Framework for 4 years UG Programme under NEP-2020 based on AICTE 2023 Model Curriculum Guidelines

1. Implementation of Four Year UG Engineering Curriculum in First Phase with effect from Academic Year 2024-25:
   The credit and Multidisciplinary Curricular Framework, designed on the lines of the National Credit Framework and AICTE Approval Process Handbook, is to be made applicable to in first phase to the AICTE-regulated UG (B.E./B. Tech. or equivalent) Engineering/ Technology Programs conducted in NIAMT, Ranchi with effect from Academic Year 2024-25.

2. Credit Framework under Four-Year UG Engineering Programme with Multiple Entry and Multiple Exit options:
   The Four-year Bachelor's Multidisciplinary Engineering Degree Programme allows the students to experience the full range of holistic and multidisciplinary education in addition to a focus on the chosen major and minors as per their choices and the feasibility of exploring learning in different institutions. The minimum and maximum credit structure for different levels under the Four-year Bachelor's Multidisciplinary Engineering UG Programme with multiple entry and multiple exit options are as given below:

Semester wise Credit distribution Structure for Four Year UG Engineering Program: One Major and One Minor/Honors

Sl. No.	Year	Credit Point	
		ODD	EVEN
1	First	21	22
2	Second	20	20
3	Third	21	20
4	Fourth	20	16
Total Credit Point		**82**	**78**
		160	

Distribution of Credits

CourseCategory	Number of Subjects	As per AICTE Recom.	Proposed Credit Point
Humanities, Social Science, and Management Courses	04	12	**12**
Basic Science Course(BSC)	08	29	**25**
Engineering Science Course (ESC)	08	27	**26**
Professional Core Course (PCC)	18	58	**59**
Professional Elective Course (PEC)	04	9	**13**
Open Elective Course (OEC)	03	9	**09**
Project work, Seminar, and Internship in industry or elsewhere (PrSI)	04	16	**10+02+04=16**
Mandatory Courses [Environmental Sciences, Induction Program, Indian Constitution, Essence of Indian Knowledge Tradition] (AUC)	03	(non-credit)	**00**
TotalCreditPoint			**160**
Minor Courses	04 - 05	18 - 20	**18-20**
Honors Courses	05	20	**20**

HUMANITIES & SOCIAL SCIENCES COURSES [HS] & MANAGEMENT COURSES

(2 compulsory + 2 others)

(i) Number of Humanities & Social Science Courses:4
(ii) Credits:12

Sl.	Code No.	Subject	Semester	Credits
1	HSMC 01	Communication Skills / English (Compulsory	2	2:0:2=3
2	HSMC 02	Universal Human Values-2 (Compulsory course)	2	2:1:0=3
3	HSMC 03	Industrial Psychology	5 / 6	3:0:0=3
4	HSMC 04	Operations Research	5 / 6	3:0:0=3
5	HSMC 05	Project Management	5 / 6	3:0:0=3
6	HSMC 06	Finance & Accounting / Engineering Economics	5 / 6	3:0:0=3
			Total Credits:	**12**

BASIC SCIENCE COURSE [BSC] (Total 8)

Sl.	Code No.	Subject	Semester	Credits
1	BSC 101	Engineering Physics	1	3:1:2=4
2	BSC 102	Engineering Mathematics-1	1	3:1:0=4
3	BSC 103	Engineering Chemistry	2	3:0:2=4
4	BSC 104	Engineering Mathematics-2	2	3:1:0=4
5	BSC 202	Engineering Mathematics-3	3	3:1:0=4
6	BSC 202	Engineering Mathematics-4 (Numerical Methods / Statistics for Engineers)	4	2:1:0=3
7	BSC 203	Biology for Engineers	3	2:0:0=2
8	BSC 204	Environment Science (Audit)	3	2:0:0=0
			Total Credits:	**25**

ENGINEERING SCIENCE COURSE [ESC] (Total 8)

Sl.	Code No.	Subject	Semester	Credits
1	ESC 101	Basic Electrical Engineering	1	2:1:2=4
2	ESC 102	Engineering Drawing and Computer Graphics	1	1:0:4=3
3	ESC 103	Design Thinking + Idea Lab (Audit)	1	0:0:2=1
4	ESC 104	Programming for Problem Solving	2	2:0:4=4
5	ESC 105	Manufacturing Practice Workshop I	2	0:0:4=2
6	ESC 201	Basic Electronic Engineering	3	3:0:2=4
7	ESC 202	Engineering Mechanics	3	3:1:0=4
8	ESC 203	Computer Integrated Manufacturing	3	3:1:0=4
			Total Credits:	**26**

Guidelines for minor/major Degree to be awarded by the Institute:

1. Selecting a particular "Specialization track" by studying subjects of specialization in the form of elective subjects; "Specialization#1" to "Specialization#5 in semesters 4, 5, 6, and 7.
2. B.Tech. Minor (M) and Honors (H) programmes by earning extra credits 18-20 through subjects "(M/H#1)" to "(M/H#5/5)" in semesters 4 to 8.
3. If a student successfully completes (i) Specialization track, (ii) Minor, or (iii) Honors, the UG degree will be awarded accordingly.
4. At present the specialization and Honors will be offered by the respective departments to the students of own disciplines, whereas the Minor will be offered to the students of other departments.
5. There shall be one division for a particular Minor or Honors programme with minimum of 15 students and maximum number of 75 students. The selection of students for specialization track, Minor or Honors programmes is based on CGPA upto 3rd semester as a merit criterion without any backlog and 'FF' grade.
6. For the students who are opting for specialization track and Minor/Honors programmes, the CGPA of 7.0 should be maintained in the subjects of the respective specialization track or Minor/Honor program and there should not be 'FF' grade in any subject of specialization track, otherwise Minor/Honor will not be awarded.

Course Scheme of B.Tech. (Computer Engineering)

SEMESTER–I

Sl. No.	Course Code	Course Name	Credits		L	T	P	C
0.		**Induction Program (3 Weeks)**						
1	05 BSC 01	Engineering Mathematics-I	3+1	4	3	1	0	4
2	05 BSC 02	Engineering Physics	3+1	4	3	0	2	4
3	05 ESC 01	Programming for Problem Solving	3+1	4	3	0	2	4
4	05 ESC 02	Engineering Drawing and Computer Graphics	1+2	3	1	0	4	3
5	05 ESC 03	Workshop Practice 1	2	2	0	0	4	2
6	05 ESC 04	Design Thinking & Idea Lab	1	1	0	0	2	1
7	05 PCC 01	Fundamental of Computer Science	3	3	3	0	0	3
8	05 AUC 01	Sports & Yoga or NSS/NCC (Audit)	0	0	0	0	2	0
	Total							**21**

SEMESTER–II

Sl. No.	Course Code	Course Name	Credits		L	T	P	C
1	05 HSMC 01	Communication Skills	2+1	3	2	0	2	3
2	05 BSC 03	Engineering Mathematics -II	3+1	4	3	1	0	4
3	05 BSC 04	Engineering Chemistry	3+1	4	3	0	2	4
4	05 ESC 05	Basics of Electrical Engineering	3+1	4	3	0	2	4
5	05 ESC 06	Engineering Mechanics	3+1	4	3	1	0	4
6	05 PCC 02	Data Structures	3	3	2	0	2	3
7	05 AUC 02	Sports & Yoga or NSS/NCC (Audit)	0	0	0	0	2	0
(Optional) Mandatory for exit with UG certificate		Vocational / Industrial Training /Laboratory Work/ Specialized course offered by respective department	4	4	8hrs/day for 4 weeks/ 4 credit course			4
	Total							**22/26**

NOTE: Mandatory Vocational / Industrial Training(4Weeks) OR Laboratory Work/ Specialized course offered by respective department for student opting for exit after first year with UG certificate

SEMESTER–III

Sl. No.	Course Code	Course Name	Credits		L	T	P	C
1	05 BSC-05	Engineering Mathematics-III	3+1	4	3	1	0	4
2	05 BSC 06	Biology for Engineers (MOOCs)	2	2	2	0	0	2
3	05 BSC 07	Environmental Science	0	0	2	0	0	0
4	05 ESC 07	Basics Electronics Engineering	3+1	4	3	0	2	4
5	05 ESC 08	Computer Integrated Manufacturing	3+1	4	3	1	0	4
6	05 PCC 03	Object Oriented Programming	3	3	2	0	2	3
7	05 HSMC 02	Universal Human Values-2	2+1	3	2	1	0	3
	Total							**20**

SEMESTER–IV

Sl.No.	Course Code	Course Name	Credits		L	T	P	C
1	05 BSC-08	Numerical Methods and Computational Techniques	3	**3**	3	0	0	3
2	05 PCC 04	Design & Analysis of Algorithm	3+1	3	3	0	2	4
3	05 PCC 05	Digital Logic Design	3+1	4	3	0	2	4
4	05 PCC 06	Formal Languages and Automata Theory	3	3	3	0	0	3
5	05 PCC 07	Discrete Structures	3	3	3	0	0	3
6	05 PCC 08	Analog Circuit	3	3	3	0	0	3
7	05 AUC 03	Indian Knowledge System	0	0	2	0	0	0
(Optional) Mandatory for exit with UG Diploma certificate		Vocational / Industrial Training /Laboratory Work/ Specialized course offered by respective department	4	4	8hrs/day for 4 weeks/ 4 credit course			4
	Total							**20/ 24**
	05 M01/H01	**Minor / Honors Course**	**4/4**	**4/4**	**-**	**-**	**-**	**4/4**

NOTE: Mandatory Vocational / Industrial Training (4 Weeks) OR Laboratory Work/ Specialized course offered by respective department for student opting for exit after 2nd year with UG Diploma Certificate .

SEMESTER–V

Sl.No.	Course Code	Course Name	Credits		L	T	P	C
1	05 PCC 09	Operating Systems	3+1	4	3	0	2	4
2	05 PCC 10	Computer Organization & Architecture	3	3	3	0	0	3
3	05 PCC 11	Compiler Design	3	3	3	0	0	3
4	05 PCC 12	Modelling and Optimization Techniques	3	3	3	0	0	3
5	05 PEC 01	Artificial Intelligence in Manufacturing	3	3	3	0	0	3
6	05 HSMC 03	Operations Research	2+1	3	2	1	0	3
7	05 PrSI 01	Summer Internship/**	2	2	8hrs/day For 4 weeks			2
	Total							**21**
	05 M02/**H**02	**Minor / Honors Course**	4/4	4/4	-	-	-	4/4

****** students have to do summer internship in summer vacation (after 4thsem) and evaluation of the same will be done in 5th semester

SEMESTER–VI

Sl.No.	Course Code	Course Name	Credits		L	T	P	C
1	05 PCC 13	Microprocessor & Microcontroller	3	3	3	0	0	3
2	05 PCC 14	Artificial Intelligence & Machine Learning	3	3	3	0	0	3
3	05 PCC 15	Database Management Systems	3+1	4	3	0	2	4
4	05 PEC 02	Computer Networks	3+1	4	3	1	0	4
5	05 OEC 01	Another department may opt	3	3	3	0	0	3
6	05 HSMC 04	Project Management	3	3	2	1	0	3
(Optional) Mandatory for exit with BSc Engineering		Vocational / Industrial Training /Laboratory Work/ Specialized course offered by respective department	4	4	8hrs/day for 4 weeks/ 4 credit course			4
	Total							**20/ 24**
	05 M03/**H**03	**Minor / Honors Course**	3/4	34	-	-	-	3/4

NOTE: Mandatory Vocational / Industrial Training (4 Weeks) OR Laboratory Work/ Specialized course offered by respective department for student opting for exit after 3rd year with BSc Engineering

SEMESTER–VII

Sl.No.	Course Code	Course Name	Credits		L	T	P	C
1	05 PCC 16	Cryptography & Network Security	3	3	3	0	0	3
2	05 PCC 17	Internet & Web Technology	3+1	4	3	0	2	4
3	05 PCC 18	System Software	3	3	2	0	2	3
4	05 PEC 03	Digital Image Processing / MOOCs	3	3	3	0	0	3
5	05 OEC 02	Another department may opt /MOOCs	3	3	3	0	0	3
6	05 PrSI 02	Colloquium/Seminar	2	2	0	0	4	2
7	05 PrSI 03	Summer Internship **	2	2	8hrs/day For 4 weeks			2
	Total							**20**
	05 M04/**H**04	**Minor / Honors Course**	3/4	3/4	-	-	-	3/4

** students have to do summer internship in summer vacation (after 6thsem) and evaluation of the same will be done in 7th semester

SEMESTER–VIII

Sl.No.	Course Code	Course Name	Credits		L	T	P	C
1	05 PEC 04	Introduction of Blockchain Technology and Applications (Swayam/NPTEL)	3	3	3	0	0	3
2	05 OEC 03	MOOCs (OpenElective-3)	3	3	3	0	0	3
3	05 PrSI 04	Research Project/ Dissertation-II	10	10	-	-	-	10
	Total							**16**
	05 M05/**H**05	**Minor / Honors Course**	3/4	3/4	-	-	-	3/4

NOTE: MOOC's courses approved by Department will be studied by the students.

xx will be the department code from where courses are offered.

1. Department of Foundry and Forge technology, **xx-01**
2. Department of Mechanical and Manufacturing Engineering, **xx-02**
3. Department of Materials and Metallurgical Engineering, **xx -03**
4. Department of applied science and Humanities, **xx - 04**
5. Department of Computer and Electronics Engineering, **xx -05**

Multiple Entry and Exit after 1st ,2nd , 3rd and 4th year

UG	Program Level	Minimum Credit earned	Exit- Equivalence forwarding degree	Entry–Requirement (UG7 years – Credit Expiry)
UG 1st year	5	40	UG-Certificate	1.12th and JEE (through JoSAA/CSAB)
UG 2nd year	6	40	UG-Diploma	1. 12th and JEE Qualified 2. 1st year UG- Certificate 3. Screening based on Branch Specific Prerequisite (Written test)
UG 3rd year	7	42	B.Sc. Engineering	1. 12th and JEE Qualified 2. 2nd year UG- Diploma Certificate 3. Screening based on Branch. Specific Prerequisite (Written test)

*The students of Department of ECE may also have to choose a subject offered by another department as open elective.

1. Professional Elective (PCEs)

1) Artificial Intelligence in Manufacturing
2) Computer Networks
3) Digital Image Processing
4) Introduction to Blockchain Technology & Applications

2. List of Open Elective Subjects (OECs)

2.1 Group 1 (OEC 01)

1. Fundamental of Power System
2. Wireless Sensor Networks
3. Pattern Recognition
4. Software project Management
5. Distributed Operating Systems
6. System Software and Administration
7. Intellectual property rights
8. Advanced Manufacturing Technology
9. Computer Vision and Image Processing
10. Big Data Analytics
11. Industrial Automation & Robotics
12. Mechatronics
13. Digital Instrumentation

2.2 Group 2 (OEC 02)

1. Introduction of Internet of Things
2. Introduction of Cloud Computing
3. Metrology and Computer aided Inspection
4. Edge Computing
5. Advanced Operating Systems
6. Additive Manufacturing
7. Soft Computing
8. 3D Printing
9. Advanced Computer Architecture
10. Advanced Algorithms
11. Formal Methods in Software Engineering

2.3 Group 3 (OEC 03)

1. Automation in Manufacturing
2. Smart Machines
3. Digital Manufacturing
4. Smart Grid Technology

5. Electric Energy Generation & Control
6. Introduction to Industry 4.0
7. Virtualization & Cloud Computing
8. Information Retrieval
9. Intrusion Detection Systems
10. Software Reliability Techniques
11. Cyber Law & IPR

Internship

- Summer Internship - I: Student will go for internship during summer vacation (after 4th semester) for a period of 4 weeks. The assessment will be done on 5th semester.
- Summer Internship - II: Student will go for internship during summer vacation (after 6th semester) for a period of 4 weeks. The assessment will be done on 7th semester.

Minor Program

Minor 1 – Machine Learning and Data Science

Minor 2 – Integrated Chip Design

Minor 3 – IoT & Cyber Physical Systems

Minor 4 – Robotics & Automation

Minor 1 (Machine Learning and Data Science)						
S. No.	**Course Code**	**Course Name**	**Credits**			
			L	**T**	**P**	**C**
1	M01	Fundamentals of Python	3	0	2	4
2	M02	Fundamentals of Data Science	3	0	2	4
3	M03	Data Mining and Data Warehousing	3	0	2	4
4	M04	Machine Learning	3	0	0	3
5	M05	Social Media Analytics	3	0	0	3
	Total					**18**

Minor 2 (Integrated Chip Design)						
S. No.	**Course Code**	**Course Name**	**Credits**			
			L	**T**	**P**	**C**
1	M01	Digital Electronics	3	0	2	4
2	M02	Microprocessor	3	0	2	4
3	M03	Semiconductor devices and Circuits	3	0	2	4
4	M04	Digital Instrumentation	3	0	0	3
5	M05	Embedded System Design	3	0	0	3
	Total					**18**

Minor 3 (IoT & Cyber Physical System)						
S. No.	**Course Code**	**Course Name**	**Credits**			
			L	**T**	**P**	**C**
1	M01	Computer Networks	3	0	2	4
2	M02	Cloud & Edge Computing	3	1	0	4
3	M03	Internet of Things	3	0	2	4
4	M04	Foundations of Cyber Physical System	3	0	0	3
5	M05	Network Security	3	0	0	3
	Total					**18**

Minor 4 (Robotics & Automation)						
S. No.	**Course Code**	**Course Name**	**Credits**			
			L	**T**	**P**	**C**
1	M01	Mechatronics	3	0	2	4
2	M02	Industrial Automation and Robotics	3	0	2	4
3	M03	Advanced CAD	3	0	2	4
4	M04	Additive Manufacturing	3	0	0	3
5	M05	Automation in Manufacturing	3	0	0	3
	Total					**18**

Honors program

Honors Course						
S. No.	**Course Code**	**Course Name**	**Credits**			
			L	**T**	**P**	**C**
1	H01	Formal Methods in Computer Science	3	1	0	4
2	H02	VLSI Design for Parallel Architectures	3	0	2	4
3	H03	High Performance Computer Architecture	3	0	2	4
4	H04	Recommender Systems	3	1	0	4
5	H05	Deep Learning	3	0	2	4
	Total					**20**

Syllabus for B.Tech. (Computer Engineering) – 1st Year

Detailed Syllabus for B.Tech. (Computer Engineering) – 1st Semester

Course Code: 05 BSC04	Engineering Chemistry	Credit: 3-0-0: 3

Pre-requisites: NA

Course Objectives:

1. Impart an understanding of Engineering chemistry's fundamental concepts, analytical methods and technological features.
2. Develop the capacity to analyze engineering problems based on the knowledge of chemistry.
3. Develop problem-solving ability.
4. Keep students abreast of the newest advancements and uses of contemporary materials.

Course Contents

Unit 1 Analytical Techniques for Engineers:

Role of materials in engineering fields; Quality control and assurance in engineering contexts.; Qualitative and quantitative analysis; Emerging trends and applications of analytical techniques for engineering; Instrumental methods of analysis: spectroscopy (UV and IR), chromatography (GLC and HPLC), Microscopy: SEM, Thermo-gravimetry: TGA.

Unit 2 Corrosion and material protection:

Introduction to corrosion and its impact on engineering materials; Mechanism, Types/forms of corrosion, Factors that enhance corrosion and choice of parameters to mitigate corrosion; Corrosion prevention techniques, advanced surface coatings and corrosion inhibitors; Case studies and real-world applications in corrosion prevention.

Unit 3 Electrochemical energy systems:

High energy electrochemical energy systems: Lithium-ion batteries principle, construction, working, advantages and applications, Na-ion Battery, fiber battery; New emerging Fuel cells- working principles, advantages, applications; Solar cells, Types Importance of silicon single crystal, polycrystalline and amorphous silicon solar cells- working principles, characteristics and applications; Green hydrogen technology

Unit 4 Nanomaterials for electronics:

Nanomaterials, classification, Nanoscale phenomena and quantum effects; Top-down and bottom –up approach, Synthesis methods: ball milling, RF sputtering, pulsed laser deposition, thin film deposition; Applications of nanomaterials in electronics; Fundamentals of Sensors and materials used in sensors, Synthesis of a sensor; Fundamentals of Super capacitor and materials used in super capacitor, Synthesis of a super capacitor.

