/week Mode: Lectures (L) Examination Duration: 3 hours	**Course Assessment Methods (internal: 30; external: 70)** Three minor examinations (20 marks), Class Performance measured through percentage of lectures attended (4 marks), assignments (6 marks), and the end-semester examination (70 marks). For the end semester examination, nine questions are to be set by the examiner. A candidate is required to attempt 5 questions in all. All questions carry equal marks. Question number 1 will be compulsory and based on the entire syllabus. It will contain seven parts of 2 marks each. Question numbers 2 to 9 will be given by setting two questions from each of the four units of the syllabus. A candidate is required to attempt the remaining four questions by selecting one question from each of the four units.

Pre-requisites: Knowledge of algorithms, flow charts and a programming language.

About the Course:
Software Development is generally a quite complex and time-consuming process. Moreover, depending on the nature and complexity of the software requirements, Software Engineering plays an important role. This course will help the students to understand the systematic approach to requirement analysis, design, development, operations and maintenance of software systems. Besides this, it also guides students in developing the optimal software systems.

Course Outcomes: By the end of the course students will be able to:
CO1. **define** the various concepts related to software engineering. (LOTS: Level 1: Remember)
CO2. **demonstrate** the use of stages of various Software Life Cycle Models. (LOTS: Level 2: Understanding)
CO3. **apply** the Software Requirement Analysis and Software Design Process. (LOTS: Level3: Apply)
CO4. **analyse** the size, cost, complexity, reliability, quality and maintenance of a software system. (LOTS: Level 4: Analyse)
CO5. **construct** software model according to the requirements of a customer. (LOTS: Level6: Create)

Course Content

Unit I

Introduction: Software Crisis, Software Process, Evolution of Software Engineering, Software Characteristics, Software Metrics and SDLC. Software Life Cycle Models: Water Fall Model, Increment Process Model, Evolutionary Process Models, Unified Process. Selection of Life Cycle Model.Software Requirements, Analysis and Specifications: Requirement Engineering, Requirements Elicitation, Requirements Analysis: Data Flow Diagram, Data Dictionary, Entity-Relationship Diagrams, Decision Table, Decision Tree and Structured Charts. Requirements Documentation and Requirements validation.

Unit II

Software Project Management: Size Estimation, Cost Estimation, Constructive Cost Model (COCOMO), Putnam Resource Allocation Model. Software Risk Management: Software Risks, Risk Identification, Risk Mitigation, Monitoring, and Management, RMMM Plan.

Unit III

Software Design: Software Design Fundamentals, Design Principles, Strategy of Design, Function Oriented Design, and Object-Oriented Design, IEEE Recommended Practice for Software Design Descriptions.Software Quality: Basic Concepts, ISO 9126, McCall's Quality Factors, Software Quality Assurance, SQA Activities, ISO 9000 Quality Standards, and CMM.

Unit IV

Software Testing: Testing fundamentals, Verification and Validation, Test Plan, Test Case, Levels of Software Testing: Unit Testing, Integration Testing, Top Down and Bottom-up Testing Integration Testing, Alpha and Beta Testing, System Testing, White Box Testing and Black Box Testing, Debugging and Software Testing Tools.Maintenance and Reengineering**:** Software Maintenance, Software Supportability, Reengineering, Business Process Reengineering, Software Reengineering, Reverse Engineering, Restructuring, Forward Engineering.

Text and Reference Books:

1. K. K. Aggarwal and Yogesh Singh, *Software Engineering*, 3rd Edition, New Age International Publishers Ltd., Reprint 2014.
2. Roger S. Pressman, *Software Engineering: A Practitioners Approach* 7th Edition, Mc Graw Hill Education, 2014.
3. Rajib Mall, *Fundamental of Software Engineering*, Prentice Hall India, 2004.
4. Pankaj Jalote, *An integrated Approach to Software Engineering*, 3rd Edition, Narosa Publications, 2014.
5. Ian Sommerville, *Software Engineering*, 10th Edition, Addison-Wesley, 2015.
6. Carlo Ghezzi, Mehdi Jazayeri and Dino Mandrioli, *Fundamentals of Software Engineering*, 2nd Edition, Pearson, 2007.
7. Waman S Jawadekar, *Software Engineering-Principles and Practice*, Tata McGraw-Hill, 2004.

CO-PO Articulation Matrix Software Engineering Course (PC/CSE/45-T)

Course Outcomes	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO1 0	PO 1 1	PO 12	PSO 13	PSO 14	PSO 15
CO1	1	_	_	_	_	_	_	_	_	_	_	_	3	_	_
CO2	1	_	_	_	_	_	_	_	_	_	_	_	3	_	_
CO3	2	1	1	_	2	_	_	_	_	_	2	_	3	_	_
CO4	2	3	2	_	2	_	_	_	_	2	2	_	3	_	_
CO5	3	3	2	_	3	_	_	_	2	2	3	_	3	_	_
3-High 2-Medium 1-Low															

Java Programming

General Course Information

Course Code: PC/CSE/46-T Course Credits: 3 Type: Professional Core Contact Hours: 3 hours/week Mode: Lectures (L) Examination Duration: 3 Hours	**Course Assessment Methods (internal: 30; external: 70)** Three minor examinations (20 marks), Class Performance measured through percentage of lectures attended (4 marks), assignments (6 marks), and the end-semester examination (70 marks). For the end semester examination, nine questions are to be set by the examiner. A candidate is required to attempt 5 questions in all. All questions carry equal marks. Question number 1 will be compulsory and based on the entire syllabus. It will contain seven parts of 2 marks each. Question numbers 2 to 9 will be given by setting two questions from each of the four units of the syllabus. A candidate is required to attempt the remaining four questions by selecting one question from each of the four units.

Pre-requisites: The course assumes knowledge of Object-Oriented Concepts and programming in any Object-Oriented language.

About the Course:
The course is very comprehensive and covers all the important Java concepts, e.g., Java basics, Object-Oriented Programming, Multithreading, File handling, Exception handling and more.

Course Outcomes: By the end of the course students will be able to:
CO1. **list** object-oriented characteristics peculiar to JAVA programming. (LOTS: Level 1: Remember)
CO2. **describe** object-oriented principles and paradigms implemented by Java programming language. (LOTS: Level 2: Understand)
CO3. **apply** object-oriented principles for solving problems using JAVA. (LOTS: Level 3: Apply)
CO4. **identify** classes, interfaces methods, hierarchy in the classes for a given programming problem in JAVA. (LOTS: Level 4: Analyse)
CO5. **design** Graphical User Interface applications and Web based applications in Java by importing applet, AWT and SWING packages. (LOTS: Level 6: Create)

Course Content

Unit I

Object-Oriented Programming Concepts: Object, Classes, Instantiation, Reuse, Procedural and object-oriented programming paradigms, Features of object-oriented programming: Encapsulation, Abstraction, Inheritance, and Polymorphism.
Java Programming Fundamentals: History of Java, Features of Java architecture, java architecture security, Garbage collections and Memory Management. Java programming language syntax, constants, variables, data types, operators, expressions. type conversion and

casting. Control statements: if-else, for, while, & do-while loops and switch statements. Methods, constructors, access specifiers and modifiers, Overloading methods and Overloading constructors. Recursion, building strings, exploring string class.

Unit II

Implementing OOP: Inheritance – Inheritance hierarchies, super and sub classes, super keyword, implementing inheritance, overriding methods, and interfaces**.** Implementing multiple inheritance using interfaces. Polymorphism- dynamic binding, Method Overriding, Abstract Methods and Classes.

Exception Handling: Exceptions in java, exception classes, built-in exceptions, try, catch and finally statements. Multiple catch statements, throw and throws statement. Creating and handling user-defined exceptions.

Unit III

Working with GUI: Introduction to an Applet, life cycle of an applet, passing parameters to applets, applet security issues. AWT and Swing components, Layout Managers.

Threads: Multithreading, Thread class and Runnable interface. lifecycle of a thread, Thread priority, thread synchronization.

Unit IV

File Handling: File class and Random-Access File class, Input and output streams, character streams, Object serialization, Serializable interface, Remote Method Invocation (RMI).

Database Connectivity: Introduction to SQL statements, ODBC/JDBC API: Connection, Statements, Prepared Statements, Record Set and execute statements.

Text and Reference Books:

1. Paul Deital, Harvey Deital, *Java^{TM}: How to Program*,9th Edition, Pearson Education (Prentice Hall), 2012.
2. Herbert Schildt, *Java^{TM}: The Complete Reference*,7th Edition, McGraw-Hill, 2007.
3. Kathy Sierra, Bert Bates, *Head First Java*, 2nd Edition, O'Reilly, 2005.
4. E. Balagurusamy, *Programming with Java: A Premier*, 3rd Edition, Tata McGraw-Hill, New Delhi, 2007.

CO-PO Articulation Matrix Java Programming Course (PC/CSE/46-T)

Course Outcomes	**PO 1**	**PO 2**	**PO 3**	**PO 4**	**PO 5**	**PO 6**	**PO 7**	**PO 8**	**PO 9**	**PO 10**	**PO 11**	**PO 12**	**PSO 13**	**PSO 14**	**PSO 15**
CO1	1	-	-	-	-	_	_	_	-	_	_	_	_	2	_
CO2	1	-	-	-	-	_	_	_	-	_	_	_	_	3	_
CO3		2	-	-	-	_	_	_	-	_	_	_	_	3	_
CO4	2	2	2	2	2	_	_	_	-	_	_	_	_	3	_
CO5	2	3	3	2	3	_	_	_	2	_	_	2	_	3	_
3-High 2-Medium 1-Low															

Microprocessors and Interfacing Lab.

General Information

Course Code: PC/CSE/41-P Course Credits: 1 Type: Professional Core Lab. Course Contact Hours: 2 hours/week Mode: Lab practice and assignments	**Course Assessment Methods (internal: 50; external: 50)** The internal and external assessment is based on the level of participation in lab. Sessions and the timely submission of lab experiments/assignments, the quality of solutions designed for the assignments, the performance in VIVA-VOCE, the quality of lab. file and ethical practices followed. The internal examination is conducted by the course coordinator. The external examination is conducted by external examiner appointed by the Controller of Examination in association with the internal examiner appointed by the Chairperson of the Department.

Pre-requisites: Basic concepts of Digital Electronics and Logic Design, Computer Organization

About the Course:

The objective of the lab course is to equip the students to design the Assembly Language programs for 8085 and 8086 microprocessors.

Course Outcomes: By the end of the course students will be able to:

CO1. **describe** the working of microprocessor kit/ TASM. (LOTS: Level 3: Apply)

CO2. **apply** interfacing of supporting chips with microprocessor. (LOTS: Level 3: Apply

CO3. **design** assembly language programs for the 8085 and 8086 microprocessors. (LOTS: Level 6: Create)

CO4. **analyse** the output of assembly language programs. (LOTS: Level 4: Analyse)

CO5. **create** lab records for the solutions of assignments. (LOTS: Level 6: Create)

CO6. **demonstrate** use of ethical practices, independent enquiry and team spirit. (LOTS: Level 3: Apply)

List of experiments/assignments

1. Two assignments to write assembly language programs using data transfer instructions
2. Two assignments to write assembly language programs using arithmetic instructions
3. Two assignments to write assembly language programs using flag manipulation instructions
4. Two assignments to write assembly language programs using shift and rotate instructions
5. Two assignments to write assembly language programs using stacks for 8086 micro-processor.
6. Two assignments to write assembly language programs using subroutines for 8086 micro-processor.
7. Two assignments on interfacing of supporting chips with 8085 and 8086 microprocessors.

Note:

The actual experiments/assignments will be designed by the course coordinator. One assignment should be designed to be done in groups of two or three students. The assignments must meet the objective of the course and the levels of the given course outcomes. The list of assignments and schedule of submission will be prepared by the course coordinator at the beginning of thesemester.

CO-PO Articulation Matrix Micro-processor and Interfacing Lab. Course (PC/CSE/41-P)

Course Outcomes	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 1 1	PO 12	PSO 13	PSO 14	PSO 15
CO1	2	-	-	-	1	-	-	-	-	-	-	1	2	-	-
CO2	2	-	-	-	1	-	-	-	-	-	-	1	3	-	-
CO3	2	2	-	2	-	-	-	-	-	-	-	-	3	-	-
CO4	2	-	1	1	2	-	-	-	1	-	-	-	3	-	-
CO5	-	-	-	-	-	-	-	-	-	3	-	-	-	-	-
CO6	-	-	-	-	-	-	-	3	3	-	-	3	-	-	-
3-High 2-Medium 1-Low															

Computer Networks Lab.

General Course Information

Course Code: PC/CSE/42-P Course Credits: 1 Type: Professional CoreLab. Course Contact Hours: 2 hours/week Mode: Lab. practice and assignments	**Course Assessment Methods (internal: 50; external: 50)** The internal and external assessment is based on the level of participation in lab. sessions and the timely submission of lab experiments/assignments, the quality of solutions designed for the assignments, the performance in VIVA-VOCE, the quality of lab. file and ethical practices followed. The internal examination is conducted by the course coordinator. The external examination is conducted by external examiner appointed by the Controller of Examination in association with the internal examiner appointed by the Chairperson of the Department.

Pre-requisites: knowledge of programming, digital and analog communication.

About the Course:

This course has been designed with an aim to provide students with an overview of the concepts and fundamentals of data communication and computer networks. Students learn about various topologies, network devices, routing protocols, firewall amongst other features and devices of Computer Networks.

Course Outcomes: By the end of the course students will be able to:

CO1. **demonstrate** various network topologies and networking devices. (LOTS: Level: 3: Apply)

CO2. **justify** a particular routing protocol for any implemented data communication networks. (LOTS: Level: 5: Evaluate)

CO3. **construct** a network and implement various network protocols. (LOTS: Level: 6:Create)

CO4. **devise** solutions for various routing and switching problems in Computer Networks. (LOTS: Level: 6: Create)

CO5. **create** lab records for the solutions of the assignments. (LOTS: Level: 6: Create)

CO6. **demonstrate** ethical practices, self-learning and team spirit. (LOTS: Level: 3: Apply)

List of Experiments/assignments:

1.
   a) Familiarization with networking components and devices: LAN Adapters - Hubs -Switches - Routers etc.
   b) Familiarization with transmission media and Tools: Co-axial cable - UTP Cable -Crimping Tool - Connectors etc.
2. Installation and introduction of simulation tools PacketTracer/ GNS3.
3. Preparing the UTP cable for cross and direct connections using crimpingtool.
4. Introduction to various interior and exterior routing protocols.
5. Configuration of RIP protocol on routers to configure a network topology.
6. Implementation EIGRP protocol on router.
7. Implementation OSPF protocol on a larger network.
8. Configuration of ARP protocol in network.
9. Configuration of a wireless device in simulated environment.
10. Implementation BGP protocol between two different networks.
11. Implementation of static routing in simulation environment.

12. Configuration of TELNET protocol on router for remote access.
13. Configuration of access lists on network to stop unwanted traffic on network.
14. Configuration of zone-based firewall in network.

Note:
The actual experiments/assignments will be designed by the course coordinator. One assignment should be designed to be done in groups of two or three students. The assignments must meet theobjective of the course and the levels of the given course outcomes. The list of assignments and schedule of submission will be prepared by the course coordinator at the beginning of the semester.

CO-PO Articulation Matrix Computer Networks Lab. (PC/CSE/42-P)

Course Outcomes	**PO 1**	**PO 2**	**PO 3**	**PO 4**	**PO 5**	**PO 6**	**PO 7**	**PO 8**	**PO 9**	**PO 10**	**PO 1 1**	**PO 12**	**PSO 13**	**PSO 14**	**PSO 15**
CO1	1	1	_	_	_	_	_	_	_	_	_	_	_	3	_
CO2	2	2	2	_	_	_	_	_	_	_	_	_	_	3	_
CO3	2	3	3	_	2	_	_	_	_	_	_	_	_	3	_
CO4	3	3	3	3	3	_	_	_	_	_	_	_	_	3	_
CO5	_	_	_	_	_	_	_	_	_	3	--	--	_	_	_
CO6	_	_	_	_	_	_	_	3	3	_	_	3	_	_	_
3-High 2-Medium 1-Low															

Database Management System Lab.

