BABU BANARASI DAS UNIVERSITY
School of Engineering
(School Code: 04)
Department of Computer Science and Engineering
(University Branch Code: 32)
Bachelor of Technology: Computer Science and Engineering

Evaluation Scheme

SEMESTER I									
Course Category	Course Code	Code Title	Contact Hours			Evaluation Scheme			Credits
			L	T	P	CIA	ESE	Course Total	
BSC	NBS4101	Matrices and Calculus	3	1	0	40	60	100	4
ESC	NCS4101	Computer Concepts & Programming in C	3	0	0	40	60	100	3
ESC	NCS4151	Programming in C Lab	0	0	2	40	60	100	1
Students need to select either GROUP 'A' or GROUP 'B'									
	NGP4101	General Proficiency				100		100	1
Total			6	1	2	220	180	400	9

GROUP 'A'									
Course Category	Course Code	Code Title	Contact Hours			Evaluation Scheme			Credits
			L	T	P	CIA	ESE	Course Total	
BSC	NBS4102	Engineering Physics	3	1	0	40	60	100	4
ESC	NME4101	Engineering Mechanics	3	1	0	40	60	100	4
ESC	NEC4101	Basic Electronics Engineering	3	0	0	40	60	100	3
CCC	NBSCC1101	Environment & Ecological Sustainability	3	0	0	40	60	100	3
ESC	NME4151	Engineering Mechanics Lab	0	0	2	40	60	100	1
ESC	NME4152	Workshop Practices	0	0	2	40	60	100	1
BSC	NBS4152	Engineering Physics Lab	0	0	2	40	60	100	1
Total			12	2	6	280	420	700	17

GROUP 'B'									
Course Category	Course Code	Code Title	Contact Hours			Evaluation Scheme			Credits
			L	T	P	CIA	ESE	Course Total	
ESC	NEE4101	Basic Electrical Engineering	3	1	0	40	60	100	4
BSC	NBS4103	Engineering Chemistry	3	1	0	40	60	100	4
ESC	NCS4102	Basics of Artificial Intelligence	3	0	0	40	60	100	3
CCC	NHSCC1101	Communicative English	2	1	0	40	60	100	3
ESC	NEE4151	Basic Electrical Engineering Lab	0	0	2	40	60	100	1
BSC	NBS4153	Engineering Chemistry Lab	0	0	2	40	60	100	1
ESC	NME4153	Engineering Graphics Lab	0	0	2	40	60	100	1
Total			11	3	6	280	420	700	17

SEMESTER II									
Course Category.	Course Code	Code Title	Contact Hours			Evaluation Scheme			Credits
			L	T	P	CIA	ESE	Course Total	
BSC	NBS4201	Differential Equations and Fourier Analysis	3	1	0	40	60	100	4
ESC	NCS4201	Programming Concepts with Python	3	0	0	40	60	100	3
ESC	NCS4251	Python Programming Lab	0	0	2	40	60	100	1
Students need to select either GROUP 'A' or GROUP 'B'									
	NGP4201	General Proficiency				100		100	1
Total			6	1	2	220	180	400	9

Note: Students who have selected group ‘A’ in the first semester will select group ‘B’ in the second semester and vice-versa.

GROUP 'A'									
Course Categor	Course Code	Code Title	Contact Hours			Evaluation Scheme			Credits
			L	T	P	CIA	ESE	Course Total	
BSC	NBS4202	Engineering Physics	3	1	0	40	60	100	4
ESC	NME4201	Engineering Mechanics	3	1	0	40	60	100	4
ESC	NEC4201	Basic Electronics Engineering	3	0	0	40	60	100	3
CCC	NBSCC1201	Environment & Ecological Sustainability	3	0	0	40	60	100	3
ESC	NME4251	Engineering Mechanics Lab	0	0	2	40	60	100	1
ESC	NME4252	Workshop Practices	0	0	2	40	60	100	1
BSC	NBS4252	Engineering Physics Lab	0	0	2	40	60	100	1
Total			12	2	6	280	420	700	17