Text Books:

1. Willard Dean, Merrittee, “Instrumental Methods of Chemical Analysis”,Tata McGraw Hill Limited.

2. Jain and Jain “A textbook of Engineering Chemistry”, Dhanpatrai Publication.

3. S. S. Dara, “A textbook of Engineering Chemistry”, S. Chand Publication 2010 ed.

4. Shashi Chawla, “A textbook of Engineering Chemistry”, Dhanpatrai Publication.

5. Charles P. Poole, Frank J. Owens “Introduction to Nanotechnology”.

Course Code: 05 BSC04	Engineering Chemistry Laboratory	Credit: 0-0-2: 1

Pre-requisites: NA

Course Objectives:

1. To provide an experimental foundation for the theoretical concepts introduced
2. To achieve hands-on experimental skills and the study of practical applications will bring more confidence.

List pf experiments

1. To prepare a solution of NaOH and find the concentration of a given solution of sodium hydroxide by titrating it with the standard solution of oxalic acid using phenolpthalein as indicator.

2. To find the concentration of a given solution of Hydrochloric acid by titrating it with the standard solution of $Na_2 CO_3.10H_2O$ using methyl orange as indicator.

3. To find the concentration of a given solution of potassium permanganate by titrating it with the standard solution of Mohr's salt.

4. Synthesis of complex compound (copper ammonium complex).

5. Synthesis of polymer (Phenol formaldehyde/urea formaldehyde resin).

6. Synthesis of aspirin.

7. pH-metric analysis of a sample solution – soil, food stuff e.t.c.

8. Analysis of inorganic solution by spectroscopic method (Calorimetry)

9. Corrosion testing of electronic integrated circuits (anodic corrosion via Faradays law).

10. Finding the Calorific value of fuel by Bomb calorimeter (GCV, LCV)

11. Flash point-fire point and cloud point-pour point of fuel/lubricant

12. Synthesis of nanomaterials by green route (co-precipitation method)

Course Code: 05 BSC01	Engineering Mathematics - I	Credit: 3-1-0: 4

Pre-requisites: NA

Course Objectives:

- Apply concepts of linear algebra in physical and engineering problems.
- Develop the essential tool of matrices and linear algebra in a comprehensive manner.
- Analyze the dynamics of real-world problem using concept of Differential Calculus of two or more variables.
- Evaluate the volume and surface area of the solid using double and triple integral.

Course Contents

Unit 1 Matrices and Linear Algebra:

Matrices: Elementary operations, Gauss Elimination, Rank of matrices: Echelon form, Normal form, Determinants, Consistency and solution of system of linear equations, Eigen values, Eigen vectors, Caylay-Hamilton theorem. Vector space, subspace, linearly independent and dependent of vectors. Basis and Dimensions, Rank-Nullity theorem. S: Basic properties of matrices, Elementary transformation, Determinants.

Unit 2 Differential Calculus:

Expansions of function of one variable using Taylor's and Maclaurin's series, Asymptotes, Curve tracing, Limit and continuity of two variables, Partial and Total derivatives, chain rule, Jacobian, Taylor's theorem, Maxima and minima of two variables, Method of Lagrange's multipliers. S: Higher order derivatives, Limit and continuity of two variables, Jacobian.

Unit 3 Integral Calculus:

Beta and Gamma function, Evaluation of Double integrals in Cartesian and Polar co-ordinates, Change of order of integration, Evaluation of Triple integrals in Cartesian, Spherical and Cylindrical co-ordinates, Change of Variables, Applications to Area, Volume, surface area and Center of Mass. Vector differentiation, Gradient, Divergence and Curl, Line Integrals and Arc Length Parameterization, Surface Integral, Volume Integral, Path independence, Statements and illustrations of theorems of Green, Stokes and Gauss, applications. S: Beta and Gamma function, Area, Volume, Surface area.

Text Books:

1. Advanced Engineering Mathematics (10th edition) by Erwin Kreyszig, Wiley Eastern Ltd.

Reference Books:

1. Serge Lang, "Linear Algebra" Springer , 3rd edition.
2. Gilbert Strang," Linear Algebra and its applications", Cengage Learnings RS, 4th edition
3. Howard Anton and Chris Rorres ,"Elementary Linear Algebra ",John Wiley, and sons, 10th edition

4. K. D. Joshi , “Calculus for Scientists and Engineers” , CRC Press
5. Sudhir Ghorpade and Balmohan Limaye , “A course in Calculus and Real Analysis”1st edition, Springer-Verlag, New York.

Course Code: 05 ESC01	Programming for Problem Solving	Credit: 3-0-0: 3

Pre-requisites: NA

Course Objectives

- To develop logic building skills for problem solving
- To translate the solution logic to computer programs using C language constructs
- To decompose a problem into modules and synthesize a complete program
- To decompose a problem into modules and synthesize a complete program

Course Contents

UNIT I Introduction to Problem Solving

The Basic Model of Computation, Algorithms, Flow-charts, Programming Languages, Compilation, Linking and Loading, Testing and Debugging, Documentation.

UNIT II Introduction to 'C' Language

Variables and Identifiers, Built-in Data Types, Variable Definition, Arithmetic operators and Expressions, Constants and Literals, Simple assignment statement, Basic input/output statement, Simple 'C' programs.

UNIT III Decision, Control and Looping Statements

Conditional Statements and Loops: Decision making within a program, Conditions, Relational Operators, Logical Connectives, if statement, if-else statement, Loops: while loop, do while, for loop, Nested loops, Infinite loops, Switch statement, structured programming

UNIT IV Arrays, Pointers and Strings

Arrays: One dimensional arrays: Array manipulation Searching, Insertion, Deletion, Finding the largest/smallest element in an array Two dimensional arrays, Addition/Multiplication of two matrices, Transpose of a square matrix Null terminated strings as array of characters, Standard library string functions

Pointers: Address operators, pointer type declaration, pointer assignment, pointer initialization, pointer arithmetic, functions and pointers, Arrays and Pointers, pointer arrays, pointers and structures, dynamic memory allocation

UNIT V Functions

Functions: Top-down approach of problem solving, Modular programming and functions, Prototype of a function: Formal parameter list, Return Type, Function call, Block structure, Passing arguments to a Function: call by reference, call by value, Recursive Functions, arrays as function arguments.

Storage Classes: Scope and extent, Storage Classes in a single source file: auto, extern and static, register, Storage Classes in multiple source files: extern and static

UNIT VI Structures and Unions

Structure variables, initialization, structure assignment, nested structure, structures and functions, structures and arrays: arrays of structures, structures containing arrays, unions

Textbooks:

1. Programming in ANSI C, 8th Edition, E. Balagurusamy

2. Programming in C, 3rd Edition, Reema Thareja

3. Let Us C, 19th Edition Yashwanth Kanetkar

4. Programming in C, Byron Gottfryed

Course Code: 05 ESC01	Programming for Problem Solving Laboratory	Credit: 0-0-2: 1

Pre-requisites: NA

Course Objectives:

- To provide an experimental foundation for the theoretical concepts introduced
- To achieve hands-on experimental skills and the study of practical applications will bring more confidence.

List pf experiments

- Programs on conditional control constructs.
- Programs on loops (while, do-while, for).
- Programs using user defined functions and library functions.
- Programs on arrays, matrices (single and multi-dimensional arrays).
- Programs using pointers (int pointers, char pointers).
- Programs on structures and unions

Course Code: 05 PCC01	Fundamentals of Computer Science	Credit: 3-0-0: 3

Pre-requisites: NA

Course Objectives

- To understanding of basic concepts of computer science and engineering.
- To learn the basic components of Computer and their requirements.
- To understand basics of computer and working with OS.
- To develop working skills with productivity tools and graphics designing.
- To acquire basics about the digital systems.
- To introduce the basic Networking Concept and Internet.

Course Contents

UNIT I Introduction to Computer

Generations of Computer (I-V); Block Diagram of a Computer; Functions of the Different Units- Input unit, Output unit, Memory unit, CPU (ALU+CU).

UNIT II Input & Output Devices

Keyboard, Point and draw devices, mouse, joystick, track ball, light pen; Data Scanning devices - image scanner, OCR, OMR, MICR, Bar code reader, card reader; Voice Recognition Device, Digitizers; Output Devices- Monitor, Printer, laser printer, dot-matrix printer, ink jet printer, Projector.

UNIT III Memories (Brief Introduction)

[Memory hierarchy]: Registers [Types of Registers]; Cache Memory; Primary Memory- RAM, SRAM, DRAM, ROM, Firmware; Secondary Memories: Hard disk- tracks, sectors, clusters, cylinders; Floppy [data storage mechanism];

UNIT IV Software, Computer Languages and Number System

System Software: Operating System- function and types; Program Language Translators- Assembler, Compiler, Interpreter; Utility Programs; Communication Software; Performance Monitoring Software.

Application Software: Software hierarchy and dependence between the different layers.

Computer Languages: Machine language, Assembly language, High level language

Digital Number System: Number System Conversion; Arithmetic Operations-Boolean, Octal, Hexadecimal, etc.

UNIT V Networking & Web Designing

The need and use of Computer Networks. Concepts of Networking-LAN, WAN, MAN. ISP's in India and their responsibilities. Video Conference, downloading and uploading files. Introduction to HTML, Basic tags, Formatting tags, Stylesheets, Table handling, Lists, Hyperlinks in HTML.

UNIT VI Cloud Computing

Introduction, Advantages & Disadvantages, Cloud Computing Technologies, Types of Clouds, Cloud Computing Models (Infrastructure as a Service (IaaS), Platform as a Service (PaaS), Software as a Service (SaaS)), Virtualization.

Textbooks:

1. Sinha K P, Sinha P., Computer Fundamentals, BPB Publication, 2017.
2. Rajaraman V., Adabala N., Fundamentals of Computers, PHI, 2014.
3. Bartee Thomas C., Digital Computer Fundamentals, McGraw Hill Education India, 2001.
4. Goel A., Computer Fundamentals, Pearson, 2010.
5. Rajaraman V., Adabala N., Fundamentals of Computers, Sixth Edition, PHI, 2015.

Reference Books:

1. Bartee Thomas C., Digital Computer Fundamentals, McGraw Hill Education India, 2001.
2. Goel A., Computer Fundamentals, Pearson, 2010.
3. Rajaraman V., Adabala N., Fundamentals of Computers, Sixth Edition, PHI, 2015.
4. Jain Satish, Iyer G M, Web Designing and Publishing, BPB Publications, 2020.
5. Kundu Sudakshina, Fundamentals of Computer Networks, Second Edition, PHI, 2008.

Course Code: 05 ESC02	Engineering Drawing and Computer Graphics	Credit: 1-0-4: 3

Pre-requisites: Programming for Problem Solving, Introduction to C Programming

Course Objectives:

- Familiarize with different drawing tools, technical standards and procedures for construction of different geometries and engineering objects.
- Develop the ability to visualize and communicate three dimensional shapes and their sections by representing three-dimensional objects into two-dimensional views using concept of orthographic projection.
- Apply the visualization practices to draw isometric projection from a given orthographic view.
- Draw the development of lateral surfaces of assembly and cut sections of different geometrical solids for engineering applications.
- Draw 2D and 3D drawings using computer aided drafting tool

Course Contents

UNIT I Introduction to Engineering Drawings

covering, Principles of Engineering Graphics and their significance, usage of Drawing instruments, lettering, Scales – Plain, Diagonal and Vernier Scales; Orthographic Projections covering, Principles of Orthographic Projections- Conventions

UNIT II Projection points

Projections of Points, Projection of lines inclined to one parallel to other and inclined to both planes; Projections of planes, parallel to one plane perpendicular to other. Inclined to both plane

UNIT III Projections of Regular Solids

covering, those inclined to both the Planes- Draw simple annotation, dimensioning and scale. Sections of simple solids,

UNIT IV Isometric Projections

covering, Principles of Isometric projection – Isometric Scale, Isometric Views, Conventions; Isometric Views of lines, Planes, Simple and compound Solids

UNIT V Overview of Computer Graphics covering

listing the computer technologies that impact on graphical communication, Demonstrating knowledge of the theory of CAD software [such as: The Menu System, Toolbars (Standard, Object Properties, Draw, Modify and Dimension), Drawing Area (Background, Crosshairs, Coordinate System), Dialog boxes and windows, Shortcut menus (Button Bars), The Command Line (where applicable), The Status Bar, Different methods of zoom as used in CAD, Select and erase objects.; Isometric Views of lines, Planes, Simple and compound Solids];

Textbooks:

1. 1. N.D. Bhatt, “Elementary Engineering Drawing”, Charotar Publishing House, Anand (India)
2. M. L. Dabhade, “Engineering Graphics” I, Vision Publications, Pune
3. Dhananjay Jolhe, “Engineering Drawing”, Tata McGraw Hill publishing company Ltd., New Delhi

Reference Books:

1. Warren Luzzader, “Fundamentals of Engineering Drawing”, Prentice Hall of India, New Delhi.
2. Shah, M.B. & Rana B.C. , “Engineering Drawing and Computer Graphics”, Pearson Education
3. Agrawal B. & Agrawal C. M. , “Engineering Graphics”, Tata McGraw Publication
4. Suraj Singh, “ Civil Engineering Building Practice ”,

Course Code: 05 ESC03	Workshop Practice - I	Credit: 0-0-4: 2

Pre-requisites: NA

Course Objectives:

- Students able to understand different tool &equipment for workshop practice.
- Students acquire skills for the preparation of different Carpentry/fitting/welding models.
- Students able to understand the safety precaution in the workshop
- Student acquires skills of Application orientated tasks.

Course Contents

Introduction and demonstration: Introduction to various shops/ sections and workshop layouts, safety norms to be followed in a workshop should be conveyed to students.

Carpentry shop: Introduction of tools and operations, types of woods & their applications, types of carpentry hardware and their uses, carpentry joints, carpentry operations such as marking, sawing, planning, chiselling, grooving, boring, joining, types of woods and carpentry hardware.

Fitting shop: Introduction of tools and operations, types of marking tools and their uses, types of fitting cutting tool and their uses, fitting operations such as chipping, filing, scraping, grinding, sawing, marking, drilling, tapping.

Metal joining shop: Introduction of tools, types of welding joint, arc welding, gas welding, gas cutting.

Machine shop: Introduction of machine tools and operations, demonstrations of basic machine tools like lathe, shaper, drilling, milling machine and CNC with basic operations and uses.

List of workshop practices:

- Hands on practice and job making in carpentry.
- Hands on practice and job making in fitting.
- Hands on practice and job making in welding.
- Demonstrate the operations of machine shop.

Textbooks:

1. Hajra Choudhury S.K., Hajra Choudhury A.K. and Nirjhar Roy S.K., "Elements of Workshop Technology", Media promoters and publishers private limited, Mumbai, Vol. I 2008 and Vol. II 2010.
2. Raghuvanshi B.S., Workshop Technology Vol. I & II, Dhanpath Rai & Sons. 2017.
3. Bawa H S., Workshop Practices, Tata McGraw-Hill, 2009.

Course Code: 05 ESC04	Design Thinking & Idea lab	Credit: 0-0-2: 1

Pre-requisites: NA

Course Objectives:

- Develop a comprehensive understanding of design thinking principles, methodologies, and their applications in various industries.
- Cultivate creative problem-solving skills through brainstorming and ideation techniques.
- Explore the intersection of design thinking with entrepreneurship, focusing on turning ideas into viable products or services.

Course Contents

Introduction to Engineering: "Engineering" as a vehicle for social and economic development; the impact of science/engineering on our day-to-day lives; the process of engineering a product; various career options.

Introduction and identifying the need: Understanding the unique needs of the user - empathize - define - ideate - prototype - test. Case Studies - Develop an appreciation for the design process and its application in specific settings (Guest lectures, Videos, Field visits, Interplay lectures of design-based movies).

Problem Formulation: Framing a problem statement neutrally using adequate checks. Case studies.

Concept Generation: Generate multiple concepts using various creativity tools and thinking styles.

Prototyping: Select from ideas and make quick prototypes (mock-ups) using available material.

Evaluation: Iterative process of ideation, prototyping and testing-Take the mock-ups to users for feedback and iterate the process till users feel delighted.

STUDENTS' RESPONSIBILITIES:

- Forming diverse teams of 3–5 members each to work collaboratively throughout the semester.
- Proactively engaging to observe the objects and interactions in their daily life and society from a design perspective.
- Identifying general societal and social problems that may be effectively addressed using design thinking principles
- Presenting and reporting the tasks to the concerned faculty members using their creative communication and people skills.

Activities:
Some of the activities which are undertaken as a part of this course include:

- Field Visits
- Case Studies on innovation, failures etc
- Guest lecture
- Group Discussions
- Presentation by student
- Experiential learning workshops

Textbooks:

4. Design Thinking: A guide to creative problem solving for everyone, Andrew Pressman, Routledge Taylor and Francis group, 2019, 1st Edition.
5. Change by Design: How Design Thinking Transforms Organizations and Inspires Innovation, Tim Brown.

Course Code: 05 AUC01	Sprots/Yoga/NCC (Audit)	Credit: 0-0-2: 0

Non-credit Course

Sports/NSS/NCC/YOGA/Painting/Music/Classical dance

Detailed Syllabus for B.Tech. (Computer Engineering) – 2nd Semester

Course Code: 05 BSC03	Engineering Mathematics - II	Credit: 3-1-0: 4

Pre-requisites: NA

Course Objectives:

- Design, Classify and Develop the linear differential equation of first order for the real-life problems.
- Evaluate the analytical solution of two-dimensional heat flow problem and wave problems using variable separable method.
- Analyse periodic phenomenon of forces, electric currents, voltage, wave motion, sound waves in the form of trigonometric function using Fourier series.

Course Contents

Unit 1 Ordinary Differential Equations:

First order Ordinary Differential Equations: Homogeneous, Linear, Exact ; Higher order linear equations with constant coefficients, Euler-Cauchy equations, Non homogeneous higher order linear differential equations with constant coefficients (method of undetermined coefficients and method of variation of parameters), Applications to Initial and boundary value problems: Orthogonal Trajectories, Statement and Application of Newton's Law of Cooling, Growth and Decay, Kirchhoff's Law, Simple Electrical Circuits, Heat Flow, Rectilinear Motion, Simple Harmonic Motion. S: First order Ordinary Differential Equations - Variable Separable, Homogeneous, Linear.

Unit 2 Partial Differential Equations:

Fourier Series, Dirichlet's condition, Half range series, Formulation of Partial differential equation, Solution of First order partial differential equations, Quasi-linear differential equations, Second order differential equations and canonical form. Initial and Boundary value problem, Method of separation of variable, Dirichlet's problem, Poisson's Equation, Vibrations of a String, One dimensional heat equation, Two- dimensional heat equation (Laplace Equation) under steady state conditions. S: two-dimensional heat equation (Laplace Equation) under steady state conditions.

Unit 3 Introduction to Probability and Statistics:

Random variables, Probability distributions, Expectation and variance, Moment Generating Function, Binomial distribution, Poisson distribution, Normal distribution and Exponential distribution. S: Basic concept of Probability, Conditional Probability, Exponential distribution.

Text Books:

1. Erwin Kreyszig , "Advanced Engineering Mathematics", Wiley eastern Ltd ,10th edition.

Reference Books:

1. Maurice D. Weir, Joel Hass, Frank R. Giordano, “Thomas’ Calculus “,14th edition Pearson Education.
2. P.N. Wartikar and J.N. Wartikar ,“Applied Mathematics”, Vidhyarthi Griha Prakashan Pune ,Vol.1 (Reprint July 2014)
3. Ross S.M., “Introduction to probability and statistics for Engineers and Scientists”, Elsevier Academic press, 8th Edition, 2014
4. Ram, B., Engineering Mathematics, Dorling Kindersley (India), Pearson Education.

Course Code: 05 BSC02	Engineering Physics	Credit: 3-0-0: 3

Pre-requisites: NA

Course Objectives:

- Apply the concepts of Quantum mechanics to one dimensional motion of electrons
- Classify solids on the basis of Band theory and to calculate carrier concentrations
- Evaluate the electrical conductivity and identify the type of semiconductor
- Implement the fundamentals of LASER for different applications.

Course Contents

Unit 1 Quantum Mechanics:

Matter waves, Properties of matter waves, Physical significance of wave function. Schrödinger's time dependent and time independent equations, Operators, Eigen values and Eigen functions, Expectation values, Applications of Schrödinger's equation; Motion of a free particle, Electron in an infinite deep potential well (rigid box), Electron in a finite deep potential well (non-rigid box).

Unit 2 Solid State Physics:

Lattice parameters, Miller indices, inter planer distance of lattice plane, density of crystals (linear, planar and volume), S*o*mmerfield's free electron theory, Density of states (3D), FermiDirac probability function, Nearly free electron theory (E-k curve), classification of solids on the basis of band theory.