General Course Information

Course Code: PC/CSE/43-P Course Credits: 1 Type: Professional Core Lab. Course Contact Hours: 2 hours/week Mode: Lab practice and assignments.	**Course Assessment Methods (internal: 50; external: 50)** The internal and external assessment is based on the level of participation in lab. sessions and the timely submission of lab experiments/assignments, the quality of solutions designed for the assignments, the performance in VIVA-VOCE, the quality of lab. file and ethical practices followed. The internal examination is conducted by the course coordinator. The external examination is conducted by external examiner appointed by the Controller of Examination in association with the internal examiner appointed by the Chairperson of the Department.

Pre-requisites: Exposure to a programming language, MS Access.

About the Course:
This lab. course on DBMS involves a rigorous training on Oracle programming. It provides a strong formal foundation in database concepts, technology and practice to the students to groom them into well-informed database application developers. The objective of the lab course is to develop proficiency in the execution of commands of the database design and query using Oracle.

Course Outcomes: By the end of the course students will be able to:

CO1. **implement** database problems using Oracle DML/DDL commands. (LOTS: Level 3: Apply)
CO2. **enforce** integrity constraints on a database using a state-of-the-art RDBMS. (LOTS: Level 3: Apply)
CO3. **analyse** the design of a relational database. (LOTS: Level 4: Analyse)
CO4. **design** a relational database for a given schema. (LOTS: Level 6: Create)
CO5. **create** lab assignment record that includes problem definitions, solutions, results and conclusions. (LOTS: Level 6: Create)
CO6. **demonstrate** ethical practices, self-learning and team spirit.

List of experiments/assignments:

1. Use oracle software and login with valid user id and password. Explore its GUI and practice some basic commands of it.
2. Three assignments related to creation of database with tables having different fields and datatypes.
3. Two assignments on the creation of table with different types of constraints.
4. Two assignments on insert, delete and modify records from the tables.
5. Two assignments on modifying the table using the alter command.
6. Two assignments on exploring select statement using various clauses like where, order by, group by, having and aggregate functions.
7. Two assignments on the use of set operations to query the tables.
8. Two assignments on creating joins and views on the tables.
9. One assignment on generating sub-queries.

Note:
The actual experiments/assignments will be designed by the course coordinator. One assignment should be designed to be done in groups of two or three students. The assignments

must meet the objective of the course and the levels of the given course outcomes. The list of assignments and schedule of submission will be prepared by the course coordinator at the beginning of the semester.

CO-PO Articulation Matrix Database Management System Lab. (PC/CSE/43-P)

Course Outcomes	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 1 1	PO 12	PSO 13	PSO 14	PSO 15
CO1	2	2	2	1	2	_	_	_	_	_	_	_	3	_	_
CO2	_	_	2	1	2	_	_	_	_	_	_	_	3	_	_
CO3	2	2	1	1	_	_	_	_	_	_	_	_	3	_	_
CO4	3	3	3	1	3	_	_	_	_	3	_	_	3	_	_
CO5	_	_	_	_	_	_	_	3	3	_	_	3	_	_	_
CO6	_	_	_	_	_	_	_	_	_	_	_	_	_	_	_
3-High 2-Medium 1-Low															

Java Programming Lab.

General Course Information

Course Code: PC/CSE/46-P Course Credits: 2 Type: Professional Core Lab. Course Contact Hours: 4 hours/week Mode: Lab practice and assignments	**Course Assessment Methods (internal: 50; external: 50)** The internal and external assessment is based on the level of participation in lab. sessions and the timely submission of lab experiments/assignments, the quality of solutions designed for the assignments, the performance in VIVA-VOCE, the quality of lab. file and ethical practices followed. The internal examination is conducted by the course coordinator. The external examination is conducted by external examiner appointed by the Controller of Examination in association with the internal examiner appointed by the Chairperson of the Department.

Pre-requisites: The course assumes knowledge of Object-Oriented Concepts and programming.

About the Course:
This Java course will provide a strong understanding of basic Java programming elements and data abstraction using problem representation and the object-oriented framework. The objective of the lab course is to inculcate proficiency in students to design and develop market-based software applications.

Course Outcomes: By the end of the course students will be able to:

CO1. **implement** Java programs using object-oriented concepts for problem solving. (LOTS: Level 3: Apply)
CO2. **detect** syntax and logical errors in java programs (LOTS: Level 4: Analyse)
CO3. **apply** exception handling for making robust JAVA code. (LOTS: Level 3: Apply)
CO4. **design** java applications using File I/O and GUI. (LOTS: Level 6: Create)
CO5. **create** lab record of the solutions of assignments that includes problem definitions, solutions and conclusions. (LOTS: Level 6: Create)
CO6. **demonstrate** ethical practices, self-learning and team spirit. (LOTS: Level 3: Apply)

List of experiments/assignments:

1. Use eclipse or NetBeans platform and acquaint with the various menus, create a test project, add a test class and run it to see how you can use auto suggestions and auto fill functionalities. Try code formatter and code refactoring like renaming variables, methods and classes. Try debug step by step with a small program of about 10 to 15 lines which contains at least one if else condition and a for loop.
2. Two assignments illustrating class, objects, methods, arrays and various data types in java.
3. Two assignments on the use of control, looping statements and user defined functions.
4. One assignment illustrating the implementation of various forms of inheritance.
5. One assignment on method overloading.
6. One assignment on polymorphism and method overriding.
7. One assignment on implementing exception handling.
8. One assignment to illustrate interfaces in java.
9. One assignment to create package in java.
10. One assignment to design of multithreaded programs in java.
11. One new assignment on event handling.
12. Two assignments related to java applets.
13. One assignment to design a GUI application.
14. One assignment to access and update data from a database using JDBC.

Note:

The actual experiments/assignments will be designed by the course coordinator. One assignment should be designed to be done in groups of two or three students. The assignments must meet the objective of the course and the levels of the given course outcomes. The list of assignments and schedule of submission will be prepared by the course coordinator at the beginning of the semester.

CO-PO Articulation Matrix Java Programming Lab. (PC/CSE/46-P)

Course	PO	PO	PO	PO	PO	PO	PO	PO	PO	PO	PO	PO	PSO	PSO	PSO
Outcomes	1	2	3	4	5	6	7	8	9	10	1 1	12	13	14	15
CO1	2	2	2	1	2	_	_	_	_	_	_	_	3	_	_
CO2	_	_	2	1	2	_	_	_	_	_	_	_	3	_	_
CO3	2	2	1	1	_	_	_	_	_	_	_	_	3	_	_
CO4	3	3	3	1	3	_	_	_	_	3	_	_	3	_	_
CO5	_	_	_	_	_	_	_	3	3	_	_	3	_	_	_
CO6	_	_	_	_	_	_	_	_	_	_	_	_	_	_	_
3-High 2-Medium 1-Low															

B.Tech. (Computer Science & Engineering) Credit Scheme – Semester V & VI

Semester	Basic Sciences' Courses BSC (BSC/xx-T/P)		Engineering Sciences' Core/ Elective/ Open Courses ESC/ (PC/CSE/xx-T/P)/ (PE/CSE/xx-T/P)/ (OE/CSE/xx-T/P)		Humanities, Social Sciences, Management Courses HSMC (HSMC/xx-T/P)		Mandatory Courses (MC/xx-T/P)		Industril Training (EEC/CSE/ xx-P)		Grand Total Credit
	No. of Courses	Total Credits	No. of Courses	Total Credits	No. of Courses	Total Credits	No. of Courses	Total Credits	No. of Courses	Total Credits	
V	00	00	07	17	01	02	01	00	02	01	21
VI	00	00	09	21	01	02	00	00	00	00	23

Courses codes, titles, and credits (Semester V)

#	Course Code	Course Title	Workload/Credit			
			Theory	Tutorial	Practical	Total
1.	PC/CSE/51-T	Computer Graphics	3/3	-/-	-	3/3
2.	PC/CSE/52-T	Python Programming	3/3	-/-	-	3/3
3.	PC/CSE/53-T	High Speed Network Technologies	3/3	-/-	-	3/3
4.	PC/CSE/54-T	Cryptography and Network Security	3/3	-/-	-	3/3
5.	OE-I	Open Elective Course to be opted by Students from another branch	3/3	-/-	-	3/3
6.	HSMC/4-T	Economics for Engineers	2/2	-/-	-	2/2
7.	MC/4-T	Essence of Indian Traditional Knowledge	3/-	-/-	-	3/-
8.	PC/CSE/51-P	Computer Graphics Lab.	-/-	-/-	2/1	2/1
9.	PC/CSE/52-P	Python Programming Lab.	-/-	-/-	2/1	2/1
10.	***EEC/CSE/51-P	Industrial Training/ Internship	-/-	-/-	4/2	4/2
Total Credit			**20/17**	**-/-**	**8/4**	**28/21**
***The students will have to prepare and submit a Micro Project report of the Industrial Training/ Internship of 6-8 weeks done during summer vacations after the examination of IV semester under the supervision of faculty during V semester.						

Courses codes, titles, and credits (Semester VI)

#	Course Code	Course Title	Workload/Credit			
			Theory	Tutorial	Practical	Total
1.	PC/CSE/61-T	Operating Systems	3/3	-/-	-	3/3
2.	PC/CSE/62-T	Formal Language and Automata Theory	3/3	-/-	-	3/3
3.	PC/CSE/63-T	Data Analytics using R	3/3	-/-	-	3/3
4.	PC/CSE/64-T	Machine Learning	3/3	-/-	-	3/3
5.	PE/CSE/61-T to PE/CSE/66-T	Professional/ Programme Elective Course-I tobe opted by students	3/3	-/-	-	3/3
6.	HSMC/3-T	Fundamentals of Management for Engineers	2/2	-/-	-	2/2
7.	OE-II	Open Elective Course to be opted by Students from another branch	3/3	-/-	-	3/3
8.	PC/CSE/61-P	Operating Systems Lab. (UNIX/LINUX)	-/-	-/-	2/1	2/1
9.	PC/CSE/63-P	Data Analytics using R Lab.	-/-	-/-	2/1	2/1
10.	PC/CSE/64-P	Machine Learning Lab.	-/-	-/-	2/1	2/1
Total Credit			20/20	-/-	6/3	26/23
***A Mini-Project/Training based on open-source tools.						

***The students will have to undergo Industrial Training/ Internship for 6-8 weeks during summer vacations after the examination of VI semester which will be evaluated in VII semester.

List of Professional/ Programme Elective Courses-I

7. PE/CSE/61-T: Embedded System Design
8. PE/CSE/62-T: Wireless and Mobile Communications
9. PE/CSE /63-T: Graph Theory
10. PE/CSE /64-T: Bioinformatics
11. PE/CSE /65-T: Component based software Engineering
12. PE/CSE /66-T: PHP Programming

Detailed Syllabus of

B.Tech.(CSE)

V Semester

Computer Graphics

General Course Information

Course Code: PC/CSE/51-T Course Credits: 3 Type: Professional Core Contact Hours: 3 hours/week Mode: Lectures (L) Examination Duration:3 hours	**Course Assessment Methods (internal: 30; external: 70)** Three minor tests each of 20 marks will be conducted. The average of the highest marks obtained by a student in the any of the two minor examinations will be considered. Class Performance will be measured through percentage of lectures attended (04 marks). Assignments, quiz etc. will have weightage of 06 marks For the end semester examination, nine questions are to be set by the examiner. A candidate is required to attempt 5 questions in all. All questions carry equal marks. Question number 1 will be compulsory and based on the entire syllabus. It will contain seven parts of 2 marks each. Question numbers 2 to 9 will be given by setting two questions from each of the four units of the syllabus. A candidate is required to attempt the remaining four questions by selecting one question from each of the four units.

Pre-requisites: Programming skills in C/C++ and Data Structures.

About the Course:
This course involves studying graphic techniques, algorithms and imaging models. Moreover, students learnabout the techniques for clipping, cropping, representing 2-D and 3-D objects.

Course Outcomes: By the end of the course students will be able to:
CO1. **state** basic concepts related to graphics. (LOTS: Level 1: Remember)
CO2. **describe** the principles of creating graphical objects and graphical user interface applications.(LOTS: Level 2: Understand)
CO3. **apply** 2-D and 3-D transformations (rotation, scaling, translation, shearing) on geometric objects.(LOTS: Level 3: Apply)
CO4. **use** different techniques for clipping and filling geometric objects. (LOTS: Level 3: Apply)
CO5. **compare** different graphics algorithms for different geometric objects. (LOTS: Level 4: Analyse)
CO6. **create** user-friendly interfaces for computer applications. (LOTS: Level 6: Create)

Course Content

Unit I
Introduction to Computer Graphics: What is Computer Graphics, Computer Graphics Applications, Computer Graphics Hardware and software, Two dimensional Graphics Primitives: Points and Lines, Line drawing algorithms: DDA, Bresenham's; Circle drawing algorithms: Using polar coordinates, Bresenham's circle drawing, mid-point circle drawing

algorithm; Filled area algorithms: Scan-line: Polygon filling algorithm, boundary filled algorithm.

Unit II

Two/Three Dimensional Viewing: The 2-D viewing pipeline, windows, viewports, window to view port mapping; Clipping: point, clipping line (algorithms):- 4 bit code algorithm, Sutherland-cohen algorithm, parametric line clipping algorithm (Cyrus Beck). Polygon clipping algorithm: Sutherland-Hodgeman polygon clipping algorithm.
Two dimensional transformations: transformations, translation, scaling, rotation, reflection, compositetransformation.
Three dimensional transformations: Three-dimensional graphics concept, Matrix representation of 3-D Transformations, Composition of 3-D transformation.

Unit III

Viewing in 3D: Projections, types of projections, coordinate systems.
Hidden surface removal: Introduction to hidden surface removal, Z- buffer algorithm, scanline algorithm, area sub-division algorithm.

Unit IV

Representing Curves and Surfaces: Parametric representation of curves: Bezier curves, B-Spline curves. Parametric representation of surfaces; Interpolation method.
Illumination, shading, image manipulation: Illumination models, shading models for polygons, shadows, transparency.

Text and reference books:

- James D. Foley, Andeies van Dam, Stevan K. Feiner and Johb F. Hughes, *Computer GraphicsPrinciples and Practices*, second edition, Addision Wesley, 2000.
- Pradeep K Bhatia, *Computer Graphics*, 3rd edition, I K International Pub, New Delhi, 2013.
- Donald Hearn and M. Pauline Baker, *Computer Graphics* 2nd Edition, PHI, 1999.
- David F. Rogers, *Procedural Elements for Computer Graphics* Second Edition, T.M.H, 2001.
- Alan Watt, *Fundamentals of 3Dimensional Computer Graphics*, Addision Wesley, 1999.
- Corrign John, *Computer Graphics: Secrets and Solutions*, BPB, 1994.
- Pilania & Mahendra, *Graphics, GUI, Games & Multimedia Projects in C*, Standard Pub., 2002.
- N. Krishanmurthy, *Introduction to Computer Graphics,* T.M.H, 2002.