GROUP 'B'									
Course Category	Course Code	Code Title	Contact Hours			Evaluation Scheme			Credits
			L	T	P	CIA	ESE	Course Total	
ESC	NEE4201	Basic Electrical Engineering	3	1	0	40	60	100	4
BSC	NBS4203	Engineering Chemistry	3	1	0	40	60	100	4
ESC	NCS4202	Basics of Artificial Intelligence	3	0	0	40	60	100	3
CCC	NHSCC1201	Communicative English	2	1	0	40	60	100	3
ESC	NEE4251	Basic Electrical Engineering Lab	0	0	2	40	60	100	1
BSC	NBS4253	Engineering Chemistry Lab	0	0	2	40	60	100	1
ESC	NME4253	Engineering Graphics	0	0	2	40	60	100	1
Total			11	3	6	280	420	700	17

SEMESTER III									
Course Category	Course Code	Code Title	Contact Hours			Evaluation Scheme			Credits
			L	T	P	CIA	ESE	Course Total	
HSC	NHS4301 / NHS4302	Organizational Behavior /Industrial Sociology	2	0	0	40	60	100	**2**
BSC	NBS4301	Complex Analysis and Integral Transforms	3	1	0	40	60	100	**4**
PCC	NCS4301	Discrete Mathematics	3	0	0	40	60	100	**3**
PCC	NCS4302	Data Structure using 'C'	3	1	0	40	60	100	**4**
ESC	NCS4303	Digital Logic Design	3	0	0	40	60	100	**3**
PCC	NCS4304	Core and Advance Java	3	0	0	40	60	100	**3**
PCC	NCS4352	Data Structure Lab	0	0	2	40	60	100	**1**
ESC	NCS4353	Digital Logic Design Lab	0	0	2	40	60	100	**1**
PCC	NCS4354	Core and Advance Java Lab	0	0	2	40	60	100	**1**
CQAC	NVC4301	Indian Constitution*	1	0	0	40	60	100	**1**
	NGP4301	General Proficiency	-	-	-	100	-	100	**1**
Total			**18**	**2**	**6**	**500**	**600**	**1100**	**24**

SEMESTER IV									
Course Category	Course Code	Code Title	Contact Hours			Evaluation Scheme			Credits
			L	T	P	CIA	ESE	Course Total	
HSC	NHS4402/ NHS4401	Industrial Sociology/ Organizational Behavior	2	0	0	40	60	100	**2**
BSC	NBS4401	Statistical and Numerical Techniques	2	1	0	40	60	100	**3**
PCC	NCS4401	Database Management Systems	3	1	0	40	60	100	**4**
PCC	NCS4402	Operating Systems	3	1	0	40	60	100	**4**

PCC	NCS4403	Software Engineering	3	0	0	40	60	100	**3**
PCC	NCS4404	Computer Organization & Architecture	3	1	0	40	60	100	**4**
PCC	NCS4451	Database Management Systems Lab	0	0	2	40	60	100	**1**
PCC	NCS4453	Software Engineering Lab	0	0	2	40	60	100	**1**
CQAC	NCC4451	NSS/YOGA*	0	0	2	100	-	100	**1**
	NGP4401	General Proficiency	-	-	-	100	-	100	**1**
* Compulsory Qualifying Audit Course									
Total			**16**	**4**	**6**	**520**	**480**	**1000**	**24**

SEMESTER V

Course Category	**Course Code**	**Code Title**	**Contact Hours**			**Evaluation Scheme**			**Credits**
			L	**T**	**P**	**CIA**	**ESE**	**Course Total**	
HSC	NHS4501	Engineering & Managerial Economics	3	0	0	40	60	**100**	**3**
PCC	NCS4502	Microprocessor and Interfacing	3	1	0	40	60	**100**	**4**
PCC	NCS4503	Computer Networks	3	0	0	40	60	**100**	**3**
PCC	NCS4504	Automata Theory and Formal Languages	3	1	0	40	60	**100**	**4**
PCC	NCS4505	Computer Graphics	2	1	0	40	60	**100**	**3**
PCC	NCS4555	Computer Graphics Lab	0	0	2	40	60	**100**	**1**
PCC	NCS4553	Computer Networks Lab	0	0	2	40	60	**100**	**1**
SPIC	NCS4554	Minor Project-I	0	0	2	100	0	**100**	**1**
CQAC	NVC4501	Essence of Indian Knowledge Tradition*	1	0	0	40	60	**100**	**1**
	NGP4501	General Proficiency	-	-	-	100	-	**100**	**1**
Total			**15**	**3**	**6**	**520**	**480**	**1000**	**22**
* Compulsory Qualifying Audit Course									