Unit 3 Semiconductor Physics:

Electron and hole concentrations in semiconductors, intrinsic density, intrinsic and Extrinsic conductivity, Position of Fermi level in intrinsic and extrinsic semiconductors, Law of mass action, Temperature variation of carrier concentration in extrinsic semiconductors, Electrical conduction in extrinsic semiconductor, Hall Effect.

Unit 4 Laser Physics:

Introduction to laser, Spontaneous and stimulated emission of radiations, Thermal equilibrium, Condition for Light amplification, Population inversion, Pumping (Three level and four level pumping), Optical resonator, Laser beam characteristics, Ruby laser, Nd-YAG Laser, HeNe Laser, Semiconductor Laser, Engineering applications of Laser (Fiber optics, Laser material interaction)

Text Books:

1. A text book of Engineering physics, Avadhanulu and Kshirsagar, S. Chand Pub.

Reference Books:

1. Introduction to quantum mechanics / David J. Griffiths

2. Concepts of Modern Physics, Arthur Beiser; Tata McGraw – Hill Edition.
3. Introduction to Solid State Physics, Charles Kittel, Wiley.
4. Solid State Physics, S. O. Pillai, New Age International Publishers.
5. Solid state electronic devices, Ben G. Streetman, Sanjay Banerjee Pearson Prentice-Hall.
6. LASERS Theory and Applications, K. Thyagarajan, A. K. Ghatak; Macmillan India Ltd.

Course Code: 05 BSC02	Engineering Physics Laboratory	Credit: 0-0-2: 1

Pre-requisites: NA

Course Objectives:

1. To provide an experimental foundation for the theoretical concepts introduced
2. To achieve hands-on experimental skills and the study of practical applications will bring more confidence.

List pf experiments

1. Frank-Hertz Experiment
2. Planck's Constant
3. To determine the wavelengths of light of a given source using diffraction grating
4. Band gap of a semiconductor by four probe method
5. Hall effect in Semiconductor
6. Magnetoresistance measurement of semiconductor
7. To determine the reverse saturation current and material constant of PN Junction
8. To determine the dielectric constant of material
9. Study of Biot-Savart’s law
10. Measurement of magnetic susceptibility by Quinke’s method

Course Code: 05 ESC05	Basics of Electrical Engineering	Credit: 3-0-0: 3

Pre-requisites: NA

Course Objectives

- Analysis of AC and DC circuits.
- Apply the principles of electric and magnetic circuits to solve engineering problems.
- Analysis and acquire knowledge about transformer.
- To understand the basics of rotating electrical machines.
- Use of relevant protective devices for electrical installations.

Course Contents

UNIT I DC Circuits:

Electrical circuit elements (R, L, and C), voltage and current sources, Kirchhoff's laws, analysis of simple DC circuits: Superposition, Thevenin and Norton theorems, Maximum Power Transfer theorem, Star-Delta transformation.

UNIT II AC Circuits:

Representation of sinusoidal waveforms, peak and rms values, phasor representation, real power, reactive power, apparent power, power factor. Analysis of single-phase ac circuits consisting of R, L, C, R-L, R-C, R-L-C combinations (series and parallel), resonance. Three-phase balanced circuits, voltage and current relations in star and delta connections, three-phase power.

UNIT III Magnetic Circuits and Transformers:

Magnetic materials, B-H curve, hysteresis loop, series and parallel magnetic circuits, ideal and practical transformer, equivalent circuit, losses in transformers, regulation, and efficiency. Autotransformer and three-phase transformer connections

UNIT IV Rotating Electrical Machines:

Construction, types, characteristics and applications of DC motors. Three-Phase induction motors, principle of operation, construction, types, slip and application.

UNIT V Electrical Wiring and Safety:

Types of wires and cables, Copper conductor sizes and rating, earth wires, Switch Fuse Unit (SFU), Miniature Circuit Breaker (MCB), Earth Leakage Circuit Breaker (ELCB), Lightning protection. Types and characteristics of Batteries, elementary calculations for energy consumption, UPS types and specifications. Electrical safety measures, safety practices, Earthing and its importance, first aid treatment after electrical shock, basic concept of electric grid.

Textbooks:

1. D. C. Kulshreshtha, "Basic Electrical Engineering", McGraw Hill, 2nd Edition2019

2. D. P. Kothari and I. J. Nagrath, “Basic Electrical Engineering”, Tata McGraw Hill,4th Edition,2019

Reference Books:

1. Vincent Del Toro, “Electrical Engineering Fundamentals”, Prentice Hall India, 2nd Edition, 2015.
2. L. S. Bobrow, “Fundamentals of Electrical Engineering”, Oxford University Press, 2nd Edition, 2003.

Course Code: 05 BSC02	Basics of Electrical Engineering Laboratory	Credit: 0-0-2: 1

Pre-requisites: NA

Course Objectives:

- To provide an experimental foundation for the theoretical concepts introduced
- To achieve hands-on experimental skills and the study of practical applications will bring more confidence.

List pf experiments

1. Overview of the Basic Electrical Engineering Lab and safety precautions.
2. To verify Network Theorems: KCL, KVL and Superposition Theorems
3. To connect a simple DC circuit with two loops and more than one source and to measure all the branch currents and node voltages.
4. To verify Thevenin's and Norton's Theorems.
5. To measure voltage, current, and power in the R-L, R-C and R-L-C series circuits and observe the phase difference between voltage and current using CRO.
6. To connect three-phase induction motor in star and delta and measure line and phase voltages and currents to verify the relationship between line and phase quantities.
7. To determine the efficiency and regulation of a single-phase transformer by direct loading.
8. Starting, reversing and speed control of DC motor.
9. Starting and reversing of three-phase induction motor and measurement of slip at different load conditions.
10. To connect the single-phase load bank through a switch-fuse unit, MCB and ELCB and check their operation in case of overload, short circuit, and earth leakage.
11. To study different types of earthing.
12. To study electrical sub-station.

Course Code: 05 ESC06	Engineering Mechanics	Credit: 3-1-0: 4

Pre-requisites: NA

Course Objectives

- Confidently tackle equilibrium equations, moments and inertia problems
- Master calculator/computing basic skills to use to advantage in solving mechanics problems.
- Gain a firm foundation in Engineering Mechanics for furthering the career in Engineering

Course Contents

UNIT I Forces and Moment of Forces

Introduction of Engineering mechanics, classifications of Engineering Mechanics, System of Units, Rigid body, Newton's laws of Motion, Introduction, Effects of a Force, Characteristics of a Force, Principle of Transmissibility of Forces, System of Forces, Resultant Force, Composition of Forces, Methods for the Resultant Force, Parallelogram Law of Forces, Triangle Law of Forces, Moment of a Force, Varignon's Principle of Moments (or Law of Moments), Classification of parallel forces, Like parallel Forces, Unlike parallel forces , Equilibrium of Forces, Principles of Equilibrium, Methods for the Equilibrium of coplanar forces, Lami's Theorem, Free Body Diagram.

UNIT II Support Reactions and Analysis of Structures

Introduction, Types of Beam Loading, Beams Subjected to a Moment, Reactions of a Frame or a Truss, Types of End Supports of Frames, Types of Frames, Perfect Frame, Imperfect Frame, Deficient Frame, Redundant Frame, Stresses, Method of Joints, Method of Sections (or Method of Moments), Force Table.

UNIT III Centre of Gravity and Moment of Inertia

Introduction, Centroid, Methods for Centre of Gravity, Centre of Gravity by Geometrical Considerations, Centre of Gravity by Moments, Axis of Reference, Centre of Gravity of Plane Figures, Symmetrical Sections, Unsymmetrical Sections, Solid Bodies, Sections with Cut out Holes

Introduction, Moment of Inertia of a Plane Area, Methods for Moment of Inertia, Routh's Rule, Integration, Moment of Inertia of a Rectangular and Hollow rectangular section, Theorem of Perpendicular and parallel Axis Moment of Inertia of circular and hollow circular section, semi-circular section, triangular section and composite section.

UNIT IV Principles and Applications of Friction

Introduction, Static Friction, Dynamic Friction, Limiting Friction, Normal Reaction, Angle of Friction, Coefficient of Friction, Laws of Friction, Laws of Static and Dynamic Friction, Equilibrium of a Body on a Rough Horizontal and Inclined plan, Ladder Friction, Wedge Friction, Screw Friction.

UNIT V Power transmission

Belt drives: Belt drive, velocity ratio, compound belt drive, length of belt, transmission of power, ratio of tensions, centrifugal tension.

Toothed Gearing: Definition, terminology, Analysis of simple, compound, reverted and epicyclic gear trains.

Textbooks:

1. Timoshenko S P and Young D H, "Engineering Mechanics", McGraw Hill (International) 4/e, New Delhi (1984).
2. Popov, E. P.,"Engineering Mechanics of Solids", Prentice Hall of India, Second Edn., 2000.

Reference Books:

1. Shames,I.H., "Engineering Mechanics", Prentice Hall of India.
2. Bansal R.K.(2010), A Text Book of Engineering Mechanics, Laxmi Publications

Course Code: 05 PCC02	Data Structures	Credit: 2-0-0: 2

Pre-requisites: Programming for Problem Solving (05 ESC01)

Course Objectives

- Designing principles of algorithms and data structures
- Learning efficiency and scaling of algorithms
- Learning essential algorithms in computing
- Understanding generic data structures for common problems.

Course Contents

UNIT I Introduction:

Performance of algorithms: Basic concepts, Mathematical Background, Complexity Analysis, Space and time complexity, asymptotic notations, Stacks and Queues: Representations and applications.

UNIT II Linked List, Stacks, and Queues:

Linear Data Structures: Arrays: one dimensional, multi-dimensional, Sparse Matrix, Elementary Operations

Stacks: Representation, elementary operations and applications such as infix to postfix, postfix evaluation, parenthesis matching

Queues: Simple queue, circular queue, de-queue, elementary operations and applications.

Linked lists: Linear, circular and doubly linked lists, elementary operations and applications such as polynomial manipulation. r.

UNIT III Non-Linear Data Structure - Trees:

Non-Linear Data Structures: Trees: Binary tree representation, tree traversal, complete binary tree, heap, binary search tree, height balanced trees like AVL tree and 2-3 tree, tries, red-black tree, B-tree, B+ tree, m-way Search tree, other operations and applications of trees.

UNIT IV Non-Linear Data Structure - Graphs:

Representation of graphs - BFS - DFS - Topological sort – String Representation and manipulations - Pattern matching. Adjacency list, graph traversal, path matrix, connected components.

UNIT V Sorting & Searching:

Sorting: Selection sort, bubble sort, quick sort, merge sort, heap sort, insertion sort, selection sort, radix sort. Searching: linear and binary search. Hashing: hash tables, hash functions, and open addressing.

Textbooks:

1. J. P. Tremblay, P. G. Sorenson, “An Introduction to Data Structures with Applications”, Second Edition, Tata McGraw Hill, 1981.
2. M. Tenenbaum, Augestien, “Data Structures using C”, Third Edition, Pearson Education, 2007.
3. Mark Allen Weiss, “Data Structures and Algorithm Analysis in C”, Second Edition, Addison-Wesley Educational Publishers, 2006.
4. Lipschutz S., Data Structure, McGraw Hill Education, 2014.
5. Srivastava S.K., Srivastava D., Data Structures Through C In Depth, BPB Publications, 2004

Reference Books:

1. Sartaj Sahni, “Data Structures, Algorithms and Applications in C++”, Universities Press (I) Pvt. Ltd., 2008.
2. Drozdek A., Data Structures and Algorithms in C++, Cengage Learning, 2012.
3. Radhakrishnan M., Srinivasan V., Data Structures Using C, BPB Publications, 2008.
4. Aho A.V., Hopperoft J.E., UIlman J.D., Data Structures and Algorithms, Pearson, 1998.
5. Tanenbaum A.M., Data Structures using C, Pearson Education, 2009..

Course Code: 05 PCC02	Data Structures Laboratory	Credit: 0-0-2: 1

Pre-requisites: NA

Course Objectives:

- At the end of the course, the student will be able to
- Develop ADT for stack and queue applications
- Implement tree and graph algorithms
- Implement and analyze internal and external sorting algorithms

List pf experiments

1. (a)Write a program to implement dynamic arrays with operations like insertion, deletion, and resizing. (b) Given an array, write a function to find the maximum and minimum elements. (c)Write a program to implement stack using arrays and evaluate a given postfix expression.

2. Write a program to implement circular queue using arrays

3. Write a program to implement double ended queue (de queue) using arrays

4. Write programs for applications based on stacks and queues.

5. Write programs to implement the following data structures and their applications

(a) Single linked list (b) Double linked list

6. Write programs to implement a stack and a queue using linked lists

7. Write a program to create a binary search tree (BST) by considering the keys in given order and perform the following operations on it.

(a) Minimum key (b) Maximum key (c) Search for a given key (d) Find predecessor of a node (e) delete a node with given key (f) applications of BST

8. Write a program to construct an AVL tree for the given set of keys. Also write function for deleting a key from the given AVL tree.

9. Implement the following sorting algorithms:

(a) Insertion sort (b) Merge sort (c) Quick sort (d) Heap sort (e) Radix sort (f) Shell sort

10. Write programs for implementation of graph traversals by applying: (a) BFS (b) DFS

11. Write programs to find out a minimum spanning tree of graph by applying:

(b) Prim’s algorithm (b) Kruskal’s algorithm c) any other algorithms

12. Write a program to implement Dijkstra’s algorithm using priority queue.

Course Code: 05 HSMCC01	Communication Skills	Credit: 2-0-2: 3

Pre-requisites: NA

Course Objectives

- Recall and use basic language skills-listening, speaking, reading and writing and attempt tasks using grammar and vocabulary efficiently
- Understand the concepts/ principles of communication skills and structure conversations effectively
- Develop the knack to make their point of view clear to the audience and portray their communicative competence efficiently in front of a large audience on a variety of relevant situations
- Analyze, apply and present themselves competently in all formal spheres.

Course Contents

UNIT I Introduction to English for Engineers:

Idea of Sentences, Verbs, Parts of Speech, Voice, Narration, Transformation, Gerund, Participle, Non-finite, Modals, Articles, Punctuation, Common Errors, Sub-Verb Agreement, Noun-Pronoun Agreement. Vocabulary Building, Root Words, Words from Foreign Languages, Antonyms-Synonyms, Prefixes-Suffixes, Standard Scientific Abbreviations, Analysis and Synthesis of Sentences, Forms of Sentences, Transformation of Sentences, Sense of Syntax, Diction, Describing and Defining Scientific Objects/ Instruments. Business Correspondences – Daily/ Routine Workplace Correspondences, Business Letters, Resume/ CV Writing, Job Application/ Covering Letter, Preparing Agendas and Minutes of Meeting, Report Writing, Tender Writing, Notices etc.

UNIT II Foundation of Communicative and Linguistic Ability Development:

Foundation of Communicative & Linguistics Ability Development. Types of Communication – Oral, Written, use of symbols, body languages, facial expressions etc. Channels of Communication, Barriers of Communication, Strategies to tackle Barriers of Communication, Strategies for Effective LSRW Skills. Linguistics – Phonology, Morphology, Semantic, Syntactic, Vowels, Consonants, Dipthongs, Syllables, Phonetic and Phonemic Transcription of Words, Rhythm, Juncture, Pauses, Accentual Pattern.

UNIT III Advanced Speaking Skills:

Accuracy and Fluency in Oral Communication, Clarity in Proper Articulation, Establish Connection with Audience, Understanding of British R.P. Conduct of Group Tasks including GDs, Debates, Extempore, Elocution etc Individual Tasks like Lecturettes. Basic techniques and tips for effective speaking and presentation. Understanding Presentation Skills – Projection, Pace, Pitch and Pauses, Supra Segmental Features

UNIT IV Business Writing Development:

Basic Mantra/ ABCs of Writing Skill – Accuracy, Brevity and Clarity. Internal and External Communication in an Organization, Note Making, Note of Action etc, Drafting letters, Different Elements of Letter Writing, Editing. Format, Layout, Spacing, numbering of paragraphs/ page numbers of letters, annexures & appendices of a letter. Avoiding use of Jargon and Cliches. Significance of Proof Reading, Paraphrasing etc. Letter to Civil Dignitaries, Formal and Informal Letters, DemiOfficial Letters, writing e-mails, Tour Report and writing reports on various Visits, Inspections, Workshops, Seminars, Events in a flawless manner. Paragraph Writing, Essay Writing, Precis Writing, Importance of Organized and Effective Writing Business Correspondences.

Textbooks:

Activity and Exposure Oriented T & L Methodology

1. **Foundation of Language Learning Skills**: Receptive Skills: Listening and Reading; Productive Skills: Speaking and Writing; Grammaticality and Appropriateness; Vocabulary Development
2. **Listening Skills**: Stages of Listening (Pre, While and Post), Strategies to Develop Active Listening Skills, Problematic Sounds for Indian Users
3. **Speaking Skills**: Oral Communication, Sounds in English, Pronunciation, Stress, Intonation and Pauses, Formal and Informal Expressions, Situational Conversations, Group Discussion
4. **Reading and Writing Skills**: Reading Techniques: Scanning and Skimming, Active Reading; Common Problems in Reading; Stages of Writing (Pre, While and Post), 7 Cs of Effective Communication; Letter/ e-mail Writing- Drafting, Editing, Summarizing

Course Code: 05 AUC02	Sprots/Yoga/NCC (Audit)	Credit: 0-0-2: 0

Non-credit Course

Sports/NSS/NCC/YOGA/Painting/Music/Classical dance

Syllabus for B.Tech. (Computer Engineering) – 2nd Year

Detailed Syllabus for B.Tech. (Computer Engineering) – 3rd Semester

(2023 Batch)

Course Code: 05 BSC06	Engineering Mathematics III (Statistical Foundations of Computer Science)	Credit: 3-1-0: 4

Pre-requisites: NA

Course Objectives:

- Apply statistical methods to data for inferences.
- Access online resources for R and import new function packages into the R workspace.
- Perform descriptive analytics over large scale data and apply appropriate statistical tests using R.
- Explore datasets to create testable hypotheses and identify appropriate statistical tests.

Course Contents

Unit 1 Introduction to Probability

Events and outcomes. Probability rules Sample space and events, The axioms of probability. Conditional probability, Independence, Bayes' Rule, Law of Total Probability Elementary theorems of probability.

Unit 2 Probability Distributions:

Population; Random variables, Joint and marginal distributions; Sample; Statistic; Estimation of parameters (consistent and unbiased); Sampling distribution of sample mean and sample variance, Correlation and Covariance. Probability Distributions, Normal Distribution- Binomial Distribution- Poisson Distributions.

Unit 3 Testing of Hypothesis:

Simple and Composite hypothesis; Critical Region; Level of Significance; Type I and Type II Errors; Best Critical Region; Neyman-Pearson Theorem; Application to Normal Population; Likelihood Ratio Test; Comparison of Binomial Populations; Normal Populations; Testing of Equality of Means; $\chi 2$—Test of Goodness of Fit (application only). Simple idea of Bivariate distribution; Correlation and Regression; and simple problems.

Unit 4 Stochastic Process & Queuing Theory:

Probability Distributions: Generating functions, Bivariate probability generating function. Stochastic Process: Introduction, Stationary Process; Markov Chains: Definition of Markov Chain, transition probability matrix, order of Markov chain, Markov chain as graphs, higher transition probabilities. Generalization of independent Bernoulli trials, classification of states and chains.

Unit 5 Introduction to Data Science and data visualization:

Introduction, How to run R, R Sessions and Functions, Basic Math, Variables, Data Types, Vectors, Conclusion, Advanced Data Structures, Data Frames, Lists, Matrices, Arrays, Classes.

R Programming Structures, Control Statements, Loops, - Looping Over Non-vector Sets,- If-Else, Arithmetic and Boolean Operators and values, Default Values for Argument, Return Values, Deciding Whether to explicitly call return- Returning Complex Objects, Functions are Objective, Doing Math and Simulation in R, Math Functions.

Text Books:

1. Norman Matloff, "*The Art of R Programming*", Cengage Learning
2. Bhat, B. R. (2000): Stochastic Models: Analysis and Applications, New Age International Publishers.
3. Mark smart, "Probability Theory: Introduction to random variables and probability distributions
4. Klenke Achim "Probability Theory: A Comprehensive Course (Universitext) Paperback – January 1, 2013"
5. Geoffrey Grimmett, "Probability and Random Processes", Oxford Press.