CO-PO Articulation Matrix Computer Graphics Course (PC/CSE/51-T)

Course Outcomes	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 1 1	PO 12	PSO 13	PSO 14	PSO 15
CO1	1	_	_	_	_	_	_	_	_	_	_	_	_	_	2
CO2	1	–	–	–	–	–	–	–	–	–	–	–	–	–	3
CO3	3	2		2	–	3	–	–	–	–	–	–	–	–	3
CO4	2	3	2	2	–	–	–	–	–	–	–	–	–	–	3
CO5	2	3	2	2	–	–	–	–	–	–	–	–	–	–	3
CO6	3	3	2	3		3	_	_	_	_	_	_	3		3
3-High 2-Medium 1-Low															

Python Programming

General Course Information

Course Code: PC/CSE/52-T Course Credits: 3 Type: Professional Core Contact Hours: 3 hours/week Mode: Lectures (L) Examination Duration: 3 hours	**Course Assessment Methods (internal: 30; external: 70)** Three minor tests each of 20 marks will be conducted. The average of the highest marks obtained by a student in the any of the two minor examinations will be considered. Class Performance will be measured through percentage of lectures attended (04 marks). Assignments, quiz etc. will have weightage of 06 marks For the end semester examination, nine questions are to be set by the examiner. A candidate is required to attempt 5 questions in all. All questions carry equal marks. Question number 1 will be compulsory and based on the entire syllabus. It will contain seven parts of 2 marks each. Question numbers 2 to 9 will be given by setting two questions from each of the four units of the syllabus. A candidate is required to attempt the remaining four questions by selecting one question from each of the four units.

Pre-requisite: Exposure to programming languages

About the Course:
Python is a popular open source programming language used for both standalone programs and scripting applications in a wide variety of domains. It is free, portable, and powerful and is both relatively easy and remarkably fun to use. In today's era Python has found great applicability in machine learning, data analytics and many other data science application. This is introductory course and covers most of the basic concepts required for basic python programming. Some of the contents are advanced may be useful for data analytics purpose.

Course Outcomes: By the end of the course students will be able to:
CO1. **outline** various basic programming constructs including operators, character sets, basic data typesand control statements. (LOTS: level 1: Understand)
CO2. **explain** Python packages and their functionalities for data analysis. (LOTS: level 2: Understand)
CO3. **solve** problems using python programming. (LOTS: level 3: Apply)
CO4. **analyse** the results of data analysis or machine learning programs (LOTS: level 4: Analyse)
CO5. **evaluate** solutions according to the problem definition. (LOTS: level 5: Evaluate)
CO6. **develop** database applications in Python. (LOTS: level 6: Create)

Course Content

Unit I
Introduction to Python, History of Python, Features of Python, Python Identifiers, Python Character Set, Keywords and Indentation, Comments, Command Line Arguments, Assignment Operator, Operators and Expressions, *print()* Function, *input()* Function, *eval()* Function, Python Data Types: *int, float, complex*, Variables, Mutable vs Immutable variables, Decision Statements: Boolean Type, Boolean Operators, *if* statement, *else* statement, Nested Conditionals Statements, Multi-way Decision Statements (*elif* statement).

Unit II
Loop Control Statements: *While* loop, *range()* Function, *For* Loop, Nested Loops, Infinite

Loop, *Break* Statement, *Continue* Statement, *Pass* Statement, Introduction to Strings, String Operations: Indexing and Slicing, Lists: Operations on List: Slicing, Inbuilt Functions for Lists, List Processing: Searching and Sorting, Dictionaries: Need of Dictionary, Operations on Directories: Creation, Addition, Retrieving Values, Deletion; Tuples, operations on Tuples, Inbuilt Functions for Tuples, Introduction to Sets, operations on sets.

Python Functions, Inbuilt functions, *Main* function, User Defined functions, Defining and Calling Function, Parameter Passing, Actual and Formal Parameters, Default Parameters, Global and Local Variables, Recursion, Passing Functions as Data, *Lamda* Function, Modules, Importing Own Module, Packages.

Unit III

Operations on File: Reading text files, read functions, *read()*, *readline()* and *readlines()*, writing Text Files, write functions, *write()* and *writelines()*,Manipulating file pointer using seek, Appending to Files.

Python Object Oriented: Overview of OOP, Classes and objects, Accessing attributes, Built-In Class Attributes, Methods, Class Inheritance: *super()*, Method Overriding, Exception Handling, *Try-except-else* clause, Python Standard Exceptions, User-Defined Exceptions

Unit IV

Databases in Python: Create Database Connection, *create, insert, read, update* and *delete* Operation, DML andDDL Operation with Databases.

Python for Data Analysis: *numpy*: Creating arrays, Using arrays and Scalars, Indexing Arrays, Array Transposition, Universal Array Function, Array Processing, Array Input and Output

Pandas: Series, Data Frame *Matplotlib*: Python for Data Visualization, Visualization Section.

Text and Reference Books:

- Ashok Namdev Kamthane, *Programming and Problem Solving with Python*, Mc Graw Hill EducationPublication, 2018.
- John Guttag, *Introduction to Computation and Programming using Python*, Springer, Revised andExpanded version (Referred by MIT), 2013.
- Lutz, M., *Learning Python: Powerful Object-Oriented Programming*. O'Reilly Media, Inc., 2013.
- Michael T Goodrich and Robertto. Thamassia, Micheal S Goldwasser, *Data Structures and Algorithmsin Python*, Wiley, 2016.
- Y. Daniel Liang, *Introduction to Programming Using Python*, Pearson, 2013.
- Reema Thareja, *Python Programming Using Problem Solving Approach* , Oxford Publications, 2017.
- Dr. R. Nageswara Rao, Allen B. Downey, *Core Python Programming , Think Python*, O’Reilly Media,2012.
- Kenneth A. Lambert, *The Fundamentals of Python: First Programs*, Cengage Learning, 2011.

CO-PO Articulation Matrix Python Programming Course (PC/CSE/52-T)

Course Outcomes	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 1 1	PO 12	PSO 13	PSO 14	PSO 15
CO1	1	_	_	_	_	_	_	_	_	_	_	_	_	_	2
CO2	1	–	–	–	–	–	–	–	–	–	–	–	–	_	3
CO3	3	2		2	_	3	–	–	–	–	–	–	–	_	3
CO4	2	3	2	2	–	–	–	–	–	–	–	–	–	_	3
CO5	2	3	2	2	–	–	–	–	–	–	–	–	–	_	3
CO6	3	3	2	3		3	_	_	_	_	_	_	3		3
3-High 2-Medium 1-Low															

High Speed Network Technologies

General Course Information

Course Code: PC/CSE/53-T Course Credits: 3 Type: Professional Core Contact Hours: 3 hours /week Mode:Lecture(L) Examination Duration: 3 hours	**Course Assessment Methods (internal: 30; external: 70)** Three minor tests each of 20 marks will be conducted. The average of the highest marks obtained by a student in the any of the two minor examinations will be considered. Class Performance will be measured through percentage of lectures attended (04 marks). Assignments, quiz etc. will have weightage of 06 marks For the end semester examination, nine questions are to be set by the examiner. A candidate is required to attempt 5 questions in all. All questions carry equal marks. Question number 1 will be compulsory and based on the entire syllabus. It will contain seven parts of 2 marks each. Question numbers 2 to 9 will be given by setting two questions from each of the four units of the syllabus. A candidate is required to attempt the remaining four questions by selecting one question from each of the four units.

Pre-requisites: Basic knowledge of computer networks, layers of OSI reference model, protocols at differentlayers of OSI reference model.

About the course:
High Speed Network Technologies is a professional core course based around Network Architectures, protocolsused across the layers, techniques used in communication and modes of data transfer. The course deals with creating High Speed Networks for any organization/institute with its various phases/life cycles.

Course Outcomes: By the end of the course students will be able to:

CO1. **define** different high speed network technologies. (LOTS: Level 1: Remember)
CO2. **explain** working of different wired / wireless technologies suitable for LAN and WAN communication. (LOTS: Level 2: Understand)
CO3. **illustrate** the mapping of OSI reference model to different high speed technologies and Internet Suiteof Protocols. (LOTS: Level 3: Apply)
CO4. **analyze** the performance of different high speed technologies in different scenarios / situations.(LOTS: Level 4: Analyse)
CO5. **design** a network for any organization using high speed technologies along with Internet connectivity.(LOTS: Level 6: Create)

Course Content

Unit I

Gigabit Ethernet: Overview of fast Ethernet, Gigabit Ethernet – overview, specifications, layered protocol architecture, frame format, network design using Gigabit Ethernet, applications, 10GB Ethernet – overview, layered protocol architecture, frame format.
Fiber Channel: Fiber channel – overview, topologies, ports, layered protocol architecture, frame structure, classof service.

UNIT II

Frame Relay: Protocol architecture and frame format.
ISDN & B-ISDN: Channels, interfaces, addressing, protocol architecture, services.
ATM: Virtual circuits, cell switching, reference model, traffic management.

Unit III

Wireless Networks: Existing and emerging standards, Wireless LAN (802.11), Broadband Wireless (802.16), Bluetooth (802.15) their layered protocol architecture and security. Mobile Networks – GSM, CDMA.

Unit IV

Internet Layer: IPV4 and IPV6, IP addressing, IP classes, CIDR.
Transport Layer: UDP/TCP protocols & architecture, TCP connection management.
Application Layer: DNS, E-Mail, Voice over IP.

Text and Reference Books:

- Jochen Schiller, *Mobile Communication*, 2nd Edition, Pearson,2009.
- Andrew S Tanenbaum, *Computer Networks*, 5th Edition, Pearson 2013.
- William C Y Lee, *Mobile Communication Engineering: Theory and Applications*, 2nd Edition, McGrawHill, 1997.

CO-PO Articulation Matrix High Speed Network Technologies Course (PC/CSE/53-T)

Course Outcomes	**PO 1**	**PO 2**	**PO 3**	**PO 4**	**PO 5**	**PO 6**	**PO 7**	**PO 8**	**PO 9**	**PO 10**	**PO 1 1**	**PO 12**	**PSO 13**	**PSO 14**	**PSO 15**
CO1	1	-	-	-	-	_	_	_	-	_	_	_	_	2	_
CO2	1	-	-	-	-	_	_	_	-	_	_	_	_	3	_
CO3		2	-	-	-	_	_	_	-	_	_	_	_	3	_
CO4	2	2	2	2	2	_	_	_	-	_	_	_	_	3	_
CO5	2	3	3	2	3	_	_	_	2	_	_	2	_	3	_
3-High 2-Medium 1-Low															

Cryptography and Network Security

General Course Information

Course Code: PC/CSE/54-T Course Credits: 3 Type: Professional Core Contact Hours: 3hours/week Mode:Lectures (L) Examination Duration: 3 hours	**Course Assessment Methods (internal: 30; external: 70)** Three minor tests each of 20 marks will be conducted. The average of the highest marks obtained by a student in the any of the two minor examinations will be considered. Class Performance will be measured through percentage of lectures attended (04 marks). Assignments, quiz etc. will have weightage of 06 marks For the end semester examination, nine questions are to be set by the examiner. A candidate is required to attempt 5 questions in all. All questions carry equal marks. Question number 1 will be compulsory and based on the entire syllabus. It will contain seven parts of 2 marks each. Question numbers 2 to 9 will be given by setting two questions from each of the four units of the syllabus. A candidate is required to attempt the remaining four questions by selecting one question from each of the four units.

Pre-requisites: Basic knowledge of Number systems, Complexity Theory, Computer Networks.

About the Course:
The increase in techniques to penetrate into systems has led to variety of information and Network attacks, To mitigate the exploitation of the vulnerabilities leading to these attacks we need to adopt robust security architecture into our premises. We have to choose between various security technologies such as cryptography, Digital Signatures, Key Management, Program Security, Database security, Wifi security. In the current scenario we require to secure end-to-end devices, Networks, Networking devices and clouds.

Course outcomes: By the end of the course students will be able to:
CO1. **recognize** need of cryptography and cryptographic Algorithms. (LOTS: Level 1: Remember)
CO2. **represent** security in terms of various techniques and algorithms. (LOTS: Level2: Understand)
CO3. **apply** mathematical techniques to cryptography for solving problems related to security issue. (LOTS: Level 3: Apply)
CO4. **identify** various types of attacks for their mitigation/proactive and reactive treatment. (LOTS: Level4: Analyze)
CO5. **judge** the security of an organization/institute by means of Network security devices/models/controls. (LOTS: Level 5: Evaluate)
CO6. **integrate** different types of securities under one environment and evaluate its performance. (LOTS: Level 6: Create)

Course Content

Unit I
Cryptography: Overview of classical cryptosystems, terminology and background, stream and block ciphers, ciphers & cipher modes, Substitution Ciphers: Mono-alphabetic Substitution and Poly-alphabetic Substitution, Transposition Ciphers: Rail Fence, ScyTale, Book cipher, Vernam cipher, Vigenere Tabluae, HillCipher. Cryptanalysis of Classical Cryptosystems.

Unit II

Mathematical Foundations: Elementary Number theory, Finite fields, Groups and Subgroups, Number theory: Divisibility, gcd, prime numbers, primality testing. Congruences, solution of congruences, Chinese remainder theorem, Fermat and Euler’s theorem, Modular Arithmetic.

Unit III

Cryptographic Algorithms and techniques: Private/Symmetric Key cryptography: DES and its variants, AES, Feistel networks, Modes of operation, Public/Asymmetric Key Cryptography: RSA Algorithm, Elliptic Curve Cryptography. Diffie Hellman Key Exchange Algorithm, Digital Signatures, Knapsack Algorithm, Public Key Infrastructure, Kerberos, secret sharing schemes, Digital Certificates, X.509 Certificates.

Unit IV

Network Security: Attacks: types, detection, mitigation. Network Security Foundations, Defense Models, Access Control: Authentication and Authorization Controls, Network Architecture, Network Device Security, Wireless Security, Firewalls, Intrusion Detection Systems, Network Role-Based Security: Email- PGP, PEM, S- MIME. Proxy servers. SSL, TLS. SET, SHTTP, IPSec. Virtual Private Networks security.

Text and Reference Books

- William Stallings, *Cryptography and Network security-Principles and Practices*, Pearson Education, Ninth Indian Reprint 2005.
- Charlie Kaufman , *Network Security : Private communication in Public World*, Prentice-HallInternational, Inc. April 2008.
- Roberta Bragg, Mark Rhodes-Ousley, Keith Strassberg, *The Complete Reference Network Security*, McGraw hill Education, 2004.
- Charles P. Fleeger, *Security in Computing*, 2nd Edition, Prentice Hall International Inc., 1996.

CO-PO Articulation Matrix Cryptography and Network Security (PC/CSE/54-T)

Course Outcomes	**PO 1**	**PO 2**	**PO 3**	**PO 4**	**PO 5**	**PO 6**	**PO 7**	**PO 8**	**PO 9**	**PO 10**	**PO 1 1**	**PO 12**	**PSO 13**	**PSO 14**	**PSO 15**
CO1	1	_	_	_	_	_	_	_	_	_	_	_	_	3	_
CO2	1	_	_	_	_	_	_	_	_	_	_	_	_	3	_
CO3	3	3	2	2	2	_	_	_	_	_	_	_	_	3	_
CO4	2	2	2	3	3	_	_	_	_	_	_	_	_	3	_
CO5	3	3	2	3	3	_	_	3	_	3	_	_	_	3	_
CO6	3	3	2	3	3									3	_
3-High 2-Medium 1-Low															

Economics for Engineers

General Course Information

Course Code: HSMC/4-T Course Credits: 2 Type: Humanities and Social Sciences including Management courses Contact Hours: 2 hours/week Mode: Lectures (L) Examination Duration: 3 hours	**Course Assessment Methods (internal: 30; external: 70)** Three minor tests each of 20 marks will be conducted. The average of the highest marks obtained by a student in the any of the two minor examinations will be considered. Class Performance will be measured through percentage of lectures attended (04 marks). Assignments, quiz etc. will have weightage of 06 marks For the end semester examination, nine questions are to be set by the examiner. A candidate is required to attempt 5 questions in all. All questions carry equal marks. Question number 1 will be compulsory and based on the entire syllabus. It will contain seven parts of 2 marks each. Question numbers 2 to 9 will be given by setting two questions from each of the four units of the syllabus. A candidate is required to attempt the remaining four questions by selecting one question from each of the four units.