SEMESTER VI

Course Category	Course Code	Code Title	Contact Hours			Evaluation Scheme			Credits
			L	T	P	CIA	ESE	Course Total	
HSC	NHS4601	Industrial Management	3	0	0	40	60	**100**	**3**
PEC	-	**Professional Elective Course-I**	3	0	0	40	60	**100**	**3**
PCC	NCS4602	Design & Analysis of Algorithms	3	1	0	40	60	**100**	**4**
PCC	NCS4604	Compiler Design	3	1	0	40	60	**100**	**4**
PEC	**-**	**Professional Elective Course-II**	3	0	0	40	60	**100**	**3**
PCC	NCS4652	Algorithms Lab	0	0	2	40	60	**100**	**1**
PCC	NCS4654	Compiler Design Lab	0	0	2	40	60	**100**	**1**
SPIC	NCS4651	Seminar	0	0	2	100	0	**100**	**1**
SPIC	NCS4653	Minor Project-II	0	0	2	100	0	**100**	**1**
	NGP4601	General Proficiency	-	-	-	100	-	**100**	**1**
Total			**15**	**2**	**8**	**580**	**420**	**1000**	**22**

Note: The students need to undergo a 4 to 6 weeks of industrial training that will be evaluated in the VII Semester.

SEMESTER VII									
Course Category	**Course Code**	**Code Title**	**Contact Hours**			**Evaluation Scheme**			**Credits**
			L	**T**	**P**	**CIA**	**ESE**	**Course Total**	
PCC	NCS4701	Distributed Systems	3	1	0	40	60	**100**	**4**
PCC	NCS4702	Soft Computing	2	1	0	40	60	**100**	**3**
PEC	**-**	**Professional Elective Course III**	3	0	0	40	60	**100**	**3**
OE	**-**	**Open Elective I***	3	1	0	40	60	**100**	**4**
PCC	NCS4751	Distributed Systems Lab	0	0	2	40	60	**100**	**1**
SPIC	NCS4753	Major Project I	0	0	4	100	0	**100**	**2**
SPIC	NCS4754	Industrial Training Evaluation	0	0	2	100	0	**100**	**1**
	NGP4701	General Proficiency	-	-	-	100	-	**100**	**1**
Total			**11**	**3**	**8**	**500**	**300**	**800**	**19**

*Students will opt any one of the open electives from the list of open electives provided by the university.

#Students need to submit an abstract for the project, select a guide and will complete the literature review related to the project.

SEMESTER VIII									
Course Category	**Course Code**	**Code Title**	**Contact Hours**			**Evaluation Scheme**			**Credits**
			L	**T**	**P**	**CIA**	**ESE**	**Course Total**	
PCC	NCS4801	Essentials of Machine Learning	**3**	**0**	**0**	40	60	**100**	**3**
PEC	**-**	**Professional Elective Course IV**	**3**	**0**	**0**	40	60	**100**	**3**
OE	**-**	**Open Elective II****	**3**	**1**	**0**	40	60	**100**	**4**
SPIC	NCS4853	Major Project II##	**0**	**0**	**16**	160	240	**400**	**8**
	NGP4801	General Proficiency	**-**	**-**	**-**	100	-	**100**	**1**
Total			**9**	**1**	**16**	**380**	**420**	**800**	**19**

**The opted subject should be different from the one selected in VII Semester.

##This is in continuation with the project work started in Semester VII. In this semester the students will formulate the methodology do experimentation and show the results. Finally all project work will be presented in a report i.e. Project Report.