Course Code: 05 BSC06	Biology for Engineers	Credit: 2-0-0: 2

Pre-requisites: NA

Course Objectives

- Understand the overlapping areas between biology and engineering
- Observe the principles of biological organization with lessons of increasing efficiency of engineered technologies
- Analyze the analogies between biological and engineering processes
- Explore the basic biological principles as guiding elements for engineering structures and processes
- Appreciate the technological optimization of living systems.

Course Contents

UNIT I Crosstalk between Biology and Engineering

a) Biologically inspired technologies: Case studies of designs in nature and inspired technologies, Biomimetics: Nature inspired material and mechanisms, Self-cleaning surfaces; Self-healing Bio concrete, Biomining, Algorithms in nature,
b) Contribution of engineering in biological domain: Contribution of Microscope, Imaging techniques, Biomedical Instruments, Mechanisms (Ergonomics).

UNIT II Organization of Living Machines:

Biomolecules and manufacturing of Biopolymers:

• Carbohydrates (structure-based function and engineering applications)

• Lipids (structure-based function and engineering applications)

• Proteins (structure-based function and engineering applications)

• Nucleic Acids (structure-based function and engineering applications) Organization of life forms: Cell to organism

Bioenergetics- Energy dynamics in biological system- principles of energy conservation and optimization.

UNIT III Analogy of biological organ/system and engineering Device/Mechanism

Organ & system: Brain & CPU, Eye & Camera, Kidney & Filtration system, Lungs & purification system, Heart & Pumping system Process: Photosynthesis & solar cells, Xylem & plumbing, Thermoregulation in human body & heat transfer in machine, Defence mechanism in organism, signalling processing in biology and electronics

UNIT IV Concepts in Bioengineering:

Biomechanics: Mechanical properties of tissues, Prosthesis and rehabilitation Bioprinting: 3D printing of biological tissues and organ engineering and transplanting Biomaterials: Types,

properties and applications Tissue Engineering: Principle, Components, Methods of Scafold synthesis, properties and applications.

UNIT V Application areas of Bioengineering:

Databases & Biocomputing: Acquisition, storage, processing and transmission of biological data and its applications like PCR Bioinstrumentation: Diagnostic and Therapeutic devices Bioimaging: Principle, types and examples Biosensors: Principle, types and examples Computational biology and application of Artificial Intelligence in bio-medical field.

Text Books:

1. Lodish H, Berk A, Zipursky SL, et al. (2000)“ Molecular Cell Biology” W. H. Freeman
2. Lehninger, A. L., Nelson, D. L., & Cox, M. M. (2000),“Lehninger principles of biochemistry” New York: Worth Publishers
3. Lewin B. (2000) “Genes VII” Oxford University Press
4. Rao CNR, et.al, “Chemistry of Nanomaterials: Synthesis, Properties and Applications”
5. Eggins BR. (1006) , “Biosensors: An Introduction”, John Wiley & Sons Publishers
6. Palsson B.O. and Bhatia S.N. (2009) “Tissue Engineering” Pearson.

Course Code: 05 PCC03	Object Oriented Programming	Credit: 3-0-0: 3

Pre-requisites: Programming for Problem Solving

Course Objectives:

- To learn program in an object-oriented programming language, focusing those who already have some experience with another programming language, and who now wish to move on to an object-oriented one.
- Learning object-oriented programming language namely, Java.
- To learn the principles of the object-oriented programming paradigm specifically including abstraction, encapsulation, inheritance and polymorphism using Java.
- To use java standard API library to write complex programs.
- To develop interactive programs using applets.

Course Contents

UNIT I Introduction

Basic features & concepts of Object-Oriented Programming, (OOP), Benefits, Languages and Applications of OOPs.

UNIT II Java Basics

History of Java, Java buzzwords, data types, variables, scope and lifetime of variables, arrays, operators, expressions, control statements, type conversion and costing, simple java program, classes and objects – concepts of classes, objects, constructors, methods, access control, this keyword, garbage collection, overloading methods and constructors, parameter passing, recursion, string handling.

UNIT III Inheritance, Packages and Interfaces

Definition, single, multilevel, multiple, hierarchical and hybrid inheritances, virtual base classes, abstract classes.

Defining, Creating and Accessing a Package, Understanding CLASSPATH, importing packages, differences between classes and interfaces, defining an interface, implementing an interface, applying interfaces, variables in an interface and extending interfaces. Exploring packages – Java.io, java.util.

UNIT IV Exception handling and multithreading

Concepts of exception handling, benefits of exception handling, Termination or resumptive models, exception hierarchy, usage of try, catch, throw, throws and finally, built in exceptions, creating own exception subclasses. Differences between multithreading and multitasking, thread life cycle, creating threads, synchronizing threads, daemon threads, thread groups.

UNIT V Strings

Creating and manipulating string objects, accessing characters in strings.

Text Books:

1. Balagurusamy Elappa., Programming with JAVA: A primer, Tata McGraw Hill, 4th Edition, 2010.
2. Schildt Herbert., Java 2: The complete reference, Tata McGraw Hill, 5th Edition, 2009.

Reference Books:

1. Bhaskar V. Vijaya & Reddy P. Venkata Subba., Object-oriented programming through JAVA, Mumbai Scitech Publication, 2007.

Course Code: 05 BSC07	Environmental Science	Credit: 2-0-0: 0

Pre-requisites: NA

Course Objectives:

- Identify environmental problems arising due to engineering and technological activities and the science behind those problems.
- Estimate the population - economic growth, energy requirement and demand.
- Analyse material balance for different environmental systems.
- Realize the importance of ecosystem and biodiversity for maintaining ecological balance.
- Identify the major pollutants and abatement devices for environmental management and sustainable development.

Course Contents

UNIT I Introduction to Environmental Science:

Environment and society, major environmental issues: Ozone layer depletion, Acid rains, global climate change etc., sustainable development, Environmental impact assessment, environmental management Natural Resources Utilization and its Impacts: Energy, minerals, water and land resources, Resource consumption, population dynamics, urbanization.

UNIT II Ecology and Biodiversity:

Energy flow in ecosystem, food chain, nutrient cycles, eutrofication, value of biodiversity, biodiversity at global, national and local levels, threats for biodiversity, conservation of biodiversity.

UNIT III Water Pollution:

Sources, types of pollutants and their effects, water quality issues, contaminant transport, self-purification capacity of streams and water bodies, water quality standards, principles of water and wastewater treatment.

UNIT IV Air Pollution:

Sources, classification and their effects, Air quality standards, dispersion of pollutants, control of air pollution, automobile pollution and its control. Solid Waste Management: Sources and characteristics of solid waste, effects, Collection and transfer system, disposal methods.

Text Books:

1. G.B. Masters, "Introduction to Environmental Engineering and Science", Pearson Education, 2013.
2. Gerard Kiely, "Environmental Engineering", McGraw Hill Education Pvt. Ltd., Special Indian Edition, 2007.

3. W P Cunningham, M A Cunningham, "Principles of Environmental Science, Inquiry and Applications", Tata McGraw Hill, 8th Edition, 2016.

Reference Books:

1. M. Chandrasekhar, "Environmental Science", Hi Tech Publishers, 2009.

Course Code: 05 ESC07	Basics of Electronics Engineering	Credit: 3-0-0: 3

Pre-requisites: NA

Course Outcomes

- Illustrate the band theory of solids and the carrier concentration in solids.
- Articulate and estimate the charge distribution and charge transfer process in semiconductors.
- Analyze the characteristics of PN junction diode and junction transistor.
- Exemplify the applications of diode.
- Design logic expressions using gates.

Course Contents

UNIT I Semiconductor Physics

Classification of Solids, intrinsic and extrinsic semiconductors, equilibrium carrier concentration, Mass action law, Fermi-Dirac probability function, Temperature dependence of carrier concentration, direct and indirect band-gap semiconductors, Carrier Transport: diffusion current, drift current, mobility and resistivity, generation and recombination of carriers, Poisson and continuity equations, Diffusion length and mean lifetime, Tunneling process.

UNIT II Semiconductor Diodes

Formation of p-n junctions, position of Fermi level in equilibrium, V-I characteristics in forward and reverse bias, Capacitances in p-n junction diode, Zener diode, Zener diode as a voltage regulator, Applications of special purpose diodes viz. PIN diode, Schottky diode, Gunn diode, LED, Laser Diode, photo diode, Tunnel diode, and solar cell, Diode Circuits: clipping, clamping, voltage multiplier and rectifiers..

UNIT III Junction Transistors

Structure of NPN and PNP Transistors, BJT Configurations, Operation of BJT Common Emitter Configuration, V-I characteristics, Introduction to FET and MOSFET, Application as a switch.

UNIT IV Fundamentals of Digital Electronics

Construction, characteristics and working of SCR, DIAC, TRIAC and UJT. Square wave generator using 555 IC.

Textbooks:

- Millman &Halkies, “Electronic Device and Circuits”, 4th edition, Tata McGraw Hill.
- R.P.Jain, “Modern Digital Electronics”, 4th edition, Tata McGraw Hill.

Reference Books:

- Millman Halkies, “Integrated Electronics”, Tata McGraw Hill.
- Boylestead&Nashelsky, “Electronic devices and Circuits Theory”, 8th edition, PHI
- Streetman, Ben G., and Sanjay Banerjee. “Solid state electronic devices”, 6th edition. New Jersey: Prentice hall.
- M Morris Mano, “Digital Design”, 4th edition, Pearson.

Course Code: 05 ESC07	Basics of Electronics Engineering Laboratory	Credit: 0-0-2: 1

Pre-requisites: NA

Course Objectives:

- To provide an experimental foundation for the theoretical concepts introduced
- To achieve hands-on experimental skills and the study of practical applications will bring more confidence.

List pf experiments

a) Introduction to various electrical passive components such as Resistors, inductors and capacitors, introduction to active components, introduction to breadboard, Measurement of resistance using the colour code, series and parallel connection of the resistances and its implementation on breadboard. Exposure to usual electronic equipment/instruments such as Multi-meter, Oscilloscope, Function generator, Power supply.
b) To Design clipping circuits - Single ended clipping, Double ended clipping, and clamping circuits.
c) To observe the effect of Variation of Frequency and Load Regulation for Voltage Multiplier.
d) To observe the output voltage of a half wave rectifier and center tapped full wave rectifier with and without capacitor filter. Calculate Vdc and Idc.
e) To observe Input and Output Characteristics of BJT in CE configuration and Find h parameters from characteristics.
f) To observe Transfer and Drain Characteristics of MOSFET and Find gm, rd and μ from characteristics.
g) To simplify and implement a Boolean function using k -map technique e.g. code converter
h) To design and implement logic using Multiplexers and Demultiplexer.

Course Code: 05 ESC08	Computer Integrated Manufacturing	Credit: 3-1-0: 4

Pre-requisites: Engineering Drawing & Computer Graphics

Course Objectives

- To comprehend basic difference between CIM and Automation.
- To study the concepts of computer aided process planning and cellular manufacturing.
- To study flexible manufacturing system and AGVs in industrial environment.
- To prepares students for learning various rapid prototyping processes.
- To understand the basic foundation of robotics and its industrial application.

Course Contents

UNIT I Introduction

Brief introduction to CAD and CAM – Manufacturing Planning, Manufacturing control Introduction to CAD/CAM – Concurrent Engineering - CIM concepts – Computerised elements of CIM system –Types of production - Basic Elements of an Automated system – Levels of Automation – Lean Production and Just-In Time Production.

UNIT II Computer Aided Process Planning

Process planning – Computer Aided Process Planning (CAPP) – Logical steps in Computer Aided Process Planning –Material Requirement planning Control Systems-Shop Floor Control Inventory Control – Brief on Manufacturing Resource Planning-II (MRP-II) - Simple Problems.

UNIT III Cellular & Flexible Manufacturing

Cellular manufacturing, Group Technology (GT), Flexible Manufacturing Systems, Automated Guided Vehicle Systems.

UNIT IV 3D PRINTING:

Additive manufacturing process, difference with traditional manufacturing, process cycle in additive manufacturing, classification, materials, tessellation, slicing, Rapid tooling.

UNIT V Industrial Robotics:

Robot Anatomy and Related Attributes – Classification of Robots- Robot Control systems – End Effectors – Sensors in Robotics – Robot Accuracy and Repeatability - Industrial Robot Applications.

Text Books:

1. Mikell.P.Groover "Automation, Production Systems and Computer Integrated manufacturing", Prentice Hall of India, 2008.
2. Radhakrishnan P, Subramanyan S.and Raju V., "CAD/CAM/CIM", 2nd Edition, New Age International (P) Ltd, New Delhi, 2000.

3. Chua Chee Kai, Leong Kah Fai, “Rapid Prototyping: Principles & Applications”, World Scientific, 2003.
4. Ian Gibson, David W Rosen, Brent Stucker., “Additive Manufacturing Technologies: Rapid Prototyping to Direct Digital Manufacturing”, Springer, 2010

List of Experiments/Activities

1. Introduction to CATIA V5
2. Working with sketcher module of CATIA V5
3. Working with Part design module of CATIA V5
4. Working with advanced modeling tools (Sweep, Blend & Swept Blend)
5. Assembly modelling in CATIA V5
6. Working with DMU kinematics module of CATIA V5
7. Generating, editing and modifying drawings in Drafting workbench CATIA V5
8. Intro to 3D printing and developing a part on SLA Apparatus.
9. 3D printing of part on FDM apparatus.

Course Code: 05 HSMC02	Universal Human Value - 2	Credit: 2-1-0: 3

Pre-requisites: NA

Course Objectives

- To help the students appreciate the essential complementarily between 'VALUES' and 'SKILLS' to ensure sustained happiness and prosperity which are the core aspirations of all human beings.
- To facilitate the development of a Holistic perspective among students towards life and profession as well as towards happiness and prosperity based on a correct understanding of the Human reality and the rest of existence. Such a holistic perspective forms the basis of Universal Human Values and movement towards value-based living in a natural way.
- To highlight plausible implications of such a Holistic understanding in terms of ethical human conduct, trustful and mutually fulfilling human behavior and mutually enriching interaction with Nature.

Course Contents

UNIT I Introduction to Value Education

Right Understanding, Relationship and Physical Facility, Understanding Value Education, Continuous Happiness and Prosperity, the Basic Human Aspirations, Happiness and Prosperity - Current Scenario, Method to Fulfil the Basic Human Aspirations.

UNIT II Harmony in the Human Being

Understanding Human being as the Co-existence of the Self and the Body, distinguishing between the Needs of the Self and the Body, Understanding Harmony in the Self.

UNIT III Harmony in the Family and Society

Harmony in the Family - the Basic Unit of Human interaction, 'Trust' - the Fundamental Value in Relationship, 'Respect'-as the Right Evaluation, Other Feelings, Justice in Human-to-Human Relationship, Understanding Harmony in the Society, and Vision for the Universal Human Order.

UNIT IV Harmony in the Nature / Existence

Understanding Harmony in the Nature, Interconnectedness, self-regulation and Mutual Fulfilment among the Four Orders of Nature, Realizing Existence as Co-existence at All Levels, The Holistic Perception of Harmony in Existence.

UNIT V Implications of the Holistic Understanding - a Look at Professional Ethics:

Natural Acceptance of Human Values, Definitiveness of (Ethical) Human Conduct, A Basis for Humanistic Education. Humanistic Constitution and Universal Human Order, Competence in Professional Ethics, Holistic Technologies, Production Systems, and Management Models-Typical Case Studios.

Text Books:

1. “A Foundation Course in Human Values and Professional Ethics”, R R Gaur, R Asthana, G P Bagaria, Excel Books, New Delhi, 2019.
2. A.N. Tripathi, “Human Values”, New Age New Delhi, Intl. Publishers, 2004.

Detailed Syllabus for B.Tech. (Computer Engineering) – 4th Semester

Course Code: 05 PCC04	Design & Analysis of Algorithm	Credit: 3-0-0: 3

Pre-requisites: NA

Course Objectives:

- Analyze the time and space complexity for any algorithm
- Apply the design techniques of algorithm in solving real world problems

Course Contents

Unit 1 Introduction to Algorithms:

Algorithms - Notion of an Algorithm – Fundamentals of Algorithmic Problem Solving – Important Problem Types – Fundamentals of the Analysis of Algorithm Efficiency – Analysis Framework – Asymptotic Notations and its properties – Mathematical analysis for Recursive and Non-recursive algorithms, Substitution method, iteration method, recursion tree method and master method.

Unit 2 Divide & Conquer and Greedy Approaches:

- Divide and Conquer method - Strassen's matrix multiplication, Randomized Quick Sort, Binary Search, Convex Hull.
- Greedy method - Huffman code - Minimum spanning trees - Dijkstra algorithm - Knapsack problem - Job sequencing with deadlines.

Unit 3 Dynamic Programming and Branch & Bound Approaches:

Dynamic Programming - Knapsack problem - Matrix Chain Multiplication - longest common subsequence Multistage graphs - All pair's shortest paths - Optimal binary search trees - Travelling salesman problem.

Branch and Bound: Basic method, use, Examples: The 15-puzzle problem, etc.

Unit 4 NP Problems:

Randomized Algorithms and Amortized Analysis - Las Vegas and Monte Carlo types - Randomized quick sort and its analysis - Min-Cut algorithm.

Unit 5 Amortization:

NP-Hard and NP-complete problems - Basic concepts - Reducibility - Vertex cover-3 - CNF - clique - Hamiltonian cycle - TSP - Approximation algorithms - Vertex cover - TSP.

Text Books:

1. T. Cormen, C. Lieserson, R. Rivest, C. Stein, “Introductions to Algorithms”, Third Edition, PrenticeHall/India, 2009.
2. Horowitz, Ellis, and Sartaj Sahni, Fundamentals of computer algorithms, Computer Science Press, 1978

Reference Books:

Reference Books

1. Anany Levitin, Introduction to the Design and Analysis of Algorithms, Pearson Education, 2012
2. J. Klienberg and E. Tardos, Algorithm Design, Pearson Education Limited, 2014

Course Code: 05 PCC04	Design & Analysis of Algorithm Laboratory	Credit: 0-0-2: 1

Pre-requisites: NA

Course Objectives:

- To provide an experimental foundation for the theoretical concepts introduced
- To achieve hands-on experimental skills and the study of practical applications will bring more confidence.

List of experiments

- Divide and Conquer: Implement Binary Search using Divide and Conquer approach Implement Merge Sort using Divide and Conquer approach Implement Quick Sort using Divide and Conquer approach, Find Maximum and Minimum element from an array of integer using Divide and Conquer approach
- Greedy method: Knapsack Problem, Job sequencing with deadlines, Minimum Cost Spanning Tree by Prim's Algorithm, Minimum Cost Spanning Tree by Kruskal's Algorithm
- Dynamic Programming: Find the minimum number of scalar multiplications needed for chain of matrix Implement all pair of shortest path for a graph (Floyed Warshall Algorithm) Implement Traveling Salesman Problem, Implement Single Source shortest Path for a graph (Dijkstra, Bellman Ford)
- Branch and Bound: Implement 15 Puzzle Problems
- Backtracking: Implement 8 Queen Problem Graph Coloring Problem Hamiltonian Problem
- Graph Traversal Algorithm: Implement Breadth First Search (BFS) Implement Depth First Search (DFS)

Course Code: 05 PCC05	Digital Logic Design	Credit: 3-0-0: 3

Pre-requisites: NA

Course Objectives

- To teach various number systems, binary codes and their applications
- To familiarize the students the importance of error detection and error correction codes.
- To inculcate concepts of K-MAP to simplify a Boolean expression
- To facilitate students in designing a logic circuit.

Course Contents

UNIT I DIGITAL SYSTEMS AND BINARY NUMBERS:

Digital systems, binary numbers, number base conversions, octal and hexadecimal numbers, complements, signed binary numbers, binary codes, error detection and error correction codes.

BOOLEAN ALGEBRA AND LOGIC GATES: Basic definitions, axiomatic definition of Boolean algebra, basic theorems and properties of Boolean algebra, Boolean functions, canonical and standard forms, other logic operations, digital logic gates.

UNIT II GATE LEVEL MINIMIZATION:

The k-map method, four-variable map, five-variable map, product of sums simplification, don't-care conditions, NAND and NOR implementation, determination and selection of Prime Implicants, Essential and Non-essential prime Implicants.

UNIT III COMBINATIONAL CIRCUITS:

Design procedure, Binary Adder, Binary Subtractor, Binary Multiplier, Magnitude Comparator, Decoders, Encoders, Multiplexers, and Demultiplexers.