Pre-requisites: None

About the Course: This course is designed to provide the elementary and essential knowledge of economics relevant to their profession as engineers. The graduating engineers will learn aboutthe basic principles of economics and cost benefit analysis for various economic alternatives.The course also gives an initial exposure to issues and challenges for sustainable development.

Course Outcomes: By the end of the course students will be able to:
CO1. **outline** the principles of economics in general and economics in Indian context.(LOTS: Level 1:Remember)
CO2. **discuss** concepts related to economics in general and particularly relevant to Indianscenario. (LOTS:Level 2: Understand)
CO3. **apply** the principles of economics for solving problems related to Engineering sector. (LOTS: Level3: Apply)
CO4. **carry** out cost/benefit/, life cycle and breakeven analyses on one or more economic alternatives.(LOTS: Level 4: Analyse)
CO5. **judge** the issues and challenges of sustainable development. (LOTS: Level 5: Evaluate)

Course Content

Unit I

Definition of Economics- various definitions, Nature of economic problem, Production possibility curve, Economics laws and their nature. Relation between Science, Engineering, Technology and Economics. Concepts and measurement of utility, Law of Diminishing Marginal Utility, Law of equi-marginal utility - its practical applications and importance.

Unit II

Meaning of Demand, Individual and Market demand schedules, Law of demand, shape of demand curve, Elasticity of Demand, measurement of elasticity of demand, factors affecting elasticity of demand, practical importance and applications of the concept of elasticity of demand.

Meaning of production and factors of production; Law of variable proportions, Returns to scale, Internal and External economics and diseconomies of scale.

Unit III

Various concepts of cost- Fixed cost, variable cost, average cost, marginal cost, money cost, real cost, opportunity cost. Shape of average cost, marginal cost, total cost etc. in short run and long run both.

Meaning of Market, Types of Market - Perfect Competition, Monopoly, Oligopoly, Monopolistic Competition(Main features of these markets)

Issues, Strategies and challenges for sustainable development for developing economies

Unit IV

Elements of Business/Managerial Economics and forms of organizations, Cost & Cost Control Techniques, Types of Costs, Lifecycle Costs, Budgets, Break Even Analysis, Capital Budgeting, Application of linear Programming. Investment Analysis- NPV, ROI, IRR, Payback Period, Depreciation, Time Value of Money (present and future worth of cash flows).

Business Forecasting- Elementary techniques. Statements- Cash Flows, Financial. Case Study Method. Nature and Characteristics of Indian Economy (brief and elementary introduction). Privatization - meaning, merits, and demerits. Globalisation of Indian economy- merits and demerits.WTO and TRIPs agreements.

T**ext and Reference Books:**

- Alfred William Stonier, D. C. Hague, *A text book of Economic Theory*, 5th edition, Longman HigherEducation, 1980.
- K. K. Dewett, M. H. Navalur, *Modem EconornicTheory*, S. Chand, 2006.
- H. L. Ahuja, *Modern Microeconomic: Theory and Applications*, S. Chand, 2017.
- N. Gregory Mankiw, *Principles of Economics*, 7th edition, South-Western College Publishing, 2013.
- Ruddar Dutt & K. P. M. Sundhram, *Indian Economy*, S. Chand, 2004.
- V. Mote, S. Paul, G. Gupta, *Managerial, Economics*, McGraw Hill Education, 2017.
- Saroj Pareek, *Text book of Business Economics*, Neha Publishers and Distributors, 2013.

CO-PO Articulation Matrix Economics for Engineers (HSMC/4-T)

Course Outcomes	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 1 1	PO 12	PSO 13	PSO 14	PSO 15
CO1	1	-	-	-	-	-	-	-	-	-	-	-	-	-	-
CO2	1	-	-	-	-	-	-	-	-	-	-	-	-	-	-
CO3	2	2	2	2	2	-	-	-	-	-	-	-	-	-	-
CO4	3	2	2	3	3	-	-	-	2	-	-	3	-	-	-
CO5	3	_	3	3	_	_	3	-		3	3	3	-	-	-
3-High 2-Medium 1-Low															

Essence of Indian Traditional Knowledge

General Course Information

Course Code: MC/4-T Course Credits: 0 Type: Mandatory course Contact Hours: 3 hours/week Mode: Lectures Examination Duration: 3 hours	**Course Assessment Methods (internal: 30; external: 70)** Three minor tests each of 20 marks will be conducted. The average of the highest marks obtained by a student in the any of the two minor examinations will be considered. Class Performance will be measured through percentage of lectures attended (04 marks). Assignments, quiz etc. will have weightage of 06 marks For the end semester examination, nine questions are to be set by the examiner. A candidate is required to attempt 5 questions in all. All questions carry equal marks. Question number 1 will be compulsory and based on the entire syllabus. It will contain seven parts of 2 marks each. Question numbers 2 to 9 will be given by setting two questions from each of the four units of the syllabus. A candidate is required to attempt the remaining four questions by selecting one question from each of the four units.

Pre-requisites: None

About the Course: This course is designed to acquaint students with Indian knowledge traditions. It introduces students to Vedic period, Post Vedic period, Sufi and Bhakti Movement in India, the ancient scientists of India and social reform movements of 19th century.

Course Outcomes: By the end of the course students will be able to:
CO1. **recognise** the forms and sources of Indian traditional knowledge. (LOTS: Level 1: Remember)
CO2. **identify** the contribution of the great ancient Indian scientists and spiritual leaders to the world ofknowledge. (LOTS: Level 2: Understand)
CO3. **apply** the reasoning based on objectivity and contextual knowledge to address the social and culturalissues prevalent in Indian society. (LOTS: Level 3: Apply)
CO4. **differentiate** the myths, superstitions from reality in context of traditional knowledge to protect thephysical and social environment. (LOTS: Level 4: Evaluate)
CO5. **suggest** means of creating a just and fair social environment that is free from any prejudices andintolerance for different opinions and cultures. (LOTS: Level 6: Create)

Course Content

Unit I

Introduction to Indian Tradition Knowledge: Defining traditional knowledge, forms, sources anddissemination of traditional knowledge.
Vedic Period: Vedas and Upanishads, Yogsutras of Patanjali
Post Vedic Period: Budhism, Janism and Indian Materialism: Charvak School of Thought

Unit II

Sufism and Sufi saints, Kabir, Nanak and Guru Jambheshwar ji Maharaj etc., CompositeCulture of Indiansub-continent.

Unit III

Jyotirao Phule and Savitri Bai Phule and other 19th Century Social Reform Movements; India's cultural heritage.

Unit IV

India's Contribution to the world of knowledge, Astrology and Astronomy, Myths and Reality

Text and Reference Books:

1. L. Bhansam, The Wonder That was India, A Survey of the Culture of the, Indian Sub-Continentbefore, the Coming of the Muslims, Vol 1, Groove Press, New York, 1959.
2. S. A. A. Rizvi, Wonder That was India, A Survey of the History and Culture of the Indian Sub-Continent from the Coming of the Muslims to the British Conquest 1200-1700, Vol2, Rupa andCo. 2001.
3. B. V. Subbarayappa, A Historical Perspective of Science in India, Rupa Publications,New Delhi,2013.
4. Thich Nhat Hanh, Nguyen Thi Hop, Mobi Ho , Old Path White Clouds: Walking in the Footstepsof the Buddha, Parallax Press, 1991.
5. Hermann Hesse, Siddhartha, Simon & Brown, 2017.
6. Rosalind O' Hanlon, Caste Conflict and Ideology, Mahatma Jyotirao Phule and low caste protestin nineteen century, Western India, Camridge University Press, 2009.
7. Melanie P. Kumar, Savitribai Phule: Forgotten liberator, Infochange, 2009.
8. Leah Verghese, Ranjna, and Medha Sundar, Savitribai, Journey of a Trailblazer, AzimPrem JiUniversity, 2014.

CO-PO Articulation Matrix Essence of Indian Traditional Knowledge (MC/4-T)

Course Outcomes	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 1 1	PO 12	PSO 13	PSO 14	PSO 15
CO1	-	1		-	-		-	-	-	-	-	1	-	-	-
CO2	-	2	1	-	-	3	-	-	-	-	-	1	-	-	-
CO3	-	3	3	2	-	3	-	-	-	-	-	3	-	-	-
CO4	-	2	3	3	-	3	1	-	-	-	-	3	-	-	-
CO5	-	3	3	3	-	3	-	-	-	-		3	-	-	-
3-High 2-Medium 1-Low															

Computer Graphics Lab.

General Course Information

Course Code: PC/CSE/51-P Course Credits: 1 Type: Professional Core Lab. Course Mode: Lab practice and assignments Contact Hours: 2 hours / week	**Course Assessment Methods (internal: 50; external: 50)** The internal and external assessment is based on the level of participation in lab. sessions and the timely submission of lab experiments/assignments, the quality of solutions designed for the assignments, the performance in VIVA- VOCE, the quality of lab. file and ethical practices followed. The internal examination is conducted by the course coordinator. The external examination is conducted by external examiner appointed by the Controller of Examination in association with the internal examiner appointed by the Chairperson of the Department.

Pre-requisites: Knowledge of C/C++ and Data Structures.

About the Course:
This lab course provides opportunity to students to implement various algorithms to do graphics. This includedrawing lines, circles and ellipses. In addition, students learn to rotate, move and transform graphical objects.

Course Outcomes: By the end of the course students will be able to:
CO1. **implement** various graphics algorithms for drawing and filling of geometric objects.(LOTS: Level 3:Apply)
CO2. **demonstrate** transformation of geometric objects. (LOTS: Level 3: Apply)
CO3. **compare** strengths and weakness of various graphics algorithms. (LOTS: Level 4:Analyse)
CO4. **design** algorithms for creating scenes like flying a kite and solar eclipse. (LOTS: Level 6: Create) CO5. **create** lab assignment record that includes problem definitions, solutions and conclusions. (LOTS:Level: 6: Create)
CO6. **demonstrate** use of ethical practices, self-learning and team spirit. (LOTS: Level 3:Apply)

List of experiments/assignments

- A program to draw a line using Digital Differential Analyzer (DDA) Algorithm
- A program to draw a line using Bresenham's Line Algorithm (BLA) for lines with slopes
- negative and less than 1.
- positive and less than 1.
- positive and greater than 1.
- negative and greater than 1.
- A program to draw a circle using Bresenham's Circle Algorithm.
- A program to draw a circle using MidPoint Circle Algorithm
- A program to draw an ellipse using MidPoint Ellipse Algorithm.
- A program to fill different types of geometric shapes using Flood Fill. Algorithm
- A program to fill different types of geometric shapes using Boundary Fill Algo.
- A program to demonstrate window to view-port mapping.A program to clip a line segment using 4-bit code algorithm.
- A program to draw a C-Curve of nth order.
- A program that shows a scene of flying kite.
- A program to rotate a line about its mid-point.
- A program that shows a scene of eclipse .
- A program that translate and rotate a circle along a horizontal line.
- A program to rotate an ellipse about its major axis and minor axis alternatively.

Note:

The actual experiments/assignments may vary and will be designed by the course coordinator. One assignment should be designed to be done in groups of two or three students. The assignments must meet the objective ofthe course and the levels of the given course outcomes. The list of assignments and schedule of submission will be prepared by the course coordinator at the beginning of the semester.

CO-PO Articulation Matrix Computer Graphics Lab. Course (PC/CSE/51-P)

Course Outcomes	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 1 1	PO 12	PSO 13	PSO 14	PSO 15
CO1	2	-	3	-	2	_	_	_	_	_	_	_	3	_	_
CO2	2	-	-	-	2	_	_	_	_	_	_	_	3	_	_
CO3	2	2	-	-	-	_	_	_	_	_	_	_	3	_	_
CO4	2	2	-	2	-	_	_	_	_	_	_	_	3	_	_
CO5	_	_	_	_	_	_	_	_	_	3	_	_	_	_	_
CO6	_	_	_	_	_	_	_	3	3	_	_	3	_	_	_
3-High 2-Medium 1-Low															

Python Programming Lab.

General Course Information

Course Code: PC/CSE/52-P Course Credits: 1 Type: Professional Core Lab. Course Contact Hours: 2 hours/week Mode: Lab practice and assignments	**Course Assessment Methods (internal: 50; external: 50)** The internal and external assessment is based on the level of participation in lab. sessions and the timely submission of lab experiments/assignments, the quality of solutions designed for the assignments, the performance in VIVA- VOCE, the quality of lab. file and ethical practices followed. The internal examination is conducted by the course coordinator. The external examination is conducted by external examiner appointed by the Controller of Examination in association with the internal examiner appointed by the Chairperson of the Department.

Pre-requisites: Basic programming skills

About the Course:
Python is a scripting programming language known for both its simplicity and wide breadth of applications. For this reason it is considered one of the best languages for beginners. Used for everything from web development to scientific computing Python is referred to as a general purpose language by the greater programming community. The major objective of Python language is to make the students solve real word problem efficiently using python library.

Course Outcomes: By the end of the course students will be able to:
CO1. **implement** solutions to the given assignments in Python. (LOTS: Level 3: Apply)
CO2. **use** various Python packages for solving different programming problems. (LOTS: Level 3: Apply)
CO3. **devise** solutions for complex problems of data analysis and machine learning. (LOTS: Level 6:
Create)
CO4. **Evaluate** the output of data analysis and machine learning models. (LOTS: Level 5: Evaluate)CO5. **create** lab records of the solutions for the given assignments. (LOTS: Level 6: Create)
CO6. **demonstrate** use of ethical practices, self-learning and team spirit.. (LOTS: Level 3: Apply)

List of experiments/assignments

- Install Python and explore various popular IDE like IDLE, PyCharm, and Anaconda.
- Assignments to perform various number operations like
- Find maximum from a list of numbers
- GCD of two number
- Square root of a number
- Check number is prime or not.
- Print first N prime numbers
- Remove duplicate numbers from list
- Print the Fibonacci series.
- Assignments to perform various operations on Strings like creation, deletion, concatenation.
- Create a List L = [10, 20, 30]. Write programs to perform following operations:
- Insert new numbers to list L.

- Delete numbers from list L.
- Sum all numbers in list L.
- Sum all prime numbers in list L.
- Delete the list L.
- Create a Dictionary D= {‘Name’: ‘Allen’, ‘Age’: 27, 5:123456}. Write programs to perform followingoperations:
- Insert new entry in D.
- Delete an entry from D.
- Check whether a key present in D.
- Update the value of a key.
- Clear dictionary D.
- Two assignments on Sets to perform various operation like union, intersection, difference etc.
- Two assignments related to searching operation like linear search, binary search.
- Three assignments related to sorting like selection sort, bubble sort, insertion sort.
- Demonstrate the use of dictionary for measuring student marks in five subjects and you have to find thestudent having maximum and minimum average marks.
- Two assignment on usage of different available packages like random package to perform
- Print N random numbers ranging from 100 to 500.
- Print 10 random strings whose length between 3 and 5.
- Two assignments on usage of package such as Numpy, Pandas.
- Implement and demonstrate the functions of a simple calculator.
- One assignment on implementing object oriented concept such as classes, inheritance, andpolymorphism.
- One assignment on file handling that how data is read and written to a file.

Note:
The actual experiments/assignments will be designed by the course coordinator. One assignment should be designed to be done in groups of two or three students. The assignments must meet the objective of the course and the levels of the given course outcomes. The list of assignments and schedule of submission will be prepared by the course coordinator at the beginning of the semester.