Legends:

L	Number of Lecture Hours per week
T	Number of Tutorial Hours per week
P	Number of Practical Hours per week
CIA	Continuous Internal Assessment
ESE	End Semester Examination

Category of Courses:

BSC	Basic Science Courses
CCC	Co-Curricular Courses
ESC	Engineering Science Courses
PEC	Professional Elective Course
GP	General Proficiency
HSC	Humanities and Social Science Courses
OE	Open Elective
PCC	Professional Core Courses
SPIC	Seminar/ Project/ Internship/ Community Services
CQAC	Compulsory Qualifying Audit Course

List of Open Electives
Offered by the Department of Computer Science and Engineering

S. N.	Course Code	Open Elective	Credit
1	OE43211	Database Administration	4
2	OE43221	Computational Intelligence	4

List of Vocational Courses
Offered by the Department of Computer Science and Engineering

S. N.	Course Code	Vocational Courses	Credit
1	NVC43241	Programming with Python	2
2	NVC43242	Fundamentals of Artificial Intelligence	2
3	NVC43243	Cyber Crime and Computer Forensics	2
4	NVC43244	Meta-verse and Virtual Reality	2

List of Professional Elective Courses

Course Code	Professional Elective Course I
NPEC43211	Advanced Computer Architecture
NPEC43212	Software Project Management
NPEC43213	Cyber Law and Security
NPEC43214	Pattern Recognition

Course Code	Professional Elective Course II
NPEC43221	Quantum Computing
NPEC43222	Cloud Computing Essentials
NPEC43223	Big Data Analytics
NPEC43224	Internet of Things

Course Code	Professional Elective Course III
NPEC43231	Full Stack Development
NPEC43232	Computer Vision
NPEC43233	Essentials of Blockchain
NPEC43234	Natural Language Processing

Course Code	Professional Elective Course IV
NPEC43241	Augmented and Virtual Reality
NPEC43242	Deep Learning
NPEC4324	Data Compression

3	
NPEC43244	Bioinformatics

BABU BANARASI DAS UNIVERSITY

School of Engineering (School Code: 04)

List of Open Electives for the Department of Computer Science and Engineering

S. No.	Course Name	Course Code
Open Elective-I		
1	Disaster Management	OE43101
2	Non-Conventional Energy Resources	OE43302
Open Elective-II		
3	Quality Management	OE43501
4	Concepts of Climate Smart Agriculture	OE43102

Program	B. Tech CSE				
Year	I	Semester	I		
Course Name	Computer Concepts and Programming in C				
Code	NCS4101				
Course Type	ESC	**L**	**T**	**P**	**Credit**
Pre-Requisite	Fundamentals of computer	3	0	0	3
Course Objectives	**1.** To learn the fundamentals of computer. **2.** Understand the various steps in programme development. **3.** Study the syntax and semantics of C programming language. **4.** To learn the usage of structured programming approach in solving problems.				
Course Outcomes					
CO1	Develop simple algorithms for arithmetic and logical problems.				
CO2	To translate the algorithms to programs & execution (in C language) and also implement conditional branching, iteration and recursion.				
CO3	To decompose a problem into functions and synthesize a complete Program using divides and conquers approach.				
CO4	Study the use of arrays, pointers and structures to develop algorithms and Programs.				

Module	**Course Contents**	**Contact Hrs.**	**Mapped CO**
1	**Introduction to components of a computer system:** Memory, processor, I/O Devices, storage, operating system, Concept of assembler, compiler, interpreter, loader and linker. **Idea of Algorithm:** Representation of Algorithm, Flowchart, and Pseudo code with examples, From algorithms to programs, source code. **Programming Basics:** Structure of C program, writing and executing the first C program, Syntax and logical errors in compilation, object and executable code. Components of C language. Standard I/O in C, Fundamental data types, Variables and memory locations, Storage classes.	30 Hours	CO1

	Arithmetic expressions and precedence : Operators and expression using numeric and relational operators, mixed operands, type conversion, logical operators, bit operations, assignment operator, operator precedence and Associativity.		
2	**Conditional Branching:** Applying if and switch statements, nesting if and else, use of break and default with switch. **Iteration and loops:** use of while, do while and for loops, multiple loop variables, use of break and continue statements. **Functions:** Introduction, types of functions, functions with array, passing parameters to functions, call by value, call by reference, recursive functions. **Arrays:** Array notation and representation, manipulating array elements, using multi-dimensional arrays. Character arrays and strings, Structure, union, enumerated data types, Array of structures, Passing arrays to functions.	30 Hours	CO2, CO3
3	**Pointers:** Introduction, declaration, applications, Introduction to dynamic memory allocation (malloc, calloc, realloc, free), Use of pointers in self-referential structures, notion of linked list (no implementation). **File handling:** File I/O functions, Standard C pre-processors, defining and calling macros, command-line arguments	30 Hours	CO4