UNIT IV SEQUENTIAL CIRCUITS:

SYNCHRONOUS SEQUENTIAL LOGIC: Sequential circuits, latches, flip-flops, analysis of clocked sequential circuits, State reduction and assignment, design procedure. REGISTERS AND COUNTERS: Registers, shift registers, ripple counters, synchronous counters, counters with unused states, ring counter, Johnson counter.

UNIT V MEMORY AND PROGRAMMABLE LOGIC:

Introduction, Random access memory, memory decoding, error detection and correction, read only memory, programmable logic array, programmable array logic, sequential programmable devices.

UNIT VI ADVANCED CONCEPTS:

Advanced Verilog Concepts - Synthesis concepts - Inferring latches and flip-flops - Modelling techniques for efficient circuit design - Design of high-speed arithmetic circuits - Parallelism Pipelined Wallace tree tipliers - Systolic algorithms - Systolic matrix multiplication.

Textbooks:

1. Morris Mano, and Michael D. Ciletti, “Digital Design”, Fifth Edition, PHI, 2012.
2. Roth (2004), Fundamentals of Logic Design, 5th Edition, Thomson, India.

Reference Books:

1. Michael D. Ciletti, “Advanced Digital Design with the Verilog HDL”, Second Edition, Pearson Education, 2010.
2. Stephen Brown, “Fundamentals of Digital Logic with Verilog”, McGraw Hill, 2007.

Course Code: 05 PCC04	Digital Logic Design Laboratory	Credit: 0-0-2: 1

Pre-requisites: NA

Course Objectives:

- To provide an experimental foundation for the theoretical concepts introduced
- To achieve hands-on experimental skills and the study of practical applications will bring more confidence.

List pf experiments

1. Verification of truth tables of the following Logic gates Two input (i) OR (ii) AND (iii) NOR (iv) NAND (v) Exclusive-OR (vi) Exclusive-NOR
2. Design a simple combinational circuit with four variables and obtain minimal expression and verify the truth table using Digital Trainer Kit.
3. Verification of functional table of 3 to 8-line Decoder /De-multiplexer.
4. 4variable logic function verification using 8 to1 multiplexer.
5. Design full adder circuit and verify its functional table.
6. Verification of functional tables of (i) JK Edge triggered Flip–Flop (ii) JK Master Slav Flip–Flop (iii) D Flip-Flop
7. Design a four-bit ring counter using D Flip–Flops/JK Flip Flop and verify output
8. Design a four bit Johnson's counter using D Flip-Flops/JK Flip Flops and verify output
9. Verify the operation of 4-bit Universal Shift Register for different Modes of operation.
10. Draw the circuit diagram of MOD-8 ripple counter and construct a circuit using T-Flip-Flops and Test It with a low frequency clock and sketch the output waveforms.
11. Design MOD–8 synchronous counter using T Flip-Flop and verify the result and sketch the output waveforms.
12. (a) Draw the circuit diagram of a single bit comparator and test the output (b) Construct 7 Segment Display Circuit Using Decoder and7 Segment LED and test it.

Course Code: 05 PCC07	Discrete Structures	Credit: 3-0-0: 3

Pre-requisites: NA

Course Objectives

- To get familiar and understand the fundamental notions in discrete mathematics
- To describe binary relations between two sets; determine if a binary relation is reflexive, symmetric, or transitive or is an equivalence relation; combine relations using set operations and composition
- To understand and demonstrate the basic concept of an algorithm and its application in combinatorial mathematics
- To identify the base step and the recursive or inductive step in applied problems and give a recursive and a non-recursive definition for an iterative algorithm
- To identify the basic properties of graphs and trees and model simple applications

Course Contents

UNIT I Set Theory and Logic:

Sets - Functions - Relations - Equivalence Relation - Poset - Functions Logic: Propositional Logic - Truth Tables - Tautologies - Resolution Proof System - Predicate Logic.

UNIT II Induction and Combinatorics

Peano's Axioms - Mathematical Induction - Pigeon Hole Principle - Principle of Inclusion and Exclusion - Review of Permutations and Combinations - Distribution Problems - Derangements - Bijection Principle.

UNIT III Algebraic Structures:

Semi-Groups - Monoids - Groups - Subgroups and their properties - Cyclic groups - Cosets - Permutation Groups - Lagrange's Theorem - Cayley's Theorem - Normal Subgroups - Homomorphism of Groups - Quotient Groups - Introduction to Rings and Fields.

UNIT IV Linear Algebra and Recurrence relations:

Linear Algebra: Vector space - Basis - Dimension - Orthogonally - Recurrence Relations: Homogenous and Inhomogenous - Recurrences and their solutions - Solving Recurrences using Generating functions.

UNIT V Graph Theory:

Definitions and basic results - Representation of a graph by a matrix and Adjacency list - Trees - Cycles - Properties - Paths and Connectedness - Subgraphs - Graph Isomorphism - Operations on Graphs - Vertex and Edge cuts - Vertex and Edge connectivity.

Textbooks:

1. C. L. Liu, D. P. Mohapatra, “Elements of Discrete Mathematics: A Computer oriented Approach”, McGraw Hill, Third Edition, 2012.
2. Kenneth H. Rosen, “Discrete Mathematics and its Applications”, Seventh Edition, McGraw Hill, 2012 (Indian Adaptation by Kamala Krithivasan, IIT Madras).
3. Narsing Deo, “Graph Theory with Applications to Engineering and Computer Science”, Prentice Hall India Pvt. Ltd., 1979.

Reference Books:

1. J. P. Tremblay and R. P. Manohar, Discrete Mathematics with Applications to Computer Science, Tata McGraw-Hill, 1997.
2. R. C. Penner, Discrete Mathematics: Proof Techniques and Mathematical Structures, World Scientific, 1999.
3. J. L. Hein, Discrete Structures, Logic, and Computability, 3rd Ed., Jones and Bartlett, 2010.

Course Code: 05 PCC06	Formal Languages and Automata Theory	Credit: 3-0-0: 3

Pre-requisites: 05 PCC01

Course Objectives

- To know about Chomsky hierarchy for organizing languages
- To introduce concepts in automata theory and theory of computation
- To identify different formal language classes and their relationships
- To design grammars and recognizers for different formal languages
- To understand undecidability and decide on languages that are undecidable.

Course Contents

UNIT I Finite Automata:

Alphabets - Strings and Languages - Automata and Grammars - Deterministic Finite Automata (DFA) - Formal Definition - Simplified notation: State transition graph - Transition table - Language of DFA - Nondeterministic Finite Automata (NFA) - NFA with epsilon transition - Language of NFA - Equivalence of NFA and DFA - Minimization of Finite Automata - Distinguishing one string from other - Myhill-Nerode Theorem.

UNIT II Regular Expression (RE):

Definition - Operators of regular expression and their precedence - Algebraic laws for Regular expressions - Kleen's Theorem - Regular expression to FA - DFA to Regular expression - Arden Theorem - Non Regular Languages - Pumping Lemma for regular Languages. Application of Pumping Lemma - Closure properties of Regular Languages - Decision properties of Regular Languages - FA with output: Moore and Mealy machine - Equivalence of Moore and Mealy Machine - Applications and Limitation of FA.

UNIT III Context Free Grammar (CFG) and Context Free Languages:

Definition - Examples - Derivation - Derivation trees - Ambiguity in Grammar - Inherent ambiguity - Ambiguous to Unambiguous CFG - Useless symbols - Simplification of CFGs - Normal forms for CFGs: CNF and GNF - Closure properties of CFLs - Decision Properties of CFLs: Emptiness - Finiteness and Membership - Pumping lemma for CFLs.

UNIT IV Push Down Automata (PDA):

Description and definition - Instantaneous Description - Language of PDA - Acceptance by Final state - Acceptance by empty stack - Deterministic PDA - Equivalence of acceptance by empty stack and final state - Conversion of CFG to PDA and PDA to CFG.

UNIT V Turing Machines (TM) and Undecidability:

Basic model - definition and representation - Instantaneous Description - Language acceptance by TM - Variants of Turing Machine - TM as Computer of Integer functions - Universal TM - Church's Thesis - Recursive and recursively enumerable languages - Halting problem - Introduction to Undecidability - Undecidable problems about TMs - Post correspondence

problem (PCP) - Modified PCP and undecidable nature of post correspondence problem - Introduction to recursive function theory.

Textbooks:

1. John Hopcroft, Rajeev Motwani, and Jeffrey Ullman, "Introduction to Automata Theory, Languages and Computation", Third Edition, Pearson Education, 2014.

Reference Books:

2. John Hopcroft, Jeffrey Ullman, "Introduction to Automata Theory, Languages and Computation", Nineteenth Reprint, Narosa Publishing House, 2002.
3. Martin J. C., "Introduction to Languages and Theory of Computations", Fourth Edition, TMH, 2010.
4. Peter Linz, "An Introduction to Formal Language and Automata", Narosa Pub. House, 2011.
5. Papadimitriou C., Lewis C. L., "Elements of the Theory of Computation", PHI, 1997.

Course Code: 05 PCCC08	Analog Circuits	Credit: 3-0-0: 3

Pre-requisites: Basics of Electronics Engineering (05 ESC07)

Course Objectives

- Understand the working of different types of amplifiers, oscillator and multivibrator circuits.
- Design BJT and FET amplifier and oscillator circuits.
- Analyze transistorized amplifier and oscillator circuits.
- Understand the applications of different types of amplifiers, oscillator, attenuators and multivibrator circuits.

Course Contents

UNIT I

Small signal amplifiers - biasing circuits of BJT and FET transistors, analysis and design of BJT and FET amplifiers, chopper stabilized amplifiers, case studies – application of current amplifiers in SCR firing circuits and power supplies.

UNIT II

Large signal amplifiers – analysis and design of class A and class B power amplifiers, class C and class D amplifiers, thermal considerations, tuned amplifiers.

UNIT III

Feedback amplifiers – gain with feedback – effect of feedback on gain stability, distortion, bandwidth, input and output impedances; topologies of feedback amplifiers, case studies – application of negative feedback in dc-dc converters.

UNIT IV

Oscillators – Barkhausen criterion for oscillation – Hartley & Colpitt's oscillators – phase shift, Wien bridge and crystal oscillators - Clapp oscillator – oscillator amplitude stabilization.

UNIT V

Pulse circuits – attenuators – RC integrator and differentiator circuits – diode clampers and clippers – multivibrators - Schmitt Trigger- UJT Oscillator, case studies – application of UJT oscillator in SCR firing circuits and opto-electronic control circuits.

Textbooks:

1. Jacob Millman, 'Microelectronics', McGraw Hill, 2nd Edition, Reprinted, 2009.
2. David A Bell, 'Fundamentals of Electronic Devices and Circuits', Oxford University Press, Incorporated, 2009.

3. Allen Mottershead, ‘Electronic Devices and Circuits-An Introduction’, PHI, 18th Reprint, 2006.

Reference Book:

1. Thomas L. Floyd, David M. Buchla, ‘Electronics Fundamentals’, Pearson Prentice Hall, 7th Edition, 2010.
2. Robert.L.Boylestad, ‘Electronic Devices and Circuit Theory’, Pearson, 10th Edition, 2009.
3. Sedra Smith, ‘Microelectronic Circuits’, Oxford University Press, 6th Edition, 2010.
4. Jacob Millman and Christos C. Halkias, ‘Integrated Electronics: Analog and Digital Circuits and Systems’, 2nd Edition, Tata McGraw Hill Education, 2011.

Course Code: 05 BSC08	Numerical Methods and Computational Techniques	Credit: 3-0-0: 3

Pre-requisites: NA

Course Objectives

- To introduce a broad range of numerical methods for solving mathematical problems arising in Science and Engineering.
- The goal is to provide a basic understanding of the derivation, analysis, and use of numerical methods, with an understanding of finite precision arithmetic, conditioning, and stability of the various methods.

Course Contents

UNIT I Numerical solutions of linear equations using iterative and least squares techniques:

Error Analysis: Exact and approximate numbers, rounding off numbers, types of errors encountered in computations, propagation of errors. Solution of system of linear equations using direct methods: Gauss elimination and LU decomposition methods. Solutions to linear system of equations using iterative methods: Jacobi, Gauss-Seidel, and successive relaxation methods with convergence rates. Least-squares, solving least-squares problem, least-squares data fitting and validation, and nonlinear regression.

UNIT II Numerical solutions of nonlinear equations

Solutions of non-linear equations in single variable using Bisection, Regula-Falsi and Newton-Raphson methods, convergence criteria, Newton-Raphson method for solution of system of non-linear equations.

UNIT III Interpolation techniques and numerical quadrature rules:

Interpolation: Finite difference operator and their relationships, difference tables, interpolation formulae, divided differences, Lagrange and Hermite interpolations. Numerical integration: Trapezoidal and Simpsons rules with errors and their combinations, Gauss Legendre 2points and 3-points formulae.

UNIT IV Numerical solutions of differential equations:

Solution of first and second order ordinary differential: Picard's method, Taylor's series method, Euler, modified Euler, Runge-Kutta methods, case studies.

Textbooks:

1. Numerical Methods for Engineers by Steven C. Chapra and Raymond P. Canale; McGraw Hill Education India Private Limited; 7 ed.; 2016.
2. Applied Numerical Analysis by C. F. Gerald and P. O. Whitely; Pearson Education India; 7 ed.; 2007.

Reference Books:

1. Numerical Methods for Scientific and Engineering Computation by M. K. Jain, S. R. K. Iyengar and R. K. Jain; New Age Pvt. Pub, New Delhi; 6 ed.; 2012.
2. Introduction to Applied Linear Algebra: Vectors, Matrices, and Least Squares by S. Boyd and L. Vandenberghe; Cambridge University Press; 1 ed.; 2018.

Course Code: 05 AUC03	Indian Knowledge System	Credit: 2-0-0: 0 (Non Credit)

Pre-requisites: NA

Course Objectives

- To introduce a broad range of numerical methods for solving mathematical problems arising in Science and Engineering.
- The goal is to provide a basic understanding of the derivation, analysis, and use of numerical methods, with an understanding of finite precision arithmetic, conditioning, and stability of the various methods.

Course Contents

UNIT I Basics of Ancient Indian Knowledge and Diverse Fields from Health (Yoga), Agriculture, Performing Arts etc.:

Yoga - Patanjali and Panini, Yoga Sutras & Mahabhashya, Yoga from Ancient Rishis, Munies, Sages and Seers, Different types of Yogas, Asanas & Pranayamas, Vagbhata Samhita for Health Benefits. Agriculture - Ancient Agricultural Trends, Practices & means of Transportation in Agriculture. Performing Arts – Different types of Ancient Arts, i.e; Murtikala, Embossing in Jewellery, Different School of Arts in Ancient India: Mathura, Gandhara and Amravati School, Pottery & Utensil making from Mud.

UNIT II Ancient Indian Knowledge in Various Science Streams like Physics, Chemistry, Biology, Forestry, Mathematics etc.

Gravitational Laws, Concept of Pendulum, Ancient knowledge of Space & Astronomy related to Outer Space and different Celestial Bodies, i.e; Planetary System, Stars and their Movement. Chemistry – Ancient Knowledge of Rasayanas, Preservative Methods using Oil and Salt etc. Biology & Forestry – Rich Cultural Heritage of Ayurveda, Different types of Medicinal uses of Plants, Fauna, Flora. Study of Animal and Plant Fossils, Interaction/ Interrelation of Mankind and Nature on Mutually Beneficial Basis. Traditional methods for conservation of Forests, Trees and Preventing Soil Erosion. Mathematics – Present Day Decimal System traces its History to Ancient India, Giving the concept of Zero as a number to the World, Negative Numbers, basic Arithmetic and Algebraic concept, Knowledge of Advance Trigonometry in Ancient India..

UNIT III Ancient Indian Knowledge in Civil Engineering, Metallurgy, Mechanical Sciences, Textile Technology etc:

Civil Engineering Concept and Familiarity with Sthapaty Kala, the Art of Construction in Ancient India, Civil Engineering Knowledge in Architecture in Making a Well Planned City by the Harappan Civilization Remains Undisputed. World Heritage Sites of Ajanta, Ellora, Khajuraho, Sanchi, Mahabalipuram are the Testaments of Excellent Civil Engineering

Craftsmanship and Architecture, Well Developed Architecture During Cholas, Pal Dynasty is Evident in Various Ancient Temples in Present India. Concept of Canals and Wells for Irrigation & Human Needs in Ancient India is Well Documented Metallurgy – Concept Well Mentioned in Vedic Age Texts Using the Term Ayas for Metals, Minting/ Metal Casting Of Gold, Silver, Bronze, Copper for Utensils and Jewellery During Ancient India. Mechanical Sciences – Agriculture and Military Equipments like Hammer, Tongs, Idea of Basic Mechanical Concept for Transportation Using Bullock-Carts, Handpulled Carts Using Wheels, Chariots, Boats Using Patwar (Rudder) During Vedic Age ss Well Known, Use of Ploughing Tools Made of Metals and Wood etc. Textile Technology – Archaeological Evidence of Cotton Textile at Mohenjo Daro in the Indus Valley, Use of Charkhas and Traditional Yarns like Khadi, Silk Fabric from Silk Worm and export of quality Silk to West and European Countries is well established.

UNIT IV Ancient Indian Knowledge in Electrical, Electronics, Computational Studies, Instrumentation etc.:

Ancient India Knowledge in Generation of Electricity from Water, Silk and Clouds, Agastya Samhita Speaks about Electroplating, Basic knowledge of Computations and Instrumentation during Vedic Period, Musical Instruments like Seven-Holed Flute and other Stringed Instruments like Ravanahatha, Cymbals, Dhol (Drum) found by Archaeologists from Indus Valley Civilization Sites.

Syllabus for B.Tech. (Computer Engineering) – 3rd Year

Detailed Syllabus for B.Tech. (Computer Engineering) – 5th Semester

Course Code: 05 PCC09	Operating Systems	Credit: 3-0-0: 3

Pre-requisites: CS - Computer Architecture, CS - Data Structures and Algorithms

Course Outcomes

- To provide knowledge about the services rendered by operating systems
- To explore the various scheduling policies and to provide solutions for critical section and deadlock problems
- To provide a detailed discussion of the various memory management techniques
- To discuss the various file-system design and implementation issues
- To discuss how the protection domains, help to achieve security in a system
- Design and develop file system, I/O system and implementation issues of Distributed OS

Course Contents

UNIT I Introduction

Batch, iterative, time sharing, multiprocessor, distributed, cluster and real-time systems, UNIX system introduction and commands

Operating system structures: Computer system structure, Network structure, I/O Structure, Storage Structure, Dual mode operation, System components, Operating-System Services, System Calls, System Programs, System structure, Virtual Machines, System Design and Implementation, System Generation.

UNIT II Process Management

Process Concept, Process Scheduling, Operations on Processes, Cooperating Processes, Interprocess Communication, Communication in Client – Server Systems, Multithreading Models, Threading Issues, Pthreads Basic Concepts,

CPU Scheduling: Scheduling Criteria, Scheduling Algorithms, Multiple-Processor Scheduling, Real-Time Scheduling, Algorithm Evaluation, Process Scheduling Models

Process Synchronization: Synchronization Background, the Critical-Section Problem, Synchronization Hardware, Semaphores, Classic Problems of Synchronization, Critical Regions, Monitors, OS Synchronization

Deadlocks: System Model, Deadlock Characterization, Methods for Handling Deadlocks, Deadlock Prevention, Deadlock Avoidance, Deadlock Detection, Recovery from Deadlock.

UNIT III Memory Management

Memory Management Background, Swapping, Contiguous Memory Allocation, Paging, Segmentation, Segmentation with Paging, Virtual Memory, Demand Paging, Process Creation, Page Replacement, Allocation of Frames, Thrashing, Operating-System Examples, Other Considerations.

UNIT IV File Management

File Concept, Access Methods, Directory Structure, File-System Mounting, File Sharing, Protection File-System Structure, File-System Implementation, Directory Implementation, Allocation Methods, Free-Space Management, Efficiency and Performance, Recovery, Log-Structured File System, NFS.

UNIT V Input/Output Systems

Hardware, Application I/O Interface, Kernel I/O Subsystem, Transforming I/O to Hardware Operations, STREAMS, Performance, Disk Structure , Disk Scheduling , Disk Management, Swap-Space Management, RAID Structure , Disk Attachment, Stable-Storage Implementation, Tertiary-Storage Structure.