CO-PO Articulation Matrix Python Programming Lab. Course (PC/CSE/52-P)

Course Outcomes	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 1 1	PO 12	PSO 13	PSO 14	PSO 15
CO1	2	1	_	_	3	_	_	_	_	_	_	_	_	_	3
CO2	2	3	_	3	3	_	_	_	_	_	_	_	_	_	3
CO3	3	3	1	3	3	_	_	_	_	_	_	_	_	_	3
CO4	3	3		3	3	_	_	_	_	_	_	_	_	_	3
CO5	_	_	_	_	_	_	_	_	_	3	_	_	_	_	_
CO6	_	_	_	_	_	_	_	3	3	_	_	3	_	_	_
3-High 2-Medium 1-Low															

Industrial Training/Internship

General Course Information

Course Code: EEC/CSE/51-P Course Credits: 2 Contact Hours: 4 hours/week Mode: Industrial Training / Internship	**Course Assessment Methods (100 Marks)** An internal evaluation is done by a faculty member appointed by the Chairperson of the Department. Significance and originality of the problem addressed and the solution provided: 20 Knowledge of the problem domain and tool used (VIVA-VOCE):25 Report Writing: 20 Judgment of the skill learnt and system developed: 20 Level of ethics followed: 15

About the Industrial training:

Students do an Industrial Training of 4 to 6 weeks after fourth semester. They are expected to learn novel skills and develop some software application during the training period.

After doing training students will be able to:

CO1. **review** the existing systems for their strengths and weaknesses. (LOTS: Level 4: Analyse)
CO2. **address** novel problems in an original and innovative manner (LOTS: Level 6:Create)
CO3. **select and apply** modern engineering tools. (LOTS: Level 3: Apply)
CO4. **evaluate** the system developed critically with respect to the requirement analysis andother similar systems. (LOTS: Level 5: Evaluate)
CO5. **prepare** training report by organizing ideas in an effective manner.
CO6. **follow** ethical practices while doing the training and writing report. (LOTS: Level 3:Apply)

CO-PO Articulation Matrix Industrial Training (EEC/CSE/51-P)

Course Outcomes	**PO 1**	**PO 2**	**PO 3**	**PO 4**	**PO 5**	**PO 6**	**PO 7**	**PO 8**	**PO 9**	**PO 10**	**PO 1 1**	**PO 12**	**PSO 13**	**PSO 14**	**PSO 15**
CO1	3	3	3	2		1	_	_	2	_	1	_	_	_	_
CO2	2	_	_	_	3	_	_	_	3	_	_	_	_	_	_
CO3	_	_	_	_	_	_	_	_	_	_	_	_	_	_	_
CO4	_	_	_	_	_	_	_	_	_	_	_	3	_	_	_
CO5	_	_	_	_	_	_	_	3	_	3	_	_	_	_	_
CO6	2	_	_	_	3	_	_	_	3	_	_	_	_	_	_
3-High 2-Medium 1-Low															

Detailed Syllabus of
B. Tech. (CSE)
VI Semester

Operating Systems

General Course Information

Course Code: PC/CSE/61-T Course Credits: 3 Type: Professional Core Contact Hours: 3 hours/week Mode: Lectures (L) Examination Duration: 3 hours	**Course Assessment Methods (internal: 30; external: 70)** Three minor tests each of 20 marks will be conducted. The average of the highest marks obtained by a student in the any of the two minor examinations will be considered. Class Performance will be measured through percentage of lectures attended (04 marks). Assignments, quiz etc. will have weightage of 06 marks For the end semester examination, nine questions are to be set by the examiner. A candidate is required to attempt 5 questions in all. All questions carry equal marks. Question number 1 will be compulsory and based on the entire syllabus. It will contain seven parts of 2 marks each. Question numbers 2 to 9 will be given by setting two questions from each of the four units of the syllabus. A candidate is required to attempt the remaining four questions by selecting one question from each of the four units.

Pre-requisites: Programming in C and Knowledge of Computer fundamentals.

About the Course:
The objective of this course is to help students become familiar with the fundamental concepts of operating systems and provide them with enough understanding of operating system design.

Course Outcomes: By the end of the course students will be able to:
CO1. **list** various functions and design characteristics of operating systems (LOTS: Level 1: Remember)
CO2. **explain** fundamental concepts of operating systems. (LOTS: Level 2: Understand)
CO3. **apply** operating system design concepts for solving problems regarding scheduling,memory management, disk management and deadlocks etc. (LOTS: Level 3: Apply)
CO4. **analyze** the issues related to various operating systems. (LOTS: Level 4: Analyse)
CO5. **design** solutions for the memory and process management problems. (LOTS: Level 6: Create).

Course Content

Unit I
Introductory Concepts: Operating systems functions and characteristics, operating system services and systems calls, system programs, operating system structure. operating systems generation, operating system services and systems calls. Types of Operating systems: Batch operating system, Time-sharing OS, Distributed operating system, Realtime systems.
File Systems: Types of Files and their access methods, File allocation methods, Directory Systems: Structured Organizations, directory and file protection mechanisms, disk scheduling and its associated algorithms.

Unit II
Processes: Process concept, Process Control Block, Operations on processes, cooperating processes. CPU scheduling: Levels of Scheduling, scheduling criteria, Comparative study of

scheduling algorithms, Algorithm evaluation, multiple processor scheduling. Critical-section problem, Semaphores.

Unit III

Storage Management: Storage allocation methods: Single contiguous allocation, non-contiguous memory allocation, Paging and Segmentation techniques, segmentation with paging, Virtual memory concepts, Demand Paging, Page replacement Algorithms, Thrashing.

Unit IV

Deadlock: System model, Deadlock characterization, Methods for handling deadlocks, Deadlock prevention, Deadlock avoidance, Deadlock detection, Recovery from deadlock
Case Studies: Comparative study of WINDOW, UNIX & LINUX system.

Text and Reference Books:

- Silberschatz, Peter B. Galvin and Greg Gagne, *Operating System Concepts*, 8th Edition, WileyIndianEdition, 2010.
- Andrew S Tanenbaum, *Modern Operating Systems,* Third Edition, Prentice Hall India, 2008.
- Naresh Chauhan, *Principles of Operating Systems*, Oxford Press, 2014.
- D.M. Dhamdhere, *Operating Systems*, 2nd edition, Tata McGraw Hill, 2010.
- William Stallings, *Operating Systems– Internals and Design Principles*, 5th Edition, Prentice HallIndia, 2000.

CO-PO Articulation Matrix Operating System Course (PC/CSE/61-T)

Course Outcomes	**PO 1**	**PO 2**	**PO 3**	**PO 4**	**PO 5**	**PO 6**	**PO 7**	**PO 8**	**PO 9**	**PO 10**	**PO 1 1**	**PO 12**	**PSO 13**	**PSO 14**	**PSO 15**
CO1	1	_	_	_	_	_	_	_	_	_	_	_	3	_	_
CO2	1	_	_	_	_	_	_	_	_	_	_	_	3	_	_
CO3	3	1	_	_	2	_	_	_	_	_	_	1	3	_	_
CO4	3	2	3		2	_	_	_	_	_	_	1	3	_	_
CO5	3	2	3	2	2	_	_	_	_	_	_	_	3	_	_
3-High 2-Medium 1-Low															

Formal Language and Automata Theory

General Course Information

Course Code: PC/CSE/62-T Course Credits: 3 Type: Professional Core Contact Hours: 3 hours/week Mode: Lectures (L) Examination Duration: 3 hours	**Course Assessment Methods (internal: 30; external: 70)** Three minor tests each of 20 marks will be conducted. The average of the highest marks obtained by a student in the any of the two minor examinations will be considered. Class Performance will be measured through percentage of lectures attended (04 marks). Assignments, quiz etc. will have weightage of 06 marks For the end semester examination, nine questions are to be set by the examiner. A candidate is required to attempt 5 questions in all. All questions carry equal marks. Question number 1 will be compulsory and based on the entire syllabus. It will contain seven parts of 2 marks each. Question numbers 2 to 9 will be given by setting two questions from each of the four units of the syllabus. A candidate is required to attempt the remaining four questions by selecting one question from each of the four units.

Pre-requisites: The students are expected to have a strong background in the fundamentals of discrete mathematics like in the areas of symbolic logic, set, induction, number theory, summation, series, combinatorics, graph, recursion, basic proof techniques.

About the Course:

Formal Languages and Automata theory presents the theoretical aspects of computer science, which lay the foundation for students of Computer Science. The course introduces some fundamental concepts in automata theory and formal languages including grammar, finite automaton, regular expression, formal language, pushdown automaton, and Turing machine.

Course Outcomes: By the end of the course students will be able to:

CO1. **define** terminology related to theory of computation. (LOTS: Level 1: Remember)

CO2. **explain** the basic concepts and applications of Theory of Computation. (LOTS: Level 2: Understand)

CO3. **apply** the principles of Theory of Computation to solve computational problems. (LOTS: Level 3: Apply)

CO4. **compare and contrast** the hierarchy of grammars (LOTS: Level 5: Evaluate).

CO5. **design** various types of automata for given problems. (LOTS: Level 6: Create)

Course Content

Unit I

Finite Automata and Regular Expressions: Finite State Systems, Basic Definitions Non-Deterministic finite automata (NDFA), Deterministic finite automata (DFA), Equivalence of DFA and NDFA Finite automata with E-moves, Regular Expressions, Equivalence of finite automata and Regular Expressions, Regular expression conversion and vice versa, Conversion of NFA to DFA by Arden's Method.

Unit II

Introduction to Machines: Concept of basic Machine, Properties and limitations of FSM. Moore and mealy Machines, Equivalence of Moore and Mealy machines.

Properties of Regular Sets: The Pumping Lemma for Regular Sets, Applications of the pumping lemma, Closure properties of regular sets, Myhill-Nerode Theorem and minimization of finite Automata, Minimization Algorithm.

Unit III

Grammars: Definition, Context free and Context sensitive grammar, Ambiguity regular grammar, Reduced forms, Removal of useless Symbols and unit production, Chomsky Normal Form (CNF), Griebach Normal Form (GNF).

Pushdown Automata: Introduction to Pushdown Machines, Application of Pushdown Machines

Unit IV

Turing Machines: Deterministic and Non-Deterministic Turing Machines, Design of T.M, Halting problem ofT.M., PCP Problem.

Chomsky Hierarchies: Chomsky hierarchies of grammars, Unrestricted grammars, Context sensitive languages,Relation between languages of classes.

Computability: Basic concepts, Primitive Recursive Functions.

Text and Reference Books:

- Hopcroaft & O. D. Ullman, R Mothwani, *Introduction to automata theory, language & computations*,AW,2001.
- K. L. P.Mishra & N. Chandrasekaran, *Theory of Computer Sc.(Automata, Languages and computation)*,PHI, 2000.
- Peter Linz, *Introduction to formal Languages & Automata*, Narosa, Publication, 2001.
- Ramond Greenlaw and H. James Hoover, *Fundamentals of the Theory of Computation-Principles andPractice*, Harcourt India Pvt. Ltd., 1998.
- H. R. Lewis & C. H. Papaditriou, *Elements of theory of Computation*, PHC, 1998.
- John C. Martin, *Introduction to Languages and the Theory of Computation*, T.M.H., 2003.

CO-PO Articulation Matrix Formal Language and Automata Theory Course (PC/CSE/62-T)

Course Outcomes	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 1 1	PO 12	PSO 13	PSO 14	PSO 15
CO1	1	_	_	_	_	_	_	_	_	_	_	_	3	_	_
CO2	1	_	_	_	_	_	_	_	_	_	_	_	3	_	_
CO3	2	1	2		2	_	_	_	_	_	_	_	3	_	_
CO4	3	2	2	2	2	_	_	_	_	_	_	_	3	_	_
CO5	3	2	2	2	2	_	_	_	_	_	_	_	3	_	_
3-High 2-Medium 1-Low															

Data Analytics using R

General Course Information

Course Code: PC/CSE/63-T Course Credits: 3 Type: Professional Core Contact Hours: 3 hours/week Mode: Lectures (L) Examination Duration: 3 hours	**Course Assessment Methods (internal: 30; external: 70)** Three minor tests each of 20 marks will be conducted. The average of the highest marks obtained by a student in the any of the two minor examinations will be considered. Class Performance will be measured through percentage of lectures attended (04 marks). Assignments, quiz etc. will have weightage of 06 marks For the end semester examination, nine questions are to be set by the examiner. A candidate is required to attempt 5 questions in all. All questions carry equal marks. Question number 1 will be compulsory and based on the entire syllabus. It will contain seven parts of 2 marks each. Question numbers 2 to 9 will be given by setting two questions from each of the four units of the syllabus. A candidate is required to attempt the remaining four questions by selecting one question from each of the four units.

Pre-requisites: Basic programming skills, Probability and Statistics

About the Course:
Data analytics is a growing and stimulating field that turns data into valuable insights. This course includes programming in R for acquiring, cleaning, visualizing and analyzing data. In addition, it also involves predictive modeling. This course will introduce students to the basic principles, tools and the craft for devising solutions for problems that come in the domain of data science. The emphasis of the course is on integration and synthesis of concepts and their applications for effective engineering solutions.

Course Outcomes: By the end of the course students will be able to:
CO1. **outline** concepts related to R programming and data analysis. (LOTS: Level 1: Remember)
CO2. **explain** the basic concepts and tools that are used to solve problems in data analytics. (LOTS: Level2: Understand)
CO3. **interpreting** results of descriptive and inferential statistics. (LOTS: Level 2: Understand)
CO4. **apply** R programming for reading, cleaning, visualizing and analysing data. (LOTS: Level 3: Apply)
CO5. **analyse** the trends in data through exploratory data analysis. (LOTS: Level 4: Analyse)
CO6. **devise** solutions for descriptive and predictive modelling. (LOTS: Level 6: Create)

Course Content

Unit I
Introduction to R programming: Data types or objects in R, Creating and manipulating objects like factors, vectors and matrices, lists and data frames, Subsetting matrices and data frames, Vectorized operations for vectors and matrices and data frames.

Unit II
Control structure in R: If-else statements, for and while loops, loop functions like lapply, apply, sapply and mapply etc.; writing user defined functions in R. Getting data in and out of R.

Unit III
Doing basic descriptive statistics: Data types for data analysis and their mapping to R objects, Mean, Median, Mode, Quantiles, Five-point summary, Variance, Correlation and Covariance, normal distribution, uniform distribution using R, Hypothesis testing: Chi-Square test and student’s T test.

Unit IV

Exploratory Data Analysis: Visualizing data through various plots and charts (bar charts, histogram, frequency polygon, scatter plot, box plots etc.), Applying KNN.

Text and Reference Books:

- Hadley Wickham and Garrett Grolemund., *R for Data Science Import, Tidy, Transform and modelData*, O'Reilly, 2017.
- Roger D. Peng, *R Programming for Data Science*, Lean Publishing, 2015.
- Paul Teeter, *R Cookbook*, O'Reilly, 2011.
- W. N. Venables, D. M. Smith and the R core Team, *An introduction to R, Notes on R: A ProgrammingEnvironment for Data Analysis and Graphics*, version 3.3.2, 2016.
- Michael J. Crawley, *Statistics, An introduction using R*, Second edition, John Wiley, 2015
- Han, J., Kamber, M, Pei, J., *Data Mining Concepts and Techniques*, Third edition, Morgan Kaufmann,2012.
- Trevor Hastie, Robert Tibshirani, Jerome Friedman, *The Elements of Statistical Learning: DataMining, Inference and Prediction*, Springer, 2nd edition, 2009.

CO-PO Articulation Matrix Data Analytics using R Course (PC/CSE/63-T)

Course Outcomes	**PO 1**	**PO 2**	**PO 3**	**PO 4**	**PO 5**	**PO 6**	**PO 7**	**PO 8**	**PO 9**	**PO 10**	**PO 1 1**	**PO 12**	**PSO 13**	**PSO 14**	**PSO 15**
CO1	1	-	-	-	-	_	_	_	_	_	_	_	_	_	2
CO2	1	-	-	-	-	_	_	_	_	_	_	_	_	_	3
CO3	3	2	-	3	-	_	_	_	_	_	_	_	_	_	3
CO4	3	-	-	-	3	_	_	_	_	_	_	_	_	_	3
CO5	2	3	2	2	3	_	_	_	1	_	_	_	_	_	3
CO6	3	3	2	3	3	_	_	_	2	_	_	_	_	_	_
3-High 2-Medium 1-Low															

Machine Learning

General Course Information

Course Code: PC/CSE/64-T CourseCredits:3 Type: Professional/ Programme Elective Contact Hours: 3 Mode: Lectures (L) ExaminationDuration:3hours	**Course Assessment Methods (internal: 30; external: 70)** Three minor examinations (20 marks), Class Performance measured through percentage of lectures attended (4marks), assignments (6marks), and the end-semester examination (70marks). For the end semester examination, nine questions are to beset by the examiner. A candidate is required to attempt 5 questions in all. All questions carry equal marks. Question number1 will be compulsory and based on the entire syllabus. It will contain even parts of 2 marks each. Question numbers 2 to 9 will be given by setting two questions from each of the four units of the syllabus. A candidate is required to attempt the remaining four questions by selecting one question from each of the four units.