Suggested Readings

1. Problem Solving and Program Design in C, by Jeri R. Hanly, Elliot B. Koffman, Pearson Addison-Wesley, 2006.

2. Computer Concepts and Programming in C, E Balaguruswami, McGraw Hill

3. The C programming by Kernighan Brain W. and Ritchie Dennis M., Pearson Education .

4. Computer Fundamentals and Programming in C. Reema Thareja, Oxford Publication

5. Computer Concepts and Programming in C by Vikas Gupta, Wiley India Publication

Online Resources

1. https://youtu.be/-wv-OERJK3M

2. https://nptel.ac.in/courses/106104074

Course Articulation Matrix

PO-PSO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	1	2	1		2								1	2
CO2	2	3	1	1									2	2
CO3	1	3	2	2	2								1	2
CO4	1	1	2	1	1								1	1

Program	B. Tech CSE				
Year	I	**Semester**		I/II	
Course Name	Engineering Mechanics				
Code	NME4101/NME4201				
Course Type	ESC	**L**	**T**	**P**	**Credit**
Pre-Requisite	Physics	3	1	0	4
Course Objectives	**1.** To apply laws of mechanics to actual engineering problems. **2.** To calculate the reactive forces and analyse the structures. **3.** To know the geometric properties of the different shapes. **4.** To understand the elastic properties of different bodies.				
Course Outcomes					
CO1	Solve the engineering problems in case of equilibrium conditions & solve the problems involving dry friction.				
CO2	Calculate the reaction forces and forces in members of statically determinate structures.				
CO3	Determine the centroid and moment of inertia of various plane surfaces.				
CO4	To find out the stress, strain and elastic properties of different bodies.				

Module	Course Contents	Contact Hrs.	Mapped CO
1	**Two Dimensional Concurrent Force Systems:** Basic concepts, Laws of motion, Principle of Transmissibility of forces, Transfer of a force to parallel position, Resultant of a force system, Simplest Resultant of Two dimensional concurrent Force systems **Two dimensional Non-concurrent Force systems** Resultant of Two dimensional Non-concurrent Force systems, Distributed force system, free body diagrams, Equilibrium and Equations of Equilibrium, Applications.	30 Hours	CO1
2	**Beam**: Introduction, Types of support, Types of load on beam, Types of beam, Reactions from supports of beam. **Friction**: Introduction, Laws of Coulomb Friction, Equilibrium of Bodies involving Dry friction, Belt friction, Application.	30 Hours	CO2
3	**Trusses:** Introduction, Perfect, Deficient, and Redundant truss, Solution of Simple truss by Method of Joints. **Centroid and Moment of Inertia:** Introduction, Centroid of plane figure and composite figure, Moment of inertia of plane area, Parallel Axes Theorem & Perpendicular axes theorem, Moment of inertia of composite bodies.	30 Hours	CO3
4	**Kinematics and Kinetics:** Linear motion, D'Alembert principle, Impulse and momentum principle, Work and energy principle. **Simple Stress and Strain:** Normal and Shear stresses, Stress- Strain Diagrams for ductile and brittle material, Elastic Constants, One Dimensional Loading of members of varying cross-sections.	30 Hours	CO4

Suggested Readings

1. Engineering Mechanics by S.S. Bhavikatti, K.G. Rajashekarappa, New Age Publications.

2. A textbook of Engineering Mechanics by Dr. R.K. Bansal, Laxmi Publications.

3. Engineering Mechanics by Irving H. Shames. Prentice-Hall.

Online Resources

1. **https://nptel.ac.in/courses/112106286**
2. **https://archive.nptel.ac.in/courses/112/106/112106286/**

Course Articulation Matrix														
PO-PSO	PO1	PO2	PO3	PO4	PO5	PO 6	PO7	PO8	PO9	PO1 0	PO11	PO1 2	PSO1	PSO2
CO1	3	3	3	2	2									
CO2	3	2	2	3	3									
CO3	1	2	3	2	3									
CO4	2	2	2	2	2									