Text Books:

1. Silberschatz, Galvin, Gagne, “Operating System Concepts”, Tenth Edition, John Wiley and Sons, 2018.
2. Andrew S. Tanenbaum, “Modern Operating Systems”, Fourth Edition, Pearson Education.
3. Richard Stevens, Stephen Rago, "*Advanced Programming in the UNIX Environment"*, Second Edition, Pearson Education.

Reference book:

1. William Stallings, “Operating Systems – Internals and Design Principles”, Eighth Edition, Pearson Publications, 2014

2. Dhananjay M. Dhamdhere, “Operating Systems - A Concept-Based Approach”, Third Edition, Tata McGraw Hill Education, 2012.

Course Code: 05 PCC09	Operating Systems Laboratory	Credit: 0-0-2: 1

Pre-requisites: NA

Course Objectives:

- To provide an experimental foundation for the theoretical concepts introduced
- To achieve hands-on experimental skills and the study of practical applications will bring more confidence.

List pf experiments

1. Hands on Unix Commands.
2. Shell programming for file handling.
3. Shell Script programming using the commands grep, awk, and sed.
4. Programs on Multithread using Pthread.
5. Implementation of CPU scheduling algorithms.
6. Implementation of Synchronization problems using Semaphores, Message Queues and Shared Memory.
7. Implementation of Memory Management - Allocation, Placement and replacement Algorithms.
8. Implementation of various Disk scheduling algorithms.

Course Code: 05 PCC10	Computer Organization & Architecture	Credit: 3-0-0: 3

Pre-requisites: Digital Logic Design (05 PCC05)

Course Objectives:

- To understand the basic hardware and software issues of computer organization
- To understand the representation of data at machine level
- To understand how computations are performed at machine level
- To understand the memory hierarchies, cache memories and virtual memories
- To learn the different ways of communication with I/O devices

Course Contents

UNIT I Introduction

Introduction - Classes of computers - Defining Computer Architecture - Trends in Technology, Power, and Energy in Integrated Circuits - Trends in Cost, Dependability, Measuring, Reporting and Summarizing Performance - Quantitative Principles of Computer Design.

Machine instructions and Programs: Numbers, Arithmetic Operations and Characters, Memory Locations and Addresses, Memory Operations, Instructions and Instruction Sequencing, Addressing Modes,

UNIT II Instructions Set Architecture

Arithmetic: Addition and Subtraction of Signed Numbers, Design of Fast Adders, Multiplication of Positive Numbers, Signed-Operand Multiplication, Fast Multiplication, Integer Division, Floating Point Numbers and Operations, Implementing Floating Point Operations

Basic Processing Unit: Some Fundamental Concepts, Execution of a Complete Instruction, Multiple-Bus Organization, Hardwired Control, Microprogrammed Control.

UNIT III Instruction-Level Parallelism

Concepts and Challenges - Basic Compiler Techniques for Exposing ILP - Reducing Branch Costs with Prediction - Overcoming Data Hazards with Dynamic Scheduling - Dynamic Scheduling - Hardware-Based Speculation - Exploiting ILP Using Multiple Issue and Static Scheduling - Exploiting ILP - Advanced Techniques for Instruction Delivery and Speculation - Studies of the Limitations of ILP.

UNIT IV Memory Hierarchy Design

Review of Memory Hierarchy Design - Cache Performance - Basic Cache Optimizations - Virtual Memory - Protection and Examples of Virtual Memory - Advanced Optimizations of Cache Performance - Memory Technology and Optimizations - Protection: Virtual Memory and Virtual Machines - Crosscutting Issues: The Design of Memory Hierarchies - Case Studies.

UNIT V Vector Architecture

SIMD Instruction Set Extensions for Multimedia - Graphics Processing Units - Detecting and Enhancing Loop-Level Parallelism - Centralized Shared-Memory Architectures - Performance of Shared-Memory Multiprocessors - Distributed Shared Memory - Models of Memory Consistency - Multicore Processors and their Performance.

Text Books:

1. David A. Patterson, John L. Hennessey, "Computer Organization and Design, The Hardware/Software Interface", Fifth Edition, Morgan Kauffman/Elsevier, 2014.
2. Smruti Ranjan Sarangi, "Computer Organization and Architecture", McGraw Hill Education, 2015.

Reference Books:

1. V. Carl Hamacher, Zvonko G. Varanesic, Safat G. Zaky, "Computer Organization", Sixth Edition, McGrawHill Inc., 2012.
2. William Stallings, "Computer Organization and Architecture", Eighth Edition, Pearson Education, 2010.

Course Code: 05 PCC12	Modelling and Optimization Techniques	Credit: 3-0-0: 3

Pre-requisites: CS - Data Structures and Algorithms

Course Outcomes

- To provide knowledge of Model transportation and flow through networks and compute optimal parameters
- To explore the solution of real life problems using Meta-heuristic techniques
- To provide knowledge of Optimize inventory levels.

Course Contents

UNIT I Introduction

Introduction to OR modelling approach and various real-life situations, Types of Models (Mathematical, Statistical, and Computational Models); Introduction to Optimization - Definition and Importance of Optimization, Classical Optimization Problems, Constraints in Optimization Problems (Linear and Non-linear Constraints).

Mathematical Foundations for Optimization – Vectors, Tensors, Differentiation and Gradient Descent, Convex Functions, Convex Sets.

Mathematical Foundations Modelling with linear programming – Introduction of Linear Programming, Simplex Method, and Duality.

UNIT II Heuristic and Meta Heuristic Programming

Simulated Annealing, Genetic Algorithm, Particle warm Optimization algorithm and Teaching learning-based optimization algorithm - Non-Linear Programming algorithms.

UNIT III Introduction to Quadratic Programming

Introduction to Quadratic Programming, Constrained Optimization Problem Solving, Convex Optimization Methods. Game Theory: Introduction, Decisions under risk, Decisions under uncertainty.

UNIT IV Stochastic Optimization

Stochastic Processes in Optimization - Markov Chains and Monte Carlo Methods, Stochastic Gradient Descent (SGD); Dynamic Programming - Bellman's Principle of Optimality; Linear Programming with Uncertainty - Robust Optimization, Stochastic Linear Programming

UNIT V Simulation Modelling

Random number generation, Random variate generation – Verification and Validation of simulation models, Simulation of Computer Systems and Computer Networks.

Text Books:

1. Hamdy A Taha – "Operations Research-An Introduction", 9th Ed, Pearson, 2017
2. Jerry Banks, Hon S Carson, Barry L Nelson, David M Nicol, "Discrete Event Simulation", 5th Ed, Pearson, 2010

Reference book:

1. V.K. Kapoor, ―Operations Research‖, 7th edn., S Chand& Co, 2001.
2. Kanti Swaroop, P. K. Gupta & Man Mohan, ―Operations Research‖, Sultan Chand, 1978.
3. Hadley G., ―Linear Programming‖, Narosa Publishers, 1987.
4. Hillier & Lieberman—Introduction to Operations Research, 7/e (with CD),TMH
5. Hiller F. and Leibermann G. J., ―Operation Research‖, Holder Day Inc, 1974.
6. Operations Research – Schaum outline series, MHChakraborty & Ghosh, ―Linear Programming & Game Theory‖, Moulik Library, 2013.
7. S. Kalavathy, ―Operations Research‖, Vikas Publishing House Pvt. Ltd, 4th edn, 2013.

Course Code: 05 PCC11	Compiler Design	Credit: 3-0-0: 3

Pre-requisites: Formal Languages and Automata Theory (05 PCC06)

Course Outcomes

- To introduce the major concept areas in compiler design and know the various phases of the compiler
- To understand the various parsing algorithms and comparison of the same
- To provide practical programming skills necessary for designing a compiler
- To gain knowledge about the various code generation principles
- To understand the necessity for code optimization Course Contents

UNIT I Introduction to Compilation Compilers

Analysis of the source program - Phases of a compiler - Cousins of the Compiler - Grouping of Phases - Compiler construction tools - Lexical Analysis - Role of Lexical Analyzer - Input Buffering - Specification of Tokens. Lab Component: Tutorial on LEX / FLEX tool, Tokenization exercises using LEX.

UNIT II Syntax Analysis Role of the parser

Writing Grammars - Context-Free Grammars - Top Down parsing - Recursive Descent Parsing - Predictive Parsing - Bottom-up parsing - Shift Reduce Parsing - Operator Precedent Parsing - LR Parsers - SLR Parser - Canonical LR Parser - LALR Parser. Lab Component: Tutorial on YACC tool, Parsing exercises using YACC tool.

UNIT III Intermediate Code Generation Intermediate languages

Declarations - Assignment Statements - Boolean Expressions - Case Statements - Back patching - Procedure calls. Lab Component: A sample language like C-lite is to be chosen. Intermediate code generation exercises for assignment statements, loops, conditional statements using LEX/YACC.

UNIT IV Code Optimization and Run Time Environments Introduction

Principal Sources of Optimization - Optimization of basic Blocks - DAG representation of Basic Blocks - Introduction to Global Data Flow Analysis - Runtime Environments - Source Language issues - Storage Organization - Storage Allocation strategies - Access to non-local names - Parameter Passing - Error detection and recovery. Lab Component: Local optimization to be implemented using LEX/YACC for the sample language.

UNIT V Code Generation Issues in the design of code generator

The target machine - Runtime Storage management - Basic Blocks and Flow Graphs - Next-use Information - A simple Code generator - DAG based code generation - Peephole Optimization. Lab Component: DAG construction, Simple Code Generator implementation, DAG based code generation using LEX/YACC for the sample language.

Text Books:

1. Alfred V. Aho, Jeffrey D Ullman, “Compilers: Principles, Techniques and Tools”, Pearson Education Asia, 2012.
2. Jean Paul Tremblay, Paul G Serenson, “The Theory and Practice of Compiler Writing”, BS Publications, 2005.
3. Dhamdhere, D. M., “Compiler Construction Principles and Practice”, Second Edition, Macmillan India Ltd., New Delhi, 2008. Reference Books

Reference book:

1. Allen I. Holub, “Compiler Design in C”, Prentice Hall of India, 2003.
2. C. N. Fischer, R. J. LeBlanc, “Crafting a compiler with C”, Benjamin Cummings, 2003.
3. Henk Alblas, Albert Nymeyer, “Practice and Principles of Compiler Building with C”, PHI, 2001.
4. Kenneth C. Louden, “Compiler Construction: Principles and Practice”, Thompson Learning, 2003.

Course Code: 05 PEC01	Artificial Intelligence in Manufacturing	Credit: 3-0-0: 3

Pre-requisites: Computer Integrated Manufacturing (05 ESC08)

Course Outcomes

- Understand fundamental AI concepts and techniques.
- Analyze the applications of AI in various manufacturing processes.
- To enable the student to learn Fuzzy Logic with their applications.

Course Contents

UNIT I Introduction to Artificial Intelligence (AI)

Understanding AI and Machine Learning, Definitions and key concepts, Types of AI: Narrow vs. General AI, Overview of Manufacturing Systems, Types of manufacturing processes, Challenges in traditional manufacturing.

UNIT II AI Technologies and Tools

Machine Learning Techniques, Supervised, unsupervised, and reinforcement learning, Common algorithms: Regression, Classification, Clustering, Deep Learning and Neural Networks, Applications of deep learning in manufacturing, Role of AI in robotics, Autonomous systems in manufacturing.

UNIT III Artificial Neural Networks, Fuzzy Logic and Genetic Algorithms

Concepts of artificial neural networks, fuzzy logic and genetic algorithms - Manufacturing applications of neural networks, fuzzy logic and genetic algorithms.

UNIT IV Applications of AI in Manufacturing

Predictive Maintenance, Quality Control and Defect Detection, Supply Chain Optimization, Production Process Optimization, Smart manufacturing and Industry 4.0

Text Books:

1. Rajasekaran, S. and G. A. Vijayalakshmi Pai, Neural Networks, Fuzzy Logic and Genetic Algorithms, PHI Learning Private Limited, New Delhi.
2. Çağlayan Arkan, The Future Computed: AI and Manufacturing; Global Lead, Manufacturing and Resources Industry, Microsoft, 2019.
3. Fazel Famili (Editor), Dana S. Nau (Editor), Steven H. Kim (Editor); Artificial Intelligence Applications in Manufacturing, AAAI Press.
4. Ellen Friedman, Ted Dunning, AI and Analytics in Production; O'Reilly Media, Inc., 2018 (ISBN: 9781492044116)
5. Çağlayan Arkan, The Future Computed: AI and Manufacturing; Global Lead, Manufacturing and Resources Industry, Microsoft, 2019.

Course Code: 05 HSMC03	Operational Research	Credit: 2-1-0: 3

Pre-requisites: Numerical Methods and Computational Techniques (05 BSC 08)

Course Outcomes

- **To classify and formulate real-life problem for modelling, solving and applying for decision making.**
- **To study the formulation and various methods of solutions for linear programming, transportation, assignment, CPM and PERT problems**
- **To solve problems using dynamic programming method**

Course Contents

UNIT I Introduction

Introduction to operational research-Linear programming problems (LPP)-Graphical method-Simplex method-Big M Method-Dual simplex method-Primal Dual problems.

UNIT II

Dual theory and Sensitivity Analysis - Transportation and assignment problems-Applications (Emphasis should be more on problems than theory)

UNIT III

CPM and PERT –Network Diagram - Events and activities-Project Planning-Reducing critical events and activities-Critical path calculations-example-Sequencing problems.

UNIT IV

Replacement problems-Capital Equipment - Discounting Costs - Group replacement. Inventory models-various costs- Deterministic inventory models-Economic lot size-Stochastic inventory models-Single period inventory models with shortage cost.

UNIT V

Dynamic programming-Formulation-Invest Problem - General allocation problem-Stage coach problem-Production Scheduling.

Text Books:

- H. A. Taha, operational research-An introduction, Macmillan, 1976
- F. S. Hiller and G. J. Liebermann, Introduction to operational research (7^{th} edition)
- B. E. Gillet, Introduction to operational research-A computer oriented algorithmic approach, McGraw Hill, 1989
- H. M. Wagner, Principles of operational research with applications to managerial decisions, PH, Inc, 1975

Course Code: 05 PrSI01	Summer Internship	Credit: 0-0-4: 2

Internship

- **Internship - I: Student will go for internship during summer vacation (after 4th semester) for a period of 4 weeks. The assessment will be done on 5th semester.**

Detailed Syllabus for B.Tech. (Computer Engineering) – 6th Semester

Course Code: 05 PEC02	Computer Networks	Credit: 3-0-0: 3

Pre-requisites: Fundamental of Computer Science – 05 PCC01

Course Outcomes

- Understanding the state-of-the-art in network protocols, architectures, and applications.
- Examining and studying of different protocols in OSI and TCP/IP.
- Understanding of network addressing, mapping etc.
- Understanding error control flows control packet recovery etc.
- Understanding the structure of LAN, WAN and MAN.
- Understanding internetworking of devices.

Course Contents

UNIT I Introduction

Network architecture - protocol implementation issues - network design. Reference models- The OSI Reference Model- the TCP/IP Model - A Comparison of the OSI and TCP/IP Models.

Physical Layer: Digital and Analog Signals - Periodic Analog Signals - Transmission Impairments - Digital data transmission techniques - Analog data transmission techniques - Multiplexing and Spread Spectrum.

UNIT II Data Link Layer

Data Link Layer: Error Detection and Correction - Parity - LRC - CRC - Hamming Code - Flow Control and Error Control - Stop and wait - ARQ - Sliding window - HDLC - Multiple Access Protocols - CSMA - CSMA/CD and CSMA/CA - IEEE 802.3 Ethernet.

UNIT III Network Layer

Packet Switching and Datagram approach - IP Addressing methods - Subnetting - Routing - Distance Vector Routing - RIP - Link State Routing - OSPF - BGP - Multicast Routing - MOSPF - DVMRP - Broadcast Routing.

UNIT IV Transport Layer

Elements of transport protocol - Congestion control – The Internet's Transmission Control Protocol (TCP) - Remote Procedure Call (RPC) – Implementation semantics of RPC – BSD sockets - client-server applications.

UNIT V Application Layer

Domain name server – Simple Mail Transfer Protocol – File Transfer Protocol - World wide web - Hypertext transfer protocol -Presentation formatting and data compression-

Introduction to Network security - Web Services architectures for developing new application protocols..

Textbooks:

1. Andrew S. Tanenbaum, David J Wetherall, "*Computer Networks"*, 5th Edition, Pearson Edu, 2010
2. James F. Kuros & Keith W. Ross, “Computer Networking”, 8th Edition, Pearson Education.
3. Behrouz A. Foruzan, “Data Communication and Networking”, Fifth Edition, Science Engineering & Math Publications, 2013

Reference Books:

1. W. Stallings, “Data and Computer Communication”, Tenth Edition, Pearson Education, 2014.

Course Code: 05 PEC02	Computer Networks Laboratory	Credit: 0-0-2: 1

Pre-requisites: NA

Course Outcomes

- To create client and server applications using the "Sockets" API and the implementation of Data link layer protocol and TCP layer
- To conduct computer communication network simulations
- To have a hands-on experience of computer network simulation and modelling techniques using NS-3 simulation software

Course Contents

1. Exercises using NS-3 Network Simulator

1) Basics of Network Simulation

a) Introduction, Platform required to run network simulator, Backend Environment of Network Simulator, Agents and applications, Tracing

2) Simulating a Local Area Network

a) Local Area Network, LAN Topologies, MAC Protocol, Taking turns, Ethernet, Ethernet Frame Structure, Ethernet Versions, Simulating a LAN using Network Simulator3
b) Implementation of various MAC protocols
c) Setting up of various network topologies
d) Measurement of routing protocols

3) Measuring Network Performance

a) Network Performance Evaluation, Performance Evaluation Metrics, Parameters Affecting the Performance of Networks, Performance Evaluation Techniques, Network Performance Evaluation using NS-3
b) Setting up of network that carries various application protocols and analyzing the performances

2. Hands on experiments on Network equipment's

a) Switches, Routers
b) Hardware firewall

3. Exercises on Socket Programming using C and Java

Reference Books / Online Resources:

1. W. Richard Stevens, "UNIX Network Programming – Networking APIs: Sockets and XTI", Vol. 1, Second Edition, Prentice Hall, 1998.
2. Eitan Altman, Tania Jimenez, "NS Simulator for Beginners", Morgan & Claypool Publishers, 2011.
3. Jack L. Burbank, "An Introduction to Network Simulator 3", First Edition, Wiley-Blackwell, 2015.

Course Code: 05 PCC15	Database Management Systems	Credit: 3-0-0: 3

Pre-requisites: NA

Course Objectives:

- To learn data models, conceptualize and depict a database system using ER diagram
- To understand the internal storage structures in a physical DB design
- To know the fundamental concepts of transaction processing techniques
- To understand the concept of Database Design in Normalization techniques
- To know the manipulation of SQL Queries

Course Contents

UNIT I Introduction

Purpose of Database System - Views of data - data models - database management system - three-schema architecture of DBMS - components of DBMS - E/R Model - Conceptual data modelling - motivation - entities - entity types - attributes - relationships - relationship types - E/R diagram notation - examples.

UNIT II Relational Model Relational Data Model

Concept of relations - schema-instance distinction - keys - referential integrity and foreign keys - relational algebra operators - SQL - Introduction - data definition in SQL - table - key and foreign key definitions - update behaviours - Querying in SQL - notion of aggregation - aggregation functions group by and having clauses - embedded SQL.

UNIT III Database Design

Dependencies and Normal forms - dependency theory - functional dependencies - Armstrong's axioms for FD's - closure of a set of FD's - minimal covers - definitions of 1NF - 2NF - 3NF and BCNF - decompositions and desirable properties of them - algorithms for 3NF and BCNF normalization - 4NF and 5NF.

UNIT IV Transactions

Transaction processing and Error recovery - concepts of transaction processing - ACID properties - concurrency control - locking based protocols for CC - error recovery and logging - undo - redo - undo-redo logging and recovery methods.

UNIT V Implementation Techniques

Data Storage and Indexes - file organizations - primary and secondary index structures - various index structures - hash-based dynamic hashing techniques - multi-level indexes - B+ trees.

Text Books:

1. Silberschatz, Henry F. Korth, S. Sudharshan, “Database System Concepts”, Fifth Edition, Tata McGraw Hill, 2006.

2. J. Date, A. Kannan, S. Swamynathan, “An Introduction to Database Systems”, Eighth Edition, Pearson Education, 2006.

Reference Books:

1. Ramez Elmasri, Shamkant B. Navathe, “Fundamentals of Database Systems”, Fourth Edition, Pearson/Addision Wesley, 2007.
2. Raghu Ramakrishnan, “Database Management Systems”, Third Edition, McGraw Hill, 2003.
3. S. K. Singh, “Database Systems Concepts, Design and Applications”, First Edition, Pearson Education, 2006.