Pre-requisites: Basics of Linear Algebra and Statistics, Basics of Probability Theory, Data Structures and Computer Algorithms.

About the Course:

The course introduces some of the key machine learning algorithms and the theory that form the backbone of these algorithms. The examples of such algorithms are classification algorithms for learning patterns from data, clustering algorithms for grouping objects based on similarity, neural network algorithms for pattern recognition, genetic algorithms for searching large and complex search spaces etc.

Course Outcomes: By the end of the course students will be able to:
CO1. **outline** the concepts and working of different machine learning algorithms. (LOTS: Level1: Remember)
CO2. **Interpret** the results of machine learning algorithms. (LOTS: Level 2: Understand)
CO3. **Apply** machine learning concepts and algorithms to given problems. (LOTS: Level 3: Apply)
CO4. **Analyse** the performance of machine learning algorithms. ((LOTS: Level 4: Analyze)
CO5. **Compare and contrast** different machine learning algorithms. (LOTS: Level5: Evaluate)
CO6. **Design** machine learning algorithms for optimization, pattern recognition and search problems.(LOTS: Level 6: Create)

Course Content

UnitI

Introduction: Well posed learning problems, designing a learning system, Issues in machine learning, the concept learning task, Concept learning as search, Version spaces and candidate elimination algorithm, Remarks on version spaces and candidate-eliminations, Inductive bias.

Unit II

Supervised Learning: Introduction to linear regression, estimating the coefficients, Accessing the accuracy of the coefficient estimates, Accessing the accuracy of the regression model, Multiple linear regression, Logistic regression, basic decision tree learning (ID3) algorithm, Inductive bias in decision tree learning, Issues in decision tree learning.

Unit III

Unsupervised Learning: About clustering, type of data in clustering analysis, DB SCAN density-based clustering method, Performance analysis of clustering algorithms,

Artificial Neural networks: Neural Network representations, Appropriate problems for neural network learning, Perceptron, perceptron training rule, Multilayer Networks and back propagation algorithm.

Unit IV

Bayesian Learning: Bayes theorem, Bayes theorem and concept learning, Maximum likelihood and least-squared error hypotheses.

Evaluating Hypotheses: Estimating hypothesis Accuracy, Basics of sampling theory, Error estimation and estimating Binomial proportions, The binomial distribution, Mean and variance, Bias and variance, Confidence intervals, Two sided or one sided bounds, Central limit theorem.

Text and Reference Books:

1. TomM.Mitchell, Machine Learning, McGraw-Hill, 1997.
2. Bishop Christopher, Pattern Recognition and Machine Learning, Springer Verlag, 2006.
3. Trevor Hastie, Robert Tibshirani, Jerome Friedman, The Elements of Statistical Learning: DataMining, Inference and Prediction, Springer, 2ndedition, 2009.
4. J.Hanand M.Kamber, Data Mining Concepts and Techniques, 3rdEdition, Elsevier, 2012.
5. S.Rajeshkaran, G.A.VijayalakshmiPai, NeuralNetworks, Fuzzy Logic and Genetic Algorithm: Synthesis and Applications, PHI, 2003.

CO-PO Articulation Matrix Machine Learning Course (PC/CSE/64-T)

Course Outcomes	**PO 1**	**PO 2**	**PO 3**	**PO 4**	**PO 5**	**PO 6**	**PO 7**	**PO 8**	**PO 9**	**PO 10**	**PO 1 1**	**PO 12**	**PSO 13**	**PSO 14**	**PSO 15**
CO1	1	_	_	1	_	_	_	_	_	_	_	_	_	_	3
CO2	2	2	2	3	_	_	_	_	_	_	_	_	_	_	3
CO3	2	2	2	2	_	_	_	_	_	_	_	_	_	_	3
CO4	3	3	2	3	_	_	_	_	_	_	_	_	_	_	3
CO5	3	3	2	3	_	_	_	_	_	_	_	_	_	_	3
CO6	3	3	2	3	_	_	_	_	_	_	_	_	_	_	3
3-High 2-Medium 1-Low															

Embedded System Design

General Course Information

Course Code: PE/CSE/61-T Course Credits: 3 Type: Professional/ Programme Elective Contact Hours: 3 Mode: Lectures (L) Examination Duration: 3 hours.	**Course Assessment Methods (internal: 30; external: 70)** Three minor tests each of 20 marks will be conducted. The average of the highest marks obtained by a student in the any of the two minor examinations will be considered. Class Performance will be measured through percentage of lectures attended (04 marks). Assignments, quiz etc. will have weightage of 06 marks For the end semester examination, nine questions are to be set by the examiner. A candidate is required to attempt 5 questions in all. All questions carry equal marks. Question number 1 will be compulsory and based on the entire syllabus. It will contain seven parts of 2 marks each. Question numbers 2 to 9 will be given by setting two questions from each of the four units of the syllabus. A candidate is required to attempt the remaining four questions by selecting one question from each of the four units.

Pre-requisites: Introduction to Microprocessors and Operating Systems.

About the Course:
An embedded system is a self-contained unit that have a dedicated purpose within a device. We come across a variety of applications of embedded systems in navigation tools, telecom applications, and networking equipment to name just a few. An Embedded System's Architecture begins with a view of embedded development and how it differs from the other systems. Students learn about setting up a development environment and then move on to the core system architectural concepts, exploring pragmatic designs, boot-up mechanisms, and memory management. They are also explored to programming interface and device drivers to establish communication via TCP/IP and take measures to increase the security of IoT solutions.

Course Outcomes: By the end of the course students will be able to:
CO1. **state** the concepts related to embedded system design. (LOTS: Level 1: Remember)
CO2. **discuss** the principles of embedded systems and their applications. (LOTS: Level 2: Understand)
CO3. **apply** the principles of embedded design for problem solving. (LOTS: Level 3: Apply)
CO4. **analyze** architectural design patterns and engineering tradeoffs. (LOTS: Level 4: Analyse)
CO5. **design** architectural patterns for connected and distributed devices in the IoT. (LOTS: Level 6: Create)

Course Content

Unit I

Embedded Systems: A Pragmatic Approach- Domain definitions, Embedded Linux systems, Low-end 8-bit microcontrollers, Hardware architecture, Understanding the challenge, Multithreading, RAM, Flash memory, Interfaces and peripherals, Asynchronous UART-based serial communication:-SPI - I2C - USB, Connected systems, The reference platform, ARM reference design, The Cortex-M microprocessor

Work Environment and Workflow Optimization: Workflow overview, C compiler, Linker, Build automation, Debugger, Embedded workflow, The GCC toolchain, The cross-compiler, Compiling the compiler, Linking the executable, Binary format conversion, Interacting with the target, The GDB session, Validation, Functional tests, Hardware tools, Testing off-target, Emulators.

Unit II

Architectural Patterns: Configuration management, Revision control, Tracking activities, Code reviews, Continuous integration, Source code organization, Hardware abstraction, Middleware Application code, The life cycle of an embedded project, Defining project steps, Prototyping Refactoring, API and documentation,

The Boot-Up Procedure: The interrupt vector table, Startup code, Reset handler, Allocating the stack, Fault handlers, Memory layout, Building and running the boot code, The makefile, Running the application, Multiple boot stages, Bootloader, Building the image, Debugging a multi-stage system, Shared libraries

Unit III

Distributed Systems and IoT Architecture: Network interfaces, Media Access Control, Ethernet, Wi-Fi, Low- Rate Wireless Personal Area Networks (LR-WPAN), LR-WPAN industrial link-layer extensions, 6LoWPAN, Bluetooth, Mobile networks, Low-power Wide Area Networks (LPWANs), Selecting the appropriate network interfaces, The Internet Protocols, TCP/IP implementations, Network device drivers, Running the TCP/IP stack, Socket communication, Mesh networks and dynamic routing, Transport Layer Security, Securing socket communication, Application protocols, Message protocols, REST architectural pattern, Distributed systems; single points of failure, Summary

Unit IV

Low-Power Optimizations: System configuration, Hardware design, Clock management, Voltage control, Low-power operating modes, Deep-sleep configuration, Stop mode, Standby mode, Wake-up intervals, Measuring power, Development boards, Designing low-power embedded applications, Replacing busy loops with sleep mode, Deep sleep during longer inactivity periods, Choosing the clock speed, Power state transitions

Embedded Operating Systems: Real-time application platforms, FreeRTOS, ChibiOS, Low-power IoT systems, Contiki OS, Riot OS, POSIX-compliant systems, NuttX, Frosted, The future of safe embedded systems, Process isolation; Tock, Summary.

Text and Reference Books:

- Daniele Lacamera, *Embedded Systems Architecture*, Packt Publishing, May 2018, ISBN: 9781788832502.
- Raj Kamal, *Embedded Systems*, TMH, 2004.
- M.A. Mazidi and J. G. Mazidi, *The 8051 Microcontroller and Embedded Systems*, PHI, 2004.
- David E. Simon, *An Embedded Software Primer*, Pearson Education, 1999.
- K.J. Ayala, , *The 8051 Microcontroller*, Penram International, 1991.
- Rajiv Kapadia, *8051 Microcontroller & Embedded Systems*, Jaico Press, 2004.
- Prasad, *Embedded Real Time System*, Wiley Dreamtech, 2004.
- John B. Peatman, *Design with PIC Microcontrollers*, Pearson Education Asia, 2002.
- Wayne Wolf, *Computers as components: Principles of Embedded Computing SystemDesign*, MorganKaufman Publication, 2000.
- Tim Wilmshurst, *The Design of Small-Scale embedded systems*, Palgrave, 2003.
- Marwedel, Peter, *Embedded System Design*, Kluwer Publishers, 2004.

CO-PO Articulation Matrix Embedded System Design Course (PE/CSE/61-T)

Course Outcomes	**PO 1**	**PO 2**	**PO 3**	**PO 4**	**PO 5**	**PO 6**	**PO 7**	**PO 8**	**PO 9**	**PO 10**	**PO 1 1**	**PO 12**	**PSO 13**	**PSO 14**	**PSO 15**
CO1	1	_	_	_	_	_	_	_	_	_	_	_	_	3	_
CO2	1	_	_	_	_	_	_	_	_	_	_	_	_	3	_
CO3	1	1	_	_	_	_	_	_	_	_	_	_	_	3	_
CO4	2	2	2	2	2	_	_	_	_	_	_	_	_	3	_
CO5	3	3	3	3	3	_	_	_	_	_	2	2	_	3	_
3-High 2-Medium 1-Low															

Wireless and Mobile Communication

General Course Information

Course Code: PE/CSE/62-T Course Credits: 3 Type: Professional Elective Contact Hours: 3 Mode: Lectures (L) Examination Duration: 3	**Course Assessment Methods (internal: 30; external: 70)** Three minor tests each of 20 marks will be conducted. The average of the highest marks obtained by a student in the any of the two minor examinations will be considered. Class Performance will be measured through percentage of lectures attended (04 marks). Assignments, quiz etc. will have weightage of 06 marks For the end semester examination, nine questions are to be set by the examiner. A candidate is required to attempt 5 questions in all. All questions carry equal marks. Question number 1 will be compulsory and based on the entire syllabus. It will contain seven parts of 2 marks each. Question numbers 2 to 9 will be given by setting two questions from each of the four units of the syllabus. A candidate is required to attempt the remaining four questions by selecting one question from each of the four units.

Pre-requisites:

Basic knowledge of computer networks, Network Architecture and reference model, High Speed Network technologies, Ethernet, TCP/IP architecture.

About the course:

This course attunes the students with mobile and wireless communication using the Networking infrastructure of organizations/institutes. Students learn to analyse Networks' Architecture for wireless communication and the protocols for various layers in the Wireless Networks, technologies used and application arena of Wireless Networks.

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

CO1. **recall** different mobile and wireless communication concepts. (LOTS: Level 1: Remember)

CO2. **explain** working of different Mobile Communication Technologies used now a days. (LOTS: Level 2: Understand)

CO3. **demonstrate** application of different mobile protocols for different Mobile and Wireless Communication Technologies. (LOTS: Level 2: Understand)

CO4. **analyze** the performance of different Mobile Communication technologies in different scenarios /situations. (LOTS: Level 4: Analyse)

CO5. **design** a mobile network for any city/state/country using combination of different MobileTechnologies. (LOTS: Level 6: Create)

Course Content

Unit I

Mobile Communication**:** Wireless Transmission--- Frequencies, signals, antennas, signal propagation, multiplexing, modulation, spread spectrum, cellular system. Specialized MAC, SDMA, FDMA, TDMA- fixed TDM, classical ALOHA, slotted ALOHA, CSMA, DAMA, PRMA, reservation TDMA. Collision avoidance. CDMA, GSM- mobile services, architecture, handover.

Unit II

Wireless LAN IEEE 802.11-System and protocol architecture, physical layer. Frame format. Bluetooth--- Protocol architecture, Frame format.
WiMAX – Layered Protocol architecture, format, Applications. Introduction to LTE.

Unit III

Mobile network Layer: Mobile IP- goals, assumption, requirement, entities, terminology, IP packet delivery, Agent advertisement and discovery, registration, tunneling, encapsulation, optimization, reverse tunneling, IPV6. DHCP. Adhoc Networks—routing , Destination Sequence Distance Vector.

Unit IV

Mobile Transport Layer: Traditional TCP, Indirect TCP, Snooping TCP, Mobile TCP fast retransmission/ recovery, transmission/time out freezing, selective retransmission, Transaction oriented TCP.

Text and Reference Books:

- Jochen Schiller, *Mobile Communication*, 2nd Edition, Pearson, 2009.
- Andrew S Tanenbaum, *Computer Networks*, 5th Edition, Pearson 2013.
- William C Y Lee, *Mobile Communication Engineering*: *Theory and Applications*, 2nd Edition, McGrawHill, 1997.

CO-PO Articulation Matrix Wireless and Mobile Communication Course (PE/CSE/62-T)

Course Outcomes	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 1 1	PO 12	PSO 13	PSO 14	PSO 15
CO1	1	_	_	_	_	_	_	_	_	_	_	_	_	3	_
CO2	1	_	_	_	_	_	_	_	_	_	_	_	_	3	_
CO3	1	1	_	_	_	_	_	_	_	_	_	_	_	3	_
CO4	2	2	2	2	2	_	_	_	_	_	_	_	_	3	_
CO5	3	3	3	3	3	_	_	_	_	_	2	2	_	3	_
3-High 2-Medium 1-Low															

Graph Theory

General Course Information

Course Code: PE/CSE/63-T Course Credits: 3 Type: Professional/ Programme Elective Contact Hours: 3 hours/week Mode: Lectures (L) Examination Duration: 3 hours	**Course Assessment Methods (internal: 30; external: 70)** Three minor tests each of 20 marks will be conducted. The average of the highest marks obtained by a student in the any of the two minor examinations will be considered. Class Performance will be measured through percentage of lectures attended (04 marks). Assignments, quiz etc. will have weightage of 06 marks For the end semester examination, nine questions are to be set by the examiner. A candidate is required to attempt 5 questions in all. All questions carry equal marks. Question number 1 will be compulsory and based on the entire syllabus. It will contain seven parts of 2 marks each. Question numbers 2 to 9 will be given by setting two questions from each of the four units of the syllabus. A candidate is required to attempt the remaining four questions by selecting one question from each of the four units.