Program	B. Tech CSE				
Year	I	**Semester**		I/II	
Course Name	Basic Electronics Engineering				
Code	NEC4101/NEC4201				
Course Type	ESC	**L**	**T**	**P**	**Credit**
Pre-Requisite	Knowledge of Physics & Maths	3	0	0	3
Course Objectives	**1.** Comprehensive idea about basic electronics devices like Diodes, BJT **2.** Comprehensive idea about basic electronics devices like JFET. **3.** Fundamental principles of Operational Amplifier and its application **4.** To have an idea about Digital electronics and principle of communication.				
Course Outcomes					
CO1	Understanding the fundamentals of electronic circuits like Diode as Rectifier and Clippers.				
CO2	Analysing the fundamentals of electronic devices like BJT and JFET.				
CO3	Evaluate the Number system, Boolean algebra, logic gates, Karnaugh map.				
CO4	Understanding the principles of Operational Amplifier and its application				

Module	Course Contents	Contact Hrs.	Mapped CO
1	**DIODES** Energy band theory, Semiconductor material, Mass action law, PN junction: Forward and Reverse Bias characteristics, Diode as Rectifier: Half wave and Full wave Rectifiers, Clippers: Series Clippers, Breakdown Mechanism: Zener & Avalanche breakdown, Zener Diode and its application, Light Emitting Diode(LED).	30 Hours	CO1
2	**TRANSISTORS** Construction of Bipolar Junction Transistor: PNP and NPN, Working of Transistor, Base-Width modulation (Early Effect),Thermal Runaway BJT configurations: CE, CB and CC, Input & Output characteristics of CB & CE configuration, Biasing: Fixed bias, Emitter bias, Potential divider bias, Collector feedback Configuration, Comparison of biasing circuits. Transistor Amplifying Action. JFET: Basic construction and characteristics, Concept of pinch off, maximum drain saturation current, Input and transfer characteristics, Biasing: Self bias, fixed bias and Voltage divider bias.	30 Hours	CO2
3	**OPERATIONAL AMPLIFIER AND DIGITAL ELECTRONICS:** Introduction to OP-AMP, Equivalent Circuit and Pin diagram of Op-amp IC741, Characteristics of ideal OP-AMP, Input Offset Current , Input Bias Current, Basics of ideal and practical OP-AMP, Configurations: Open loop and closed loop, Applications of OP-AMP, Inverting amplifier, Non-inverting amplifier, Voltage follower, summing amplifier, Difference Amplifier, Integrator and Differentiator. Principle of feedback, Concept of positive and Negative feedback. Number System, Complements, Subtraction of binary number using 1's and 2's Complements, Excess 3 code, Gray	30 Hours	CO3, CO4

	Code (Cyclic Code), Boolean Algebra: Basic Theorems and De Morgan Theorems, Standard logic gates, Universal Logic Gates, Implementation of Boolean function using Basic gates and Universal gates.		

Suggested Readings

1. Robert L. Boylestad and Louis Nashelsky Electronic Devices and Circuit Theory, Pearson India.
2. Kennedy, Electronic Communication System, TMH
3. M. Morris Mano, Digital Logic and Computer Design, PHI

Online Resources

1. https://onlinecourses.nptel.ac.in/noc21_ee55/preview
2. https://archive.nptel.ac.in/courses/122/106/122106025/

Course Articulation Matrix

PO-PSO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	1	1	1	1	1									
CO2	1	1	1	1	1									
CO3	1	1	3	3	3									
CO4	1	2	1	1	3									

Program	B. Tech CSE				
Year	I	**Semester**	I/II		
Course Name	Engineering Mechanics Lab				
Code	NME4151/NME4251				
Course Type	ESC	**L**	**T**	**P**	**Credit**
Pre-Requisite	Intermediate School Education	0	0	2	1
Course Objectives	**1.** To gain the practical knowledge of equilibrium and non- equilibrium conditions. **2.** To perform experimental analysis of Torsion tese. **3.** To apply the practical knowledge of finding bendinding moment of simply-supported and cantilever beam.				
Course Outcomes					
CO1	Able to understand the behaviour of metals under tension, compression and impact load condition.				
CO2	To gain the practical knowledge of indentation effect on material using different hardness testing methods.				
CO3	To apply the role of friction in lifting and lowering of loads.				
CO4	To analyse the effect of load in deflection for simply supported beam.				