Course Code: 05 PCC15	**Database Management Systems Laboratory**	**Credit: 0-0-2: 1**

Pre-requisites: NA

Course Outcomes

- To explore the features of a Database Management Systems
- To interface a database with front end tools
- To understand the internals of a database system
- To identify Structure Query Language statements used in creation and manipulation of Database
- To identify the methodology of conceptual modelling through Entity Relationship model

Course Contents

1. Working with DDL, DML and DCL.
2. Inbuilt functions in RDBMS.
3. Nested Queries & Join Queries.
4. Set operators & Views in SQL.
5. Control structures.
6. Working with Procedures and Functions.
7. Triggers.
8. Dynamic & Embedded SQL.
9. Working with XML.
10. Forms & Reports.
11. Database Design and implementation (Mini Project).

Course Code: 05 PCC14	Artificial Intelligence and Machine Learning	Credit: 3-0-0: 3

Pre-requisites: Modelling and Optimization Techniques – 05 PCC12 and Data Structures – 05 PCC02

Course Outcomes

- Develop an appreciation for what is involved in learning models from data.
- Understand the strengths and weaknesses of many popular machine learning approaches.
- Understand how to evaluate models generated from data.
- Apply the algorithms to a real-world problem, optimize the models learned and report on the expected accuracy that can be achieved by applying the models.

Course Contents

Unit I:

Introduction to AI: History, early work, fundamental issues, Progress of Artificial Intelligence, AI techniques, lntelligent System

Introduction to machine learning, different forms of learning, Data Objects and Attribute Types, Cross Validation.

Unit II:

Dimension Selection and Reduction Techniques, Classification Methods: Linear Discriminant Analysis Logistic regression, Linear regression, estimator bias and variance, active learning, Active learning, non-linear predictions, Kernel regression, kernel optimization, Model selection criteria, expectation maximization.

Unit III:

Classification problems; decision boundaries; nearest neighbor methods, Probability and classification, Naive Bayes, Bayes' Rule and Naive Bayes Model, Hidden Markov models (HMMs), Bayesian networks, Learning Bayesian networks, online gradient descent, neural network, support vector machine (SVM), kernel ridge regression.

Unit IV:

Ensemble methods: Bagging, random forests, boosting, Unsupervised learning: clustering, k-means, hierarchical agglomeration. Lazy Learners

Text Books:

1. Christopher M. Bishop, Pattern Recognition and Machine Learning (Information Science and Statistics), Springer, 2006
2. Tom.M.Mitchell, “Machine Learning, McGraw Hill International Edition”.
3. Rosasco. Introductory Machine Learning Notes.
4. Hastie, Tibshirani and Friedman. Elements of statistical learning.

5. E. Rich and Knight, “Artificial Intelligence”, McGraw Hill International.

Reference book:

1. Simon Haykin, Neural Networks and Learning Machines Third Edition, Pearson Publisher

2. Pattern Classification. Richard Duda, Peter Hart and David Stock. Second Edition, Wiley-Interscience, 2000.

3. Machine Learning. Tom Mitchell. First Edition, McGraw-Hill, 1997.

Course Code: 05 PCC13	Microprocessor & Microcontroller	Credit: 3-0-0: 3

Pre-requisites: Computer Organization & Architecture (05 PCC10)

Course Outcomes

- To understand the concepts of Architecture of 8086 microprocessor
- To understand the design aspects of I/O and Memory Interfacing circuits
- To understand the architecture and programming of ARM processor

Course Contents

UNIT I: THE 8086 MICROPROCESSOR -
Introduction to 8086 – Microprocessor architecture – Addressing modes - Instruction set and assembler directives – Assembly language programming – Modular Programming - Linking and Relocation - Stacks - Procedures – Macros – Interrupts and interrupt service routines – Byte and String Manipulation.

UNIT II: 8086 SYSTEM BUS STRUCTURE –
8086 signals – Basic configurations – System bus timing –System design using 8086 – IO programming – Introduction to Multiprogramming – System Bus Structure - Multiprocessor configurations – Coprocessor, closely coupled and loosely Coupled configurations – Introduction to advanced processors.

UNIT III MICROCONTROLLER -
Architecture of 8051 – Special Function Registers (SFRs) - I/O Pins Ports and Circuits - Instruction set - Addressing modes - Programming 8051 Timers – Interfacing Microcontroller - Serial Port Programming - Interrupts Programming – LCD & Keyboard - External Memory Interface- Stepper Motor.

UNIT IV INTRODUCTION TO EMBEDDED SYSTEMS
Complex systems and microprocessors– Embedded system design process – Instruction sets preliminaries - ARM Processor – CPU: programming input and output supervisor mode, exceptions and traps – Co-processors- Memory system mechanisms – CPU performance

UNIT V: EMBEDDED COMPUTING PLATFORM DESIGN AND OPTIMIZATION
The CPU - Bus-Memory devices and systems–Designing with computing platforms – platform level performance analysis - Components for embedded programs-Models of programs Assembly, linking and loading – compilation techniques- Program level performance analysis – Software performance optimization – Analysis and optimization of program size- Program validation and testing.

Text Books:

1. Yu-Cheng Liu, Glenn A.Gibson, “Microcomputer Systems: The 8086 / 8088 Family - Architecture, Programming and Design”, Second Edition, Prentice Hall of India, 2007

2. Mohamed Ali Mazidi, Janice Gillispie Mazidi, Rolin McKinlay, “The 8051 Microcontroller and Embedded Systems: Using Assembly and C”, 2 nd Edition, Pearson Education, 2011
3. Marilyn Wolf, “Computers as Components - Principles of Embedded Computing System Design”, 3rd Edition “Morgan Kaufmann Publisher (An imprint from Elsevier), 2012

Reference book:

1. Doughlas V. Hall, “Microprocessors and Interfacing, Programming and Hardware”, Tata McGraw-Hill, 2012
2. Jonathan W. Valvano, “Embedded Microcomputer Systems Real Time Interfacing”, 3 rd Edition, Cengage Learning, 2012
3. David. E. Simon, “An Embedded Software Primer”, 1st Edition, Fifth Impression, Addison-Wesley Professional, 2007

Course Code: 05 OEC01		Credit: 3-0-0: 3

Pre-requisites:

Course Outcomes

Course Contents

Text Books:

Reference book:

Course Code: 05 HSMC04	Project Management	Credit: 2-1-0: 3

Pre-requisites: CS -

Course Outcomes

- **To evaluate methods, models and technologies towards achieving project success**
- **To design and evaluate network planning models with criticality**
- **To apply appropriate methods and models for the development of solutions.**

Course Contents

UNIT I Introduction

Introduction to Software Project Management- Software Projects – ways of categorizing software projects – problems with software projects – Project Life Cycle– Management - Setting objectives –Stakeholders – Project Team- Step-wise : An overview of project planning -project Evaluation –Selection Of Appropriate Project Objectives- Software Effort Estimation Techniques, Function Point Analysis-Object Point-COCOMO.

UNIT II Project Management

Activity planning– project schedules – sequencing and scheduling projects – Network planning model – AON and AOA-identifying critical activities-Crashing And Fast Tracking-, Risk management—Categories , Risk planning, Management and Control – Evaluating risks to the schedule. PERT- Resource Allocation, Monitoring and Tracking – Monitoring and control – allocation – identifying resource requirements – scheduling resources – creating critical paths – publishing schedule – cost schedules- sequence schedule.

UNIT III

Monitoring and control – Visualizing Progress, Earned value analysis, managing people and organizing teams- organizational structures- Planning for small projects. Case Study: PMBOK , Agile Development

Text Books:

Mike Cotterell, Bob Hughes. Software Project Management, Fifth Edition, Tata McGraw-Hill; 2012.

Jalote P. Software Project Management in practice, Second edition, Person Education; 2003.

Syllabus for B.Tech. (Computer Engineering) – 4th Year

Detailed Syllabus for B.Tech. (Computer Engineering) – 7th Semester

Course Code: 05 PCC17	Internet & Web Technology	Credit: 3-0-0: 3

Pre-requisites: Computer Networks – 05 PEC02

Course Objectives:

- To complete an in-depth knowledge of web technology.
- To know and to have the idea for different web application that most web developers are likely to use.
- To be aware of, and to have used, the enhancements of the web applications.
- To know the different types of web application software.

Course Contents

UNIT I Introduction to Internet

Introduction, Evolution of Internet, Internet Applications, Internet Protocol -TCP/IP, UDP, HTTP, Secure Http (Shttp) Internet Addressing – Addressing Scheme – Ipv4 & IPv6, Network Byte Order, Domain Name Server and IP Addresses, Mapping, Internet Service Providers, Types Of Connectivity Such As Dial-Up Leaded Vsat Etc. Web Technologies: Three Tier Web Based Architecture; Jsp, Asp, J2ee, .Net Systems.

UNIT II HTML CSS AND SCRIPTING HTML

Introduction, Sgml, Dtd(Document Type Definition, Basic Html Elements, Tags and usages, HTML Standards , Issues in HTML Dhtml: Introduction Cascading Style Sheets: Syntax ,Class Selector, Id Selector Dom (Document Object Model) & Dso (Data Source Object) Approaches To Dynamic Pages: Cgi, Java Applets, Plug Ins, Active X, Java Script – Java Script Object Model, Variables-Constant – Expressions, Conditions- Relational Operators- Data Types – Flow Control – Functions & Objects-events and event handlers – Data type Conversion & Equality – Accessing HTML form elements.

UNIT III XML

What is XML – Basic Standards, Schema Standards, Linking & Presentation Standards, Standards that build on XML, Generating XML data, Writing a simple XML File, Creating a Document type definition, Documents & Data, Defining Attributes & Entities in the DTD, Defining Parameter Entities & conditional Sections, Resolving a naming conflict, Using Namespaces, Designing an XML data structure, Normalizing Data, Normalizing DTDS.

UNIT IV INTERNET SECURITY & FIREWALLS

Security Threats From Mobile Codes, Types Of Viruses, Client Server Security Threats, Data & Message Security, Various electronic payment systems, Introduction to EDI, Challenges–

Response System, Encrypted Documents And Emails, Firewalls: Hardened Firewall Hosts, Ip-Packet Screening, Proxy Application Gateways, AAA(Authentication, Authorization And Accounting).

UNIT V WEBSITE PLANNING & HOSTING

Introduction, Web Page Lay-Outing, Where To Host Site, Maintenance Of Site, Registration Of Site On Search Engines And Indexes, Introduction To File Transfer Protocol, Public Domain Software, Types Of Ftp Servers (Including Anonymous),Ftp Clients Common Command. Telnet Protocol, Server Domain, Telnet Client, Terminal Emulation. Usenet And Internet Relay Chat.

Text Books:

1. Internet & Intranet Engineering, - Daniel Minoli, TMH.
2. Alexis Leon and Mathews Leon – Internet for Every One, Tech World.

Reference Books:

1. Eric Ladd, Jim O'Donnel – "Using HTML 4, XML and JAVA"-Prentice Hall of India 1999.
2. "Beginning Java Script "– Paul Wilton – SPD Publications –2001.
3. Addison Wesley Advance Java– Gajendra Gupta, firewall Media

Course Code: 05 PCC12	Internet & Web Technology Laboratory	Credit: 0-0-2: 1

Pre-requisites: NA

Course Objectives:

- To provide an experimental foundation for the theoretical concepts introduced
- To achieve hands-on experimental skills and the study of practical applications will bring more confidence.

List of experiments

1. Create a HTML page, which has properly aligned paragraphs with image along with it. Write a program to display list of items in different styles.
2. Create both client side and server-side image maps.
3. Create your own style sheets and use them in your web page using CSS, DHTML.
4. Create a form with various fields and appropriate front and validations using any one of the scripting languages.
5. Write a program to store the form fields in a database, use any appropriate Server Slide Scripting.
6. Create a web page using XML.
7. Write a program to connect a XML web page to any database engine.

Course Code: 05 PCC16	Cryptography & Network Security	Credit: 3-0-0: 3

Pre-requisites: Computer Networks – 05 PEC02

Course Objectives:

- **To gain knowledge about the mathematics of the cryptographic algorithms**
- **To get an insight into the working of different existing cryptographic algorithms**
- **To learn about key exchange protocols and attacks on such protocols**
- **To learn how to use cryptographic algorithms in security**

Course Contents

UNIT I Mathematical Foundations

Number theory: Introduction to number theory – Modular Arithmetic; Finite fields; Number theory properties – Primality testing; Fermat's and Euler's theorem; Chinese remainder theorem; Integer factorization; discrete logarithm; Euclid's algorithm for integers - quadratic residues - Legendre symbol - Jacobi symbol.*

UNIT II Introduction to security

Security architecture; security attacks; security services; security mechanisms; different type of attack: CMA - CPA - CCA - Shannon perfect secrecy - OTP - Pseudo random bit generators; CIA Architecture.

UNIT III Classical and Modern Ciphers

Classical and modern ciphers; pseudorandomness; statistical properties of random sequences; discrete probability; Symmetric key and public key cryptosystems; General design principles of block ciphers; substitution-permutation networks; General design principles of stream ciphers; linear feedback shift-register sequences; boolean functions; canonical examples - DES, 3DES, AES, RC4, RC5, RC6, A5/1,2; Analysis methodologies - differential, linear, square, algebraic techniques. Public key cryptosystems Diffie Hellman key exchange, public key encryption, digital signatures, Knapsack, RSA, ElGamal, Rabin schemes.

UNIT IV Message Authentication

Functionalities of entity, content authentication; message digests and hashing schemes; Key management and Distribution-Certificate authorities; PKI; MAC; Hashing; Authentication protocols.

UNIT V Digital Signature & Cryptanalysis

Digital Signature Standard; Cryptographic embedding in different layers of network stack; applications, protocols and standards; social, economic and geo-political; Introduction to Elliptic Curve Cryptosystems, Elliptic Curve Cryptosystems based Digital Signature scheme; Intractable (Hard) Problems.

Text Books:

1. Behrouz A. Forouzan, Debdeep Mukhopadhyay, “Cryptography and Network Security”, Second Edition, Tata McGraw Hill, 2013.
2. Cryptography: Theory and Practice, Third Edition (Discrete Mathematics and Its Applications) by Douglas R. Stinson, CRC Press.
3. Menezes, P. Van Oorschot, S. Vanstone, "*Handbook of Applied Cryptography*", CRCPress, 2004

Reference Books:

1. William Stallings, "*Cryptography and Network Security*", 6th edition Pearson Education, 2014
2. *[Online Course]* Course on Cryptography by Dan Boneh.

Course Code: 05 PCC18	System Software	Credit: 3-0-0: 3

Pre-requisites: Formal Languages and Automata Theory – 05 PCC06, Compiler Design – 05 PCC11

Course Outcomes

- To understand systems software components, finite automata, regular expression and context free grammar.
- To apply the knowledge of assembler and macro processors to convert assembly language into machine code.
- To analyse working phases of Compiler, various parsing techniques, semantic analysis, Error handling, code generation and code optimization techniques to undertake meaningful language translation.
- To evaluate Linkers, Loaders, interpreters and debugging methods to manages system memory and provide a portable runtime environment.
- To create a language translator application and mimic a simple compiler.

Course Contents

UNIT I INTRODUCTION

Introduction to System Software, Utility Software, Systems Programming, Recent Trends in Software Development, Programming Languages and Language Processors, Data Structures for Language Processing.

UNIT II ASSEMBLERS

Overview of the Assembly Process, Cross Assembler, Micro Assembler, Meta Assembler, Single Pass Assembler, Two Pass Assembler, Design of Operation Code Table, Symbol Table, Literal Table, Advanced Assembly Process.

UNIT III MACRO PROCESSORS

Introduction of Macros, Macro Processor Design, Forward Reference, Backward Reference, Positional Parameters, Keyword Parameters, Conditional Assembly, Macro Calls within Macros, Implementation of Macros Within Assembler. Designing Macro Name Table, Macro Definition Table, Kew Word Parameter Table, Actual Parameter Table, Expansion Time Variable Storage.

UNIT IV COMPILERS

Phases of Compiler, Analysis-Synthesis Model of Compilation, Interface with Input, Parser and Symbol Table, Token, Lexeme, Patterns and Error Reporting in Lexical Analysis, Programming Language Grammars, Classification of Grammar, Ambiguity in Grammatical Specification, Top Down Parsing, Recursive Descent Parsing, Transformation on The Grammars, Predictive Parsing, Bottom Up Parsing, Operator Precedence Parsing, LR Parsers, Language Processor Development Tools – LEX & YACC, Semantic Gap, Binding and Binding Times, Memory Allocation, Compilation of Expression, Intermediate Representations, Basic Code Optimization.

UNIT V LINKERS AND LOADERS

Design of a Linker, Program Relocation, Linking of Overlay Structured Programs, Dynamic Linking, General Loader Schemes, Absolute Loader, Relocating Loader, Dynamic Loader, Bootstrap Loader, Linking Loader, other Loading Schemes, Linkers v/s Loaders.

UNIT VI INTERPRETERS & DEBUGGERS

Overview of Interpretation and Debugging Process, Types of Errors, Classification of Debuggers, Dynamic/Interactive Debugger, The Java Language Environment, Java Virtual Machine and Recent Developments.

Text Books:

1. D. M. Dhamdhere, "Systems Programming", 1/E, McGraw Hill, 2011.
2. Leland L. Beck, "System Software - An Introduction to System Programming", 3/E, Pearson Education, 2002.
3. John Donovan, “Systems programming”, 1/E, McGraw Hill, 2017.
4. Santanu Chattopadhyay, “System Software” 1/E, Prentice-Hall India, 2007.

Course Code: 05 PEC11	Digital Image Processing	Credit: 3-0-0: 3

Pre-requisites: NA

Course Outcomes

- Differentiate and interpret various image enhancement techniques
- Reconstruct the image from the degraded image
- Analyze and use appropriate image compression techniques
- Suggest proper image feature for classification problems
- Build image processing applications for real world problems

Course Contents

UNIT I Introduction

Introduction to Digital Image Processing - Characteristics of Digital Image - Basic relationship between pixels - Image sampling and quantization - Color models - Basic Geometric Transformations - Fourier Transform - Cosine- Sine and Hartley Transform - Hadamard-Haar-Slant Transform - Discrete Fourier Transform.

UNIT II Image Enhancement Techniques

Spatial Domain Methods - Basic Grey Level Transformation - Histogram Processing - Image subtraction - Image averaging - Spatial filtering - Smoothing - Sharpening filters - Laplacian filters - Frequency domain filters - Smoothing - Sharpening filters - Homomorphic filtering.

UNIT III Image Restoration

Model of Image Degradation/restoration process - Noise models - Spatial and Frequency Filters - Inverse filtering & Wiener Filtering - Least mean square filtering - Constrained least mean square filtering.

UNIT IV Image Compression Fundamentals

Image Compression Models - Lossless compression: Variable length coding - LZW coding - Bit plane coding - predictive coding - DPCM - Lossy Compression: Lossy Predictive Coding - Transform coding - Wavelet coding.

UNIT V Image Segmentation & Analysis

Image Segmentation techniques - Edge detection - Thresholding - Region - Boundary Extraction & Representation

Region - Moment representation - chain codes - Polygonal approximation - Texture - Pattern Recognition. Applications - Finger print/iris recognition - Remote sensing - Automatic character recognition - Medical image processing.

Text Books:

1. Rafael C Gonzalez, Richard E Woods, “Digital Image Processing”, Fourth Edition, Pearson Education, 2018.

Reference book:

2. A.K. Jain, “Fundamentals of Digital Image Processing”, PHI, New Delhi, 1995.
3. William K Pratt, “Digital Image Processing”, Fourth Edition, John Wiley, 2007.
4. S E Umbaugh, “Digital Image Processing and Analysis: Application with MATLAB and CVIP Tools”, Third Edition , Taylor & Francis, CRC Press, 2018.
5. Frank Y. Shih, “Image Processing and Pattern Recognition”, Wiley – IEEE Press, 2010.