Pre-requisites: Basic knowledge of Abstract Algebra, Set Theory and Counting Techniques

About the Course:
Graph Theory is an elective course for every graduate in Computer Science and Engineering. The importance of Graph Theory reveals from the fact that it can be applied to solve any practical problem in electrical networks, operation research, data structure or social sciences etc. Also, Graph Theory provides easy representation of mathematical facts with insightful theories behind them. This course explains different types of graphical structures, related properties, various operations and facts related to these graphical structures with the help of proofs.

Course Outcomes: By the end of the course students will be able to:
CO1. **recognize** different kinds of Graphs. (LOTS: Level 1: Remember)
CO2. **demonstrate** various types of graphical structures with the operations implemented onthese structures. (LOTS: Level 2: Understand)
CO3. **apply** graph theory constructs for solving problems. (LOTS: Level 3: Apply)
CO4. **justify** various facts and results associated with graphical structures with the help of proofs. (LOTS:Level 5: Evaluate)
CO5. **sketch** the graph to solve any problem in pictorial and easy representation. (LOTS: Level 6: Create)

Course Content

Unit I

Introduction to graphs, Types of graphs -Regular, Complete, Bipartite, Isomorphic, Connected, Applications, Operations on Graphs, Walks, Path, Circuits, Euler Graphs, Hamiltonian Path and Circuits, Trees, Properties of Trees, Spanning Trees (Standard Results with proofs based on all mentioned topic).

Unit II

Cut-Sets, Properties of Cut-Set, All Cut-Sets in a graph, Fundamental Circuits and Cut-Sets, Connectivity and Separability, Network Flows, 1-Isomorphism, 2- Isomorphism, Planar Graphs, Kuratowski's Two Graphs.

Unit III

Sets with one operation, Sets with two operations, Modular Arithmetic and Galois Fields, Vector and Vector Spaces, Vector Space associated with a graph, Basic Vectors of a graph, Circuits and Cut-Set Subspaces, Orthogonal Vectors and Spaces, Intersection and Join of W and W_S.

Unit IV

Matrix representation of graphs, Incidence Matrix, Submatrices, Circuit Matrix, Fundamental Circuit Matrix and Rank, Coloring of graphs: Chromatic Number, Vertex Coloring of graphs, Edge Coloring of graphs, Coloring ofPlanar Graphs.

Text and Reference Books:

- V. K. Balakrishnan, *Graph Theory*, Tata McGraw Hill, 1st Edition, 2004.
- Narsingh Deo, *Graph Theory with Applications to Engineering and Computer Science*, Prentice-Hall ofIndia, Reprint, 2004.
- Frank Harary, *Graph Theory*, Narosa/Addison Wesley, Indian Student Edition, 1988.
- Bollobas, Bela, *Modern Graph Theory*, Springer Verlag New York, 1st Edition, 1998.
- R. Diestel, *Graph Theory*, Springer, 2nd Edition, 2000.
- Douglas B. West, *Introduction to Graph Theory*, Prentice Hall of India, 2nd Edition, 2002.

CO-PO Articulation Matrix Graph Theory Course (PE/CSE/63-T)

Course Outcomes	**PO 1**	**PO 2**	**PO 3**	**PO 4**	**PO 5**	**PO 6**	**PO 7**	**PO 8**	**PO 9**	**PO 10**	**PO 1 1**	**PO 12**	**PSO 13**	**PSO 14**	**PSO 15**
CO1	2	1	_	_	_	_	_	_	_	_	_	_	2	_	_
CO2	2	1	_	_	_	_	_	_	_	_	_	_	3	_	_
CO3	2	3	1		2	_	_	_	_	_	_	2	3	_	_
CO4	3	2	2	3	2	_	_	_	_	_	_	2	3	_	_
CO5	3	_	1	2	2	_	_	_	_	_	_	2	3	_	_
3-High 2-Medium 1-Low															

Bio-informatics

General Course Information:

Course Code: PE/CSE/64-T Course Credits: 3 Type: Professional/ Programme Elective Contact Hours: 3 hours/week Mode: Lectures (L) Examination Duration: 3 hours	**Course Assessment Methods (internal: 30; external: 70)** Three minor tests each of 20 marks will be conducted. The average of the highest marks obtained by a student in the any of the two minor examinations will be considered. Class Performance will be measured through percentage of lectures attended (04 marks). Assignments, quiz etc. will have weightage of 06 marks For the end semester examination, nine questions are to be set by the examiner. A candidate is required to attempt 5 questions in all. All questions carry equal marks. Question number 1 will be compulsory and based on the entire syllabus. It will contain seven parts of 2 marks each. Question numbers 2 to 9 will be given by setting two questions from each of the four units of the syllabus. A candidate is required to attempt the remaining four questions by selecting one question from each of the four units.

Pre-requisites: None

About the Course:
The scope of Bio-informatics is growing rapidly. Analysing data related to bio-informatics is not possible without computational skills. This course is designed to impart fundamental knowledge of bio-informatic which would enable students to understand the intricacies of Bioinformatics. The students will learn about the characteristic of bio-informatic data and the tools for analysis of such data.

Course Outcomes: By the end of the course students will be able to:
CO1. **list** the applications of bioinformatics and biological databases. (LOTS: Level 1: Remember)
CO2. **explain** storage and retrieval of biological data from various biological databases.(LOTS: Level 2:Understand)
CO3. **apply** the knowledge of bio-informatic concepts. (LOTS: Level 3: Apply)
CO4. **identify** challenges in bioinformatics and computational biology. (LOTS: Level 4: Analyse)
CO5. **compare and contrast** various algorithms for sequence alignment and scoring algorithms. (LOTS:Level 5: Evaluate)
CO6. **Devise** schemes for addressing bio-informatic problems. (LOTS: Level 6: Create)

Course Content

Unit: I
Bioinformatics: Introduction to Bioinformatics, Scope, Overview of molecular biology & genetics, Nucleic acid; structure & function, Protein structure & function; DNA Replication, Transcription, Translations, Genetic code, Codon Bias, Molecular Biology Techniques used in Bioinformatics.
Computer applications in molecular biology, Protein domains and human genome analysis program (BLAST, FASTA etc.). Search and retrieval of biological information and databases sequence, databank (NCBI)12hrs

Unit: II

Sequence Alignment

Pairwise Sequence Alignment: Evolutionary Basis, Sequence Homology versus Sequence Similarity, Sequence Similarity versus Sequence Identity, Methods, Scoring Matrices, Statistical Significance of Sequence Alignment

Database Similarity Searching: Unique Requirements of Database Searching, Heuristic Database Searching, Basic Local Alignment Search Tool (BLAST), FASTA, Comparison of FASTA and BLAST, Database Searching with the Smith–Waterman Method.

Unit: III

Multiple Sequence Alignment: Scoring Function, Exhaustive Algorithms, Heuristic Algorithms, Practical Issues.

Profiles and Hidden Markov Models: Position-Specific Scoring Matrices, Profiles, Markov Model and Hidden Markov Model.

Protein Motifs and Domain Prediction: Identification of Motifs and Domains in Multiple Sequence Alignment, Motif and Domain Databases Using Regular Expressions, Motif andDomain Databases Using Statistical Models, Protein Family Databases, Motif Discovery in Unaligned Sequences, Sequence Logos**.**

Unit: IV

Molecular Phylogenetics

Phylogenetics Basics: Molecular Evolution and Molecular Phylogenetics, Terminology, Gene Phylogeny versusSpecies Phylogeny, Forms of Tree Representation, Procedure.

Phylogenetic Tree Construction Methods and Programs: Distance-Based Methods, Character-Based Methods, Phylogenetic Tree Evaluation, Phylogenetic Programs

Text and References Books:

- T K Attwood and D J Parry Smith , *Introduction to Bioinformatics*, Pearson Education Asia, Singapore,2001.
- Sensen, C.W., *Essentials of Genomics and Bioinformatics*, John Wiley and Sons. 2002
- Attwood, T. and Pary-Smith, D., *Introduction to Bioinformatics*, Prentice Hall.1999
- Baxevanis, A.D. and Ouellette, B.F.F., *Bioinformatics: A Practical Guide to the Analysis of genes andProtein* , Wiley- Interscience, 2001
- Stuart M. Brown, *Bioinformatics: A Biologists Guide to Computing and the Internet*, NKU MedicalCentre, NY USA, 2000.

CO-PO Articulation Matrix Bio-informatics Course (PE/CSE/64-T)

Course Outcomes	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 1 1	PO 12	PSO 13	PSO 14	PSO 15
CO1	1	_	_	_	_	_	_	_	_	_	_	_	_	_	2
CO2	1	_	_	_	_	_	_	_	_	_	_	_	_	_	3
CO3	2	_	_	_	_	_	_	_	_	_	_	_	_	_	3
CO4	_	2	_	_	_	_	_	_	_	_	_	_	_	_	3
CO5	2	3	2	_	2	_	_	_	_	_	_	_	_	_	3
CO6	3	3	2	3	2	_	_	_	_	_	_	_	_	_	3
3-High 2-Medium 1-Low															

Components Based Software Engineering

General Course Information

Course Code: PE/CSE/65-T Course Credits: 3 Type: Professional Core Contact Hours: 3 hours/week Mode: Lectures (L) Examination Duration: 3 hours	**Course Assessment Methods (internal: 30; external: 70)** Three minor tests each of 20 marks will be conducted. The average of the highest marks obtained by a student in the any of the two minor examinations will be considered. Class Performance will be measured through percentage of lectures attended (04 marks). Assignments, quiz etc. will have weightage of 06 marks For the end semester examination, nine questions are to be set by the examiner. A candidate is required to attempt 5 questions in all. All questions carry equal marks. Question number 1 will be compulsory and based on the entire syllabus. It will contain seven parts of 2 marks each. Question numbers 2 to 9 will be given by setting two questions from each of the four units of the syllabus. A candidate is required to attempt the remaining four questions by selecting one question from each of the four units.

Pre-requisites: Data Structure & AlgorithmsAbout the Course:

To understand the importance, limitations and challenges of processes involved in software development. To gain knowledge of various software models as waterfall and evolutionary models and software design activities. To learn about software requirements, analysis, specification, cost estimation, software testing, maintenance and debugging.

Course Outcomes:

By the end of the course students will be able to:

CO1. Understand the difference between software engineering discipline with the other engineering disciplines (LOTS: Level 1:Remember)

CO2. Elaborate knowledge of various software models (LOTS: Level 2: Understand)

CO3. Analyze about software requirements analysis and specification(LOTS: Level 4: Analyse)

CO4. Able to get the knowledge of various software design activities. (LOTS: Level 6: Create)

CO5. **compare and contrast** various testing techniques. (LOTS:Level 5: Evaluate)

Course Content

Unit I

Software Engineering Fundamentals: Definition of software product and process, Software Characteristics, Components, Applications, Layered Technologies, Processes and Product, Methods and Tools, Generic View of Software Engineering, Software Crisis, Software development paradigms, Techniques of Process Modelling, Software Process and lifecycle models.

Unit II

Software Requirements Analysis & Specification: System specification, Software requirements specification (SRS) standards, Analysis and Design Modelling: ER Diagram, Dataflow Model, Control Flow Model, Control and Process Specification,
Data Dictionary

Unit III

Software Design: Software architecture, Modular Design-cohesion and coupling, Process-oriented design, Process and Optimization, Data-oriented design, User- interface design, Real-time software design, Architectural Designing, Interface Design, Procedural Design, Object Oriented Design.
CASE Tools: Computer-aided software engineering, Introduction to CASE, Building Blocks of CASE, Relevance of CASE tools, High-end and low-end CASE tools, automated support for data dictionaries, DFD, ER diagrams, Integrated Case
Environment, CASE workbenches.

Unit VI

Coding and Testing: Choice of Programming languages, Coding standards for Software. User Interface Design: Concepts of Ui, Interface Design Model, Internal and External Design, Evaluation, Interaction and Information Display Testing Objectives, Unit Testing, Integration Testing, Acceptance Testing, Regression Testing, Testing for Functionality and Testing for Performance, Top-Down and Bottom-Up Testing. Configuration Management: Concepts in Configuration Management, The Configuration Management Process: Planning and Setting up Configuration Management, Perform Configuration Control, Status Monitoring and Audits. Software Maintenance: What is software maintenance, Maintenance Process & Models, Reverse Engineering, Software re-engineering, Configuration Management issues and concept, Configuration planning & techniques, Software versions and change control process, Documentation.

Text and Reference Books:

- Hennessey and Patterson, "Computer Architecture: A quantitative Approach", Morgan Kaufman.
- Kai Hwang, Faye A. Briggs, "Computer Architecture and Parallel Processing" McGraw-Hillinternational Edition
- Kai Hwang, "Advanced Computer Architecture", Tata McGraw-Hill
- El-Rewini, H., & Abd-El-Barr, M. (2005). Advanced computer architecture and parallel processing (Vol. 42). John Wiley & Sons.

CO-PO Articulation Matrix Components of Software Engineering Course (PE/CSE/65-T)

Course Outcomes	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 1 1	PO 12	PSO 13	PSO 14	PSO 15
CO1	2	2	-	-	-	2	_	_	_	_	_1	_	_	_	2
CO2	-	2	-	-	-	_	_	1	_	_	_	3	_	_	3
CO3	2	1	-	2	-	3	_	3	1	_	_	_	_	_	3
CO4	-	-	2	1	-	3	_	_	2	_	3	_	_	_	3
CO5	2	1	-	2	-	3	_	3	1	_	_	_	_	_	3
3-High 2-Medium 1-Low															

PHP Programming

General Course Information

Course Code: PE/CSE/66-T Course Credits: 3 Type: Professional Core Contact Hours: 3 hours/week Mode: Lectures (L) Examination Duration: 3 hours	**Course Assessment Methods (internal: 30; external: 70)** Three minor tests each of 20 marks will be conducted. The average of the highest marks obtained by a student in the any of the two minor examinations will be considered. Class Performance will be measured through percentage of lectures attended (04 marks). Assignments, quiz etc. will have weightage of 06 marks For the end semester examination, nine questions are to be set by the examiner. A candidate is required to attempt 5 questions in all. All questions carry equal marks. Question number 1 will be compulsory and based on the entire syllabus. It will contain seven parts of 2 marks each. Question numbers 2 to 9 will be given by setting two questions from each of the four units of the syllabus. A candidate is required to attempt the remaining four questions by selecting one question from each of the four units.

Pre-requisites: Data Structure & Algorithms

About the Course:

To introduce the necessary knowledge to design and develop dynamic, database-driven webapplications using PHP. To understand basics of web programming, POST and GET in form submission. To illustrate how server-side programming works on the web. To analyze how to Read, write cookies and develop PHP application.

Course Outcomes:

By the end of the course students will be able to:

CO1. Understand principle of Web page design and about types of Websites (LOTS: Level 1:Remember)

CO2. Explain and recognize the basic concept of HTML, CSS, JavaScript and theirapplication in web designing. (LOTS: Level 2: Understand)

CO3. Implement the dynamic web pages with validation using JS object by applying different handling mechanism. (LOTS: Level 3: Apply)

CO4. Develop a simple web application using server-side PHP programming and Database Connectivity using My SQL (LOTS: Level 6: Create)

CO5. **Compare and contrast** PHP session management. (LOTS:Level 5: Evaluate)

Course Content

Unit I

HTML: Basics of HTML, formatting and fonts, commenting code, color, hyperlink, lists, tables, images, forms. Style sheets: Need for CSS, introduction to CSS, basic syntax and structure, using CSS, background images, colors and properties. Introduction to JavaScript: Client-side scripting with JavaScript, variables, functions, conditions, loops and repetition, Pop up boxes

Unit II

Introduction to PHP, Language Features, PHP Basics, PHP's Supported Data Types,Identifiers, Variables, Constants, Expressions, String Interpolation, Control Structures, Arrays, Strings and Regular Expressions, Working with the File and Operating System.

Unit III

Handling Html Form With PHP: Capturing Form Data, Dealing with Multi-valuefiled, and Generating File uploaded form, Redirecting a form after submission. Function: What is a function, Define a function, Call by value and Call by reference, Recursive function.

Unit IV

PHP state management: Using query string (URL rewriting), Using Hidden field, Using cookies, Using session. PHP string matching with regular expression: What is regular expression, Pattern matching in PHP, Replacing text, Splitting a string with a Regular Expression. PHP OOPs concepts, Abstract
class, Inheritance, Constructor.

Text and Reference Books:

- Beginning PHP and MySQL,W. Jason Gilmore, Apress, 2010, Fourth Edition
- Head First PHP & MySQL, Lynn Beighley & Michael Morrison, First Edition, O'Reilly.
- Developing Web Applications in PHP and AJAX, Harwani, McGraw Hill
- PHP6 and MySQL, Steve Suehring, Tim Converse and Joyce Park, Wiley India 2010, Second Edition.

CO-PO Articulation Matrix PHP Programming Course (PE/CSE/66-T)

Course Outcomes	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 1 1	PO 12	PSO 13	PSO 14	PSO 15
CO1	2	2	-	-	3	-	-	1	-	-	-	-	_	_	2
CO2	-	2	2	-	-	-	1	-	-	-	-	-	_	_	3
CO3	-	-	2	-	2	-	-	-	1	-	-	-	_	_	3
CO4	-	-	2	-	2	-	3	-	1	-	-	-	_	_	3
CO5	-	-	2	-	2	-	3	-	1	-	-	-	_	_	3
3-High 2-Medium 1-Low															

Fundamentals of Management for Engineers

General Course Information

Course Code: HSMC/3-T Course Credits: 2 Type: Humanities and Social Sciencesincluding Management Contact Hours: 2 hours/week Mode: Lecture (L) Examination Duration: 3 hours	**Course Assessment Methods (internal: 30; external: 70)** Three minor tests each of 20 marks will be conducted. The average of the highest marks obtained by a student in the any of the two minor examinations will be considered. Class Performance will be measured through percentage of lectures attended (04 marks). Assignments, quiz etc. will have weightage of 06 marks For the end semester examination, nine questions are to be set by the examiner. A candidate is required to attempt 5 questions in all. All questions carry equal marks. Question number 1 will be compulsory and based on the entire syllabus. It will contain seven parts of 2 marks each. Question numbers 2 to 9 will be given by setting two questions from each of the four units of the syllabus. A candidate is required to attempt the remaining four questions by selecting one question from each of the four units.

Pre-requisites: None

About the Course:
Fundamentals of Management for Engineers is a necessary course for B. Tech. (CSE) graduates wishing to work with organizations in their near future. It helps them acquiring managerial, planning and decision-making skills. This course makes students ready to work in teams as well as play leadership roles.

Course Outcomes: By the end of the course students will be able to:
CO1. **define** fundamental concepts of management (LOTS: Level 1: Remember)
CO2. **explain** the basic principles of management related to planning and decision making, HRM andmotivation, and leadership. (LOTS: Level 2: Understand)
CO3. **apply** the managerial skills to solve real world management problems. (LOTS: Level 3: Apply)
CO4. **identify** leadership roles in various scenarios. (LOTS: Level 4: Analyse)
CO5. **evaluate** a business model based on principles of management. (LOTS: Level 5: Evaluate)
CO6. **prepare** a plan for a start up in IT sector. (LOTS: Level 6: Create)

Course Content

Unit I
Management Definition: Scope and process of management, Managerial Roles, Levels of Management, Managerial Skills, Challenges of Management, Evolution of Management, Scientific and Administrative Management, The Behavioural approach, The Quantitative approach, The Systems Approach, Contingency Approach, IT Approach.

Unit II
Planning and Decision Making: General Framework for Planning, Planning Process, Types of plans, Management by objectives, Development of business strategy.
Decision making and Problem Solving: Programmed and Non-Programmed Decisions, Steps in Problem Solving and Decision Making, Bounded Rationality and Influences on

Decision Making, Group Problem Solving and Decision Making, Creativity and Innovation in Managerial Work.

Unit III

Organization HRM and Controls: Organizational Design & Organizational Structures, Delegation, Empowerment, Centralization, Decentralization, Organizational culture, Organizational climate and Organizational change, Talent management, Talent management Models and strategic human Resource planning; Recruitment and selection; Training and development, Performance Appraisal. Types of controls and controlling Techniques.

Unit IV

Leading and Motivation: Leadership, Power and authority, Leadership styles; Behavioural leadership, Situational leadership, Leadership skills, Leader as mentor and coach, Leadership during adversity and crisis; Handling employee and customer complaints, Team leadership. Motivation: Types of motivation, Relationship between motivation, performance and engagement, Content motivational theories.

Text and Reference Books:

- Robert N Lussier, *Management Fundamentals*, 5th edition, Cengage Learning, 2013.
- Stephen P. Robbins, *Fundamentals of Management*, Pearson Education, 2009.
- Weihrich Koontz, *Essentials of Management*, fifth edition, Tata Mc Graw Hill, 1990.
- Dubrin Andrew, *Management Essentials*, 9th edition, Cengage Learning, 2012.

CO-PO Articulation Matrix Fundamentals of Management for Engineers Course (HSMC/3-T)

Course Outcomes	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 1 1	PO 12	PSO 13	PSO 14	PSO 15
CO1	1	_	_	_	_	_	_	_	_	_	_	_	_	_	_
CO2	1	_	_	_	_	_	_	_	_	_	_	_	_	_	_
CO3	2		1	_	_	_	_	_	_	_	_	_	_	_	_
CO4	_	_	_	_	_	_	_	3	3	_	_	_	_	_	_
CO5	2	3	2		_	_	_	_	_	_	_	2	_	_	_
CO6	3	3	3	2	_	3	_	_	_	3	3	_	_	_	_
3-High 2-Medium 1-Low															

Operating Systems Lab. (UNIX/LINUX)

General Course Information

Course Code: PC/CSE/61-P Course Credits: 1 Type: Professional Core Lab. Course Contact Hours: 2 hours/week Mode: Lab practice and assignments	**Course Assessment Methods (internal: 50; external: 50)** The internal and external assessment is based on the level of participation in lab. sessions and the timely submission of lab experiments/assignments, the quality of solutions designed for the assignments, the performance in VIVA- VOCE, the quality of lab. file and ethical practices followed. The internal examination is conducted by the course coordinator. The external examination is conducted by external examiner appointed by the Controller of Examination in association with the internal examiner appointed by the Chairperson of the Department.

Pre-requisites: Basic programming skills.

About the Course:
This lab. course on data science involves a rigorous training on R programming. It incorporates solving problems related to data science in statistical and predictive modelling framework. The objective of the lab course is to equip the students to solve the practical data science problems related to intelligent data analysis using R.

Course Outcomes: By the end of the course students will be able to:
CO1. **apply** commands related to vi and Emacs editors, general utilities and file systems. (LOTS: Level 3:Apply)
CO2. **write** basic shell scripts and use *sed* commands as well as *awk* programming. (LOTS: Level 3:Apply)
CO3. **analyse** the results of memory management and disk management commands. (LOTS: Level 4:Analyse)
CO4. **evaluate** solutions for different operating system problems such as scheduling, memory managementand file management. (LOTS: Level 5: Evaluate)
CO5. **create** lab record for assignments that includes problem definitions, design of solutions andconclusions. (LOTS: Level 6: Create)
CO6. **demonstrate** use of ethical practices, self-learning and team spirit. (LOTS: Level 3: Apply)

List of experiments/assignments:

- Study of WINDOWS and Linux operating system (Linux kernel, shell, basic commands pipe & filtercommands).
- Study vi editor.
- Administration of LINUX Operating System.
- Writing of Shell Scripts (Shell programming).
- AWK programming.
- Write a C program to simulate different scheduling algorithms
- Write a C program to simulate different file allocation strategies

Note:
The actual experiments/assignments will be designed by the course coordinator. One assignment should be designed to be done in groups of two or three students. The assignments must meet the objective of the course and the levels of the given course outcomes. The list of assignments and schedule of submission will be prepared by the course coordinator at the beginning of the semester.

CO-PO Articulation Matrix Operating System Lab. (PC/CSE/61-P)

Course Outcomes	**PO 1**	**PO 2**	**PO 3**	**PO 4**	**PO 5**	**PO 6**	**PO 7**	**PO 8**	**PO 9**	**PO 10**	**PO 1 1**	**PO 12**	**PSO 13**	**PSO 14**	**PSO 15**
CO1	1	_	_	_	_	_	_	_	_	_	_	_	1	_	_
CO2	2	_	_	_	_	_	_	_	_	_	_	_	3	_	_
CO3	2	2		2	2	_	_	_	_	_	_	_	3	_	_
CO4	2	2		2	2	_	_	_	_	_	_	_	3	_	_
CO5	_	_	_	_	_	_	_	_	_	3	_	_	_	_	_
CO6	_	_	_	_	_	_	_	3	3	_	_	3	_	_	_
3-High 2-Medium 1-Low															

Data Analytics using R Lab.

General Course Information

Course Code: PC/CSE/63-P Course Credits: 1 Type: Professional Core Lab. CourseContact Hours:2 hours/week Mode: Lab. practice and assignments	**Course Assessment Methods (internal: 50; external: 50)** The internal and external assessment is based on the level of participation in lab. sessions and the timely submission of lab experiments/assignments, the quality of solutions designed for the assignments, the performance in VIVA- VOCE, the quality of lab. file and ethical practices followed. The internal examination is conducted by the course coordinator. The external examination is conducted by external examiner appointed by the Controller of Examination in association with the internal examiner appointed by the Chairperson of the Department.

Pre-requisites: Basic programming skills and knowledge of statistics

About the Course:
This lab. course on data science involves a rigorous training on R programming. It incorporates solving problems related to data science in statistical and predictive modelling framework. The objective of the lab course is to equip the students to solve the practical data science problems related to intelligent data analysis using R.

Course Outcomes: By the end of the course students will be able to:
CO1. **implement** R programming concepts for data analysis. (LOTS: Level 3: Apply)
CO2. **analyse** the trends in data through exploratory data analysis. (LOTS: Level 4: Analyse)
CO3. **evaluate** the results of descriptive and inferential statistics. (LOTS: Level 5: Evaluate)
CO4. **devise** solutions for descriptive and predictive modelling. (LOTS: Level 6: Create)
CO5. **create** lab. Record of assignment solutions that include problem definition, solutions and interpretation of results. (LOTS: Level 6: Create)
CO6. **demonstrate** use of ethical practices, independent enquiry and self-learning, and team spirit to solve unseen problems. (LOTS: Level 3: Apply)

List of experiments/assignments

- Install R studio and explore its GUI. Explore the base R package- datasets. See the list of datasetsavailable in the package. Write description for the following datasets:
- HairEyeColor
- Iris
- Airquality
- mtcars
- In addition to general description of the dataset, it should include the number of attributes and instances, class of the datasets. It should also include the type of each attribute. Apply *summary()* and *str()* functions to these datasets.
- Three assignment related to creating and manipulating objects like vectors, factors, matrices, lists and data frames.

- Two assignments on the use of control, looping statements and user defined functions.
- Two assignment on finding descriptive statistics and exploratory data analysis.
- Two assignments on making different charts and writing the finding on the basis of these charts.
- Two assignments on hypothesis testing for descriptive and inferential statistics.
- Two assignments on predictive modelling using R packages in groups of two or three studentsdepending on the size of the assignment.

Note:
The actual experiments/assignments will be designed by the course coordinator. One assignment should be designed to be done in groups of two or three students. The assignments must meet the objective of the course and the levels of the given course outcomes. The list of assignments and schedule of submission will be prepared by the course coordinator at the beginning of the semester.

CO-PO Articulation Matrix Data Analytics using R Lab. (PC/CSE/63-P)

Course Outcomes	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 1 1	PO 12	PSO 13	PSO 14	PSO 15
CO1	2	1	-	-	3	_	_	_	_	_	_	_	_	_	2
CO2	2	2	-	3	3	_	_	_	_	_	_	_	_	_	3
CO3	3	3	-	3	3	_	_	_	_	_	_	_	_	_	3
CO4	3	3	1	3	3	_	_	_	_	_	_	_	_	_	3
CO5	_	_	_	_	_	_	_	_	_	3	_	_	_	_	_
CO6	_	_	_	_	_	_	_	3	3	_	_	3	_	_	_
3-High 2-Medium 1-Low															

Machine Learning Lab.

General Course Information

Course Code: PC/CSE/64-P Course Credits: 1 Type: Professional Core Lab. Course Mode: Lab practice and assignments Contact Hours: 2 hours / week	**Course Assessment Methods (internal: 50; external: 50)** The internal and external assessment is based on the level of participation in lab. sessions and the timely submission of lab experiments/assignments, the quality of solutions designed for the assignments, the performance in VIVA- VOCE, the quality of lab. file and ethical practices followed. The internal examination is conducted by the course coordinator. The external examination is conducted by external examiner appointed by the Controller of Examination in association with the internal examiner appointed by the Chairperson of the Department.

Pre-requisites: Programming in Java, Python and Octave/MATLAB.

About the Course:
In this lab. Course, students learn to solve optimization, supervised and unsupervised learning problems using machine learning tools. Students will use machine learning tools available in WEKA, R, Python and Octave etc.The lab experiments involve downloading datasets and applying machine learning techniques on these datasets. The course has a special focus on interpreting and visualizing results of machine learning algorithms.

Course Outcomes: By the end of the course students will be able to:

CO1. **implement** machine learning algorithms using modern machine learning tools. (LOTS: Level 3:Apply)
CO2. **analyse** the trends in datasets using descriptive statistics. (LOTS: Level 4: Analyse)
CO3. **apply** descriptive and predictive modelling. (LOTS: Level 3: Apply)
CO4. **compare and contrast** machine learning algorithms for a given problem. (describe datasets usingdescriptive statistics. (LOTS: Level 5: Evaluate)
CO5. **create** lab records of assignment by incorporating problem definitions, design of solutions, resultsand interpretations. (LOTS: Level 6: Create)
CO6. **demonstrate** use of ethical practices, self-learning and team spirit. (LOTS: Level 3: Apply)

List of experiments/assignments

1. Install WEKA/R/Python/Octave and learn to use these software packages.
2. Two assignments related to classification algorithms and interpreting the results of these algorithms.
3. Two assignments related to clustering algorithms and interpreting the results of these algorithms.
4. Three assignment on designing neural networks for solving learning problems.
5. Two assignment on ranking or selecting relevant features.
6. Two assignments on linear regression and logistic regression.
7. One assignment to be done in groups.

Note:

The actual experiments/assignments will be designed by the course coordinator. One assignment should be designed to be done in groups of two or three students. The assignments must meet the objective of the course and the levels of the given course outcomes. The list of assignments and schedule of submission will be prepared by the course coordinator at the beginning of the semester.

CO-PO Articulation Matrix Machine Learning Lab. Course (PC/CSE/64-P)

Course Outcomes	**PO 1**	**PO 2**	**PO 3**	**PO 4**	**PO 5**	**PO 6**	**PO 7**	**PO 8**	**PO 9**	**PO 10**	**PO 1 1**	**PO 12**	**PSO 13**	**PSO 14**	**PSO 15**
CO1	2	2	2	3	3	_	_	_	_	_	_	_	_	_	3
CO2	3	3	2	3	3	_	_	_	_	_	_	_	_	_	3
CO3	3	3	2	3	3	_	_	_	_	_	_	_	_	_	3
CO4	3	3	2	3	3	_	_	_	_	_	_	_	_	_	3
CO5	_	_	_	_	_	_	_	_	_	3	_	_	_	_	_
CO6	_	_	_	_	_	_	_	3	3	_	_	3	_	_	_
3-High 2-Medium 1-Low															