Course Code: 05 OEC02		Credit: 3-0-0: 3

Pre-requisites:

Course Outcomes

Course Contents

Text Books:

Reference book:

Course Code: 05 PrSI02	Colloquium/Seminar	Credit: 0-0-4: 2

- **In the 7th semester of the BTech CSE syllabus, the Colloquium/Seminar involves students presenting a detailed study on a specific research topic, emerging technology, or current trends in computer science. This activity helps students develop research, presentation, and critical thinking skills, preparing them for their final year projects and future career opportunities.**

Course Code: 05 PrSI03	Summer Internship	Credit: 0-0-4: 2

Internship

- **Internship - II: Student will go for internship during summer vacation (after 6th semester) for a period of 4 weeks. The assessment will be done on 7th semester.**

Detailed Syllabus for B.Tech. (Computer Engineering) – 8th Semester

Course Code: 05 PEC04	Introduction of Blockchain Technology	Credit: 3-0-0: 3

Pre-requisites: Cryptography and Network Security – 05 PCC16

Course Outcomes

- **To assess blockchain applications in a structured manner.**
- **To impart knowledge in block chain techniques and able to present the concepts clearly and structured.**
- **To get familiarity with future currencies and to create own crypto token.**

Course Contents

UNIT I Introduction of Blockchain

Distributed Database, Two General Problem, Byzantine General problem and Fault Tolerance, Hadoop Distributed File System, Distributed Hash Table, ASIC resistance, Turing Complete. Cryptography: Hash function, Digital Signature-ECDSA, Memory Hard Algorithm, Zero Knowledge Proof.

Introduction, Advantage over conventional distributed database, Blockchain Network, Mining Mechanism, Distributed Consensus, Merkle Patricia Tree, Gas Limit, Transactions and Fee, Anonymity, Reward, Chain Policy, Life of Blockchain application, Soft & Hard Fork, Private and Public blockchain.

UNIT II Distributed Consensus

Nakamoto consensus, Proof of Work, Proof of Stake, Proof of Burn, Difficulty Level, Sybil Attack, Energy utilization and alternate.

UNIT III Cryptocurrency

History, Distributed Ledger, Bitcoin protocols-Mining strategy and rewards, Ethereum-Construction, DAO, Smart Contract, GHOST, Vulnerability, Attacks, Sidechain, Namecoin.

UNIT IV Cryptocurrency Regulation

Stakeholders, Roots of Bitcoin, Legal Aspects Cryptocurrency Exchange, Black Market and Global Economy.

UNIT V Application

Internet of Things, Medical Record Management System, Domain Name Service and future of Blockchain.

Textbooks:

1. Thompson J., Blockchain: The Blockchain for Beginnings, Guild to Blockchain Technology and Blockchain Programming, Create Space Independent Publishing Platform, 2017.
2. Narayanan A., Bonneau J., Felten E., Miller A., Goldfeder S., Bit coin and Cryptocurrency Technologies: A Comprehensive Introduction, Princeton University Press, 2016.

Reference Books:

1. Wood G., ETHEREUM: A Secure Decentralized Transaction Ledger, Yellow paper, 2014.

Course Code: 05 OEC03		**Credit: 3-0-0: 3**

Pre-requisites:

Course Outcomes

Course Contents

Text Books:

Reference book:

Course Code: 05 PrSI04	Research Project/Dissertation	Credit: 10-0-0: 10

- **In the 8th semester of the BTech CSE syllabus, the Research Project/Dissertation involves students conducting independent research or developing a software/system solution on a chosen topic under the guidance of a faculty advisor. This project allows students to apply theoretical knowledge to real-world problems, fostering innovation, problem-solving, and technical writing skills in preparation for their professional careers or further studies.**

Honors Program

Course Code: 05 H01	Formal Methods in Computer Science	Credit: 3-1-0: 4

Pre-requisites: Data Structures – (05 PCC02)

Course Outcomes

- **Understanding and Application of Formal Specification Techniques.**
- **To develop capability to Perform Theorem Proving and Algorithm Verification.**
- **To develop knowledge of Real-World Applications of Formal Methods.**

Course Contents

UNIT I Introduction to Formal Methods and Mathematical Foundations

Definition, importance, and areas of application in software and hardware development, Informal vs formal approaches to system development.

Mathematical Foundations: Propositional and Predicate Logic, Proof techniques: Induction, contradiction, and equivalence; Set Theory.

Introduction of Automata Theory - Finite Automata (Deterministic and Non-Deterministic), Regular expressions and languages, and Basics of Formal Languages.

UNIT II Formal Specification Techniques

Purpose of formal specification in system design and verification; VDM (Vienna Development Method): Concepts and formal syntax, Z-Notation: Basic syntax and constructs; Z-Notation: Basic syntax and constructs.

UNIT III Model Checking and Verification

Introduction to model checking: What is model checking and why is it important? Verification of properties through state-space exploration, Temporal Logic (LTL - Linear Temporal Logic, CTL - Computation Tree Logic).

UNIT IV Formal Verification and Proof Method

Introduction to automated theorem proving; Verification of Algorithms - Proving correctness of algorithms using formal methods, Using preconditions, postconditions, and invariants; Hoare Logic - Formal reasoning about programs using Hoare Logic, Inductive proofs and the concept of loop invariants.

Textbooks:

1. "Formal Methods: An Introduction to Mathematical Logic and Formal Verification" by R. K. Guy.

2. "Discrete Mathematics and Its Applications" by Kenneth H. Rosen.
3. "Model Checking" by Ed Brinksma and E. M. Clarke
4. "Interactive Theorem Proving and Program Development" by Yves Bertot, Pierre Castéran

Reference Books:

1. "Theorem Proving in Higher Order Logic" by L. C. Paulson.
2. "Mathematical Foundations of Computer Science" by H. S. M. Coxeter

Course Code: 05 H02	VLSI Design for Parallel Architecture	Credit: 3-0-0: 3

Pre-requisites:

Course Outcomes

- To provide rigorous foundation in MOS and CMOS digital circuits.
- To train the students in transistor budgets, clock speeds and the growing challenges of power consumption and productivity.
- To introduce the field of parallel architectures and discuss in-depth shared memory management for parallel architectures.
- To introduce the interconnection topologies and routing methods which are important for connection and communication of the multiple cores executing the parallel applications.

Course Contents

UNIT I

Introduction to CMOS circuits: MOS transistors, CMOS combinational logic gates, multiplexers, latches and flip-flops, CMOS fabrication and layout, VLSI design flow.

MOS transistor theory: Ideal I-V and C-V characteristics, non-ideal I-V effects, DC transfer characteristics, Switch level RC delay models.

UNIT II

CMOS technologies: Layout design rules, CMOS process enhancement, Technology related CAD issues.

Circuit characterization and performance estimation: Delay estimation, Logical effort and transistor sizing, Power dissipation, Interconnect design margin, Reliability, Scaling.

Combinational circuit design: Static CMOS, Ratioed circuits, Cascode voltage switch logic, Dynamic circuits, Pass transistor circuits.

UNIT III

Introduction to Parallel Architectures, Parallel Programming models and Architectures, Memory Hierarchy-Cache and Virtual memory

UNIT IV

Overview of Cache coherence, Coherence Protocols- Snooping, Directory based protocols, VI protocol, MSI, MESI, Dragon protocol and Correctness of coherence protocols- Types of cache misses, update vs invalidate protocol

UNIT V

Snoop based multiprocessor design, Single and multi-level cache with atomic bus, Snoop based multiprocessor design, Single and multi-level cache with split transaction bus, Scalable shared memory systems: Directory coherence protocols- Memory based, cache based, correctness

UNIT VI

Case study: Origin- Architecture, protocol, correctness; Sequent NUMA Q- Architecture, protocol, correctness, Memory consistency models- Sequential, Relaxed consistency models, Synchronization- LL-SC, point to point, barrier synchronization, Interconnects- Introduction, Topologies, routing, flow control.

Textbooks:

1. N.H.E.Weste and D. Harris, "CMOS VLSI Design: A Circuits and Systems Perspective", 4th Edition, Pearson, 2011.
2. J.Rabey and B. Nikolic, "Digital Integrated circuits", 2nd Edition, Pearson, 2003.
3. E. Culler and J. P. Singh with A. Gupta. Parallel Computer Architecture. Morgan-Kaufmann publishers. 4. J. L. Hennessy and D. A. Patterson. Computer Architecture: A Quantitative Approach. Morgan- Kaufmann publishers.

Reference Books:

1. Pucknell and Eshraghian, "Basic VLSI Design", 3rd Edition, PHI, 1996.
2. Recent literature in Basics of VLSI.
3. M. Dubois, M. Annavaram, Per Stenstrom. Parallel Computer Organisation and Design. Cambridge University Press.

Course Code: 05 H02	VLSI Design for Parallel Architecture Laboratory	Credit: 0-0-4: 2

Pre-requisites:

Course Outcomes

- To provide an experimental foundation for the theoretical concepts introduced
- To achieve hands-on experimental skills and the study of practical applications will bring more confidence.

List of Experiments

1. CMOS Inverter : a) Design and verify the circuit (using 180 nm technology) using transient analysis. b) Obtain VTC curve and threshold voltage of inverter for a specific parameter, verify with the value of threshold voltage obtained using formula. c) Create symbol of this inverter for further application
2. Design NAND and NOR gate using 180 nm technology perform all the analysis using cadence virtuoso.
3. Design XOR gate by using NAND and NOR gate. Perform transient analysis.
4. Design 1-bit half adder using 90 nm technology and verify the circuit using transient analysis.
5. Design Full adder using 90 nm technology and verify the circuit using transient analysis.
6. Design a multiplexer using 90 nm technology and perform all the analysis to verify its characteristics.
7. Design a MOS based SRAM cell using 90 nm technology and verify its characteristics.
8. Design NOR gate using Domino logic CMOS inverter and verify its characteristics.
9. Design CMOS transmission gate and perform all the analysis to verify its characteristics.
10. Design XOR and XNOR gate using dynamic CMOS logic circuits and verify its characteristics.
11. Design Layout of CMOS inverter and perform post layout analysis, Monte Carlo analysis, Corner analysis and etc.

Course Code: 05 H03	High Performance Computer Architecture	Credit: 3-0-0: 3

Pre-requisites: Computer Organization & Architecture – 05 PCC10

Course Outcomes

- Design and analyze parallel algorithms for real world problems and implement them on available parallel computer systems.
- Optimize the performance of a parallel program to suit a particular hardware and software environment.
- Design algorithms suited for Multicore processor systems using OpenCL, OpenMP, and Threading techniques.

Course Contents

UNIT I Introduction

Implicit parallelism, Limitations of memory system performance, control structure, communication model, physical organization, and communication costs of parallel platforms, Routing mechanisms for interconnection networks, Mapping techniques.

UNIT II Parallel algorithm design:

Preliminaries, decomposition techniques, tasks and interactions, mapping techniques for load balancing, methods for reducing interaction overheads, parallel algorithm models, Basic communication operations: Meaning of all-to-all, all-reduce, scatter, gather, circular shift and splitting routing messages in parts.

UNIT III

Analytical modelling of parallel programs: sources of overhead, performance metrics, the effect of granularity on performance, scalability of parallel systems, minimum execution time, minimum cost optimal execution time, asymptotic analysis of parallel programs Programming using message passing paradigm: Principles, building blocks, MPI, Topologies and embedding, Overlapping communication and computation, collective communication operations, Groups and communicators.

UNIT IV

Programming shared address space platforms: Threads, POSIX threads, Synchronization primitives, attributes of threads, mutex and condition variables, Composite synchronization constructs, OpenMP. Multi-core Programming: Multi-core processor, CPU Cache, Cache coherence protocols, Memory Consistency Models, An Overview of Memory Allocators, Programming Libraries- PThreads, TBB, OpenMP, Dense Matrix Algorithms: matrix vector multiplication, matrix-matrix multiplication, solving system of linear equations.

UNIT V Sorting Methods

Sorting networks, Bubble sort, Quick sort, Bucket sort and other sorting algorithms Graph algorithms: Minimum spanning tree, single source shortest paths, all-pairs shortest paths, Transitive closure, connected components, algorithms for sparse graphs.

Textbooks:

1. Ananth Grama, Anshul Gupta, George Karypis, Vipin Kumar, Introduction to Parallel Computing, Second Edition, Pearson Education,2007.
2. Benedict R Gaster, Lee Howes, David R Kaeli Perhaad Mistry DanaSchaa, Heterogeneous Computing with OpenCL, McGraw-Hill, Inc. Newyork , 2011.

Reference Books:

1. Michael J. Quinn, Parallel Programming in C with MPI and OpenMP, McGraw-Hill International Editions, Computer Science Series,2004.

Course Code: 05 H03	High Performance Computer Architecture Laboratory	Credit: 0-0-4: 2

Pre-requisites:

Course Outcomes

1. To provide an experimental foundation for the theoretical concepts introduced
2. To achieve hands-on experimental skills and the study of practical applications will bring more confidence.

List of Experiments

- Design Ripple Carry Adder, Carry-Look-Ahead Adder, Wallace Tree Adder
- Synthesis of Flip Flops, Registers and Counters, Combinational Multipliers
- Design Booth's Multiplier, Arithmetic Logic Unit
- Design Memory Design, Associative cache Design, Direct Mapped cache Design
- Design and Analysis of Karnaugh Map, Quine - Mc Clusky Algorithm
- Design a binary RAM cell using a S-R flipflop, AND gates, NOT gates having select, read/write, input, output and test it by giving proper input.
- Design a 4X3 RAM memory which will have 4 words each of 3 bits using binary RAM cells, decoder with enable, OR gates and test it by giving proper input.
- Design a model of CPU.

Course Code: 05 H04	Recommender Systems	Credit: 3-1-0: 4

Pre-requisites: Artificial Intelligence & Machine Learning – 05 PCC14

Course Outcomes

- Understand basic techniques and problems in the field of recommender systems
- Aalyze the different approaches towards recommendation
- Evaluate the effectiveness of recommender system
- Design state-of-the-art recommender system using algorithms

Course Contents

Unit I INTRODUCTION

Introduction, basic taxonomy and bussiness value of recommender systems – Types of Recommender System-Traditional and non-personalized Recommender Systems – Overview of data mining methods for recommender systems- similarity measures- Dimensionality reduction – Singular Value Decomposition (SVD)

Unit II CONTENT-BASED RECOMMENDATION SYSTEMS

Content based recommender system foundations, Examples with text data, Feature engineering: Feature extraction, feature selection, dimensionality reduction, Content based recommender system examples with few supervised machine learning techniques.

Unit III COLLABORATIVE FILTERING

Introduction to collaborative filtering, Collaborative filtering approaches: Memory based and model based,

Memory based collaborative filtering foundations: Distance and similarity measures User based collaborative filtering; Item based collaborative filtering

Model based collaborative filtering foundations: matrix factorization, UV decomposition, Singular value decomposition Model based collaborative filtering techniques: SVD, SVD++ etc

Unit IV EVALUATING RECOMMENDER SYSTEMS

Evaluating Paradigms – Goals of evaluation design– Design Issues Limitations of Evaluation measures. Evaluation of recommender systems: Online and offline evaluation, metrics such as RMSE, AME, Good Item MAE, Good predicted item MAE, Precision, Recall, F1 Measure, NDCG, Average Reciprocal Rank, Top@N Measure.

Unit V ATTACK-RESISTANT RECOMMENDER SYSTEMS

Introduction – Types of Attacks – Detecting attacks on recommender systems – Individual attack -Group attack – Strategies for robust recommender design – Robust recommendation algorithms.

Textbooks:

1. Charu C. Aggarwal, Recommender Systems: The Textbook, Springer, 2016.
2. Dietmar Jannach, Markus Zanker, Alexander Felfernig and Gerhard Friedrich, Recommender Systems: An Introduction, Cambridge University Press (2011), 1st ed.
3. Francesco Ricci, Lior Rokach, Bracha Shapira , Recommender Systems Handbook, 1st ed,
4. Springer (2011).

Reference Books:

1. Jure Leskovec, Anand Rajaraman, Jeffrey David Ullman, Mining of massive datasets, 3rd
2. edition, Cambridge University Press, 2020.

Course Code: 05 H05	Deep Learning	Credit: 3-0-0: 3

Pre-requisites: Artificial Intelligence & Machine Learning – 05 PCC14

Course Outcomes

- Develop application using Deep Learning
- Apply the Deep Learning techniques to a real-world problem, optimize the models learned and report on the expected accuracy that can be achieved by applying the models**.**

Course Contents

Unit I: Introduction to basic Terminologies

Introduction to basic Terminologies: Types of errors, bias-variance trade-off, overfitting-underfitting, Vector Calculus and optimization, variants of gradient descent, momentum. Issues and Challenges in Deep Learning, Relation and Differences among Deep learning, Neural Networks, Machine Learning, Artificial Intelligence.

Unit II: Deep Learning Architectures

Introduction to Deep Learning Architectures, Convolutional Neural Networks Architecture, CNN representations: invertibility, stability, invariance, covariance/invariance: capsules and related models. Applications of CNN. Deep

Unsupervised Learning: Autoencoders (standard, denoising, contractive, etc.), Variational Autoencoders, Adversarial Generative Networks, Maximum Entropy Distributions.

Unit III: Recurrent Neural Networks

Recurrent Neural Networks (RNNs), Long-Short Term Memory (LSTM) architectures, Gated Recurrent Units,

Bidirectional LSTMs, Bidirectional RNNs, Generative models: Restrictive Boltzmann Machines (RBMs), Introduction to MCMC and Gibbs Sampling, gradient computations in RBMs, Deep Boltzmann Machines.

Unit IV: Implications of Deep Learning

Python Programming in Deep Learning, Case studies on Deep Learning in Healthcare, Weather Forecasting, Business Intelligence, Biometrics.

Textbooks:

1. Deep Learning, Ian Goodfellow and Yoshua Bengio and Aaron Courville, MIT Press, 2016.
2. Neural Networks and Deep Learning: A Textbook, Charu C. Aggarwal, Springer 2018.

3. Deep Learning with Python, Francois Chollet, Manning 2017Rajasekaran, and G. A. Vijayalakshmi Pai, Prentice Hall of India, 2007.

Reference Books:

1. Neural Networks: A Systematic Introduction, Raúl Rojas, 1996
2. Pattern Recognition and Machine Learning, Christopher Bishop, 2007,Education, 2002 1997.

Course Code: 05 H05	Deep Learning Laboratory	Credit: 0-0-4: 2

Pre-requisites:

Course Outcomes

- To provide an experimental foundation for the theoretical concepts introduced
- To achieve hands-on experimental skills and the study of practical applications will bring more confidence.

List of Experiments

1. Build an Artificial Neural Network by implementing the Backpropagation algorithm and test the same using appropriate data sets. Vary the activation functions used and compare the results.
2. Build a Deep Feed Forward ANN by implementing the Backpropagation algorithm and test the same using appropriate data sets. Use the number of hidden layers >=4.
3. Design and implement an Image classification model to classify a dataset of images using Deep Feed Forward NN. Record the accuracy corresponding to the number of epochs. Use the MNIST, CIFAR-10 datasets.
4. Design and implement a CNN model (with 2 layers of convolutions) to classify multi category image datasets. Record the accuracy corresponding to the number of epochs. Use the MNIST, CIFAR-10 datasets.
5. Design and implement a CNN model (with 4+ layers of convolutions) to classify multi category image datasets. Use the MNIST, Fashion MNIST, CIFAR-10 datasets. Set the No. of Epoch as 5, 10 and 20. Make the necessary changes whenever required. Record the accuracy corresponding to the number of epochs. Record the time required to run the program, using CPU as well as using GPU in Colab.

6. Design and implement a CNN model (with 2+ layers of convolutions) to classify multi category image datasets. Use the concept of padding and Batch Normalization while designing the CNN model. Record the accuracy corresponding to the number of epochs. Use the Fashion MNIST/MNIST/CIFAR10 datasets.
7. Use the concept of Data Augmentation to increase the data size from a single image.
8. Design and implement a CNN model to classify CIFAR10 image dataset. Use the concept of Data Augmentation while designing the CNN model. Record the accuracy corresponding to the number of epochs.
9. Implement the standard LeNet-5 CNN architecture model to classify multi category image dataset (MNIST, Fashion MNIST) and check the accuracy.
10. Implement the standard VGG-16 & 19 CNN architecture model to classify multi category image dataset and check the accuracy.
11. Implement RNN for sentiment analysis on movie reviews.
12. Implement Bidirectional LSTM for sentiment analysis on movie reviews.
13. Implement Generative Adversarial Networks to generate realistic Images. Use MNIST, Fashion MNIST or any human face datasets.
14. Implement Auto encoders for image denoising on MNIST, Fashion MNIST or any suitable dataset.