S. No.	List of Experiments	
1	To conduct the tensile test and determine the ultimate tensile strength, percentage elongation for a steel specimen.	CO1
2	To conduct the Impact-tests (Izod) on Impact-testing machine to find the toughness.	CO1
3	To conduct the Impact-tests (Charpy) on Impact-testing machine to find the toughness.	CO1
4	To determine the compression test and determine the ultimate compressive strength for a Specimen.	CO1
5	Friction experiment(s) on inclined plane and/or on screw-jack.	CO3
6	Worm & worm-wheel experiment for load lifting.	CO3
7	Bending of simply-supported and cantilever beams for theoretical & experimental deflection.	CO4
8	Statics experiment on equilibrium.	CO2
9	Belt-Pulley experiment.	CO3
10	Torsion of rod/wire experiment.	CO4

Online Resources

1. https://www.vlab.co.in/broad-area-mechanical-engineering

Course Articulation Matrix														
PO-PSO	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**	**PSO1**	**PSO2**
CO 1	**2**	**3**	**2**	**3**	**3**									
CO 2	**3**	**2**	**2**	**2**	**2**									
CO 3	**3**	**2**	**3**	**3**	**2**									
CO 4	**2**	**3**	**2**	**2**	**3**									

Program	B. Tech CSE (AI)				
Year	I	**Semester**	I		
Course Name	Programming in C Lab				
Code	NCS4151				
Course Type	ESC	**L**	**T**	**P**	**Credit**
Pre-Requisite	Basic knowledge of C	0	0	2	1
Course Objectives	**1.** Formulate problems and implement algorithms using C programming language. **2.** Learn memory allocation techniques using pointers. **3.** Learn memory allocation techniques using pointers **4.** Use structured programming approach for solving of computing problems in real world.				
Course Outcomes					
CO1	Understand the concept of basics of C, data types and variables.				
CO2	Understand the concept of operators, precedence of operators, conditional statements and looping statements.				
CO3	Explore the concept of strings, functions, recursive functions and differences between call by value and call by reference.				
CO4	Understand the concept of file handling functions, searching and sorting methods and real time applications of C.				

S. No.	List of Experiments	Mapped CO
1	WAP that accepts the marks of 5 subjects and finds the sum and percentage marks obtained by the student.	CO1,2
2	WAP that swaps values of two variables using a third variable.	CO 1,2
3	WAP to find the greatest of three numbers.	CO1,2
4	WAP that finds whether a given number is even or odd.	CO1,2
5	WAP that takes two operands and one operator from the user and perform the operation and prints the result by using Switch statement.	CO2,3
6	WAP to find the factorial of a given number.	CO3,4
7	WAP that simply takes elements of the array from the user and finds the sum of these elements.	CO2,3,4
8	WAP to search an element in a array using Linear Search.	CO2,3,4
9	WAP to add and multiply two matrices of order nxn.	CO2,3,4
10	WAP to implement strlen (), strcat (), strcpy () using the concept of Functions.	CO2,3,4

Suggested Readings

1. Byron Gottfried, “Programming with C”, Schaum's Outlines Series, McGraw Hill Education, 3 rd Edition, 2017.
2. E. Balagurusamy, “Programming in ANSI C”, McGraw Hill Education, 6th Edition, 2012.
3. Yashavant Kanetkar, “Exploring C”, BPB Publishers, 2nd Edition, 2003.
4. Schildt Herbert, “C: The Complete Reference”, Tata McGraw Hill Education, 4th Edition, 2014

Online Resources

1. https://ps-iiith.vlabs.ac.in/
2. https://www.vlab.co.in/ba-nptel-labs-computer-science-and-engineering

Course Articulation Matrix														
PO-PSO	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PO 6**	**PO7**	**PO8**	**PO9**	**PO1 0**	**PO11**	**PO1 2**	**PSO1**	**PSO2**
CO1	**1**				**2**								**1**	**1**
CO2	**1**	**2**	**2**										**2**	**2**
CO3	**2**	**2**	**2**	**2**	**2**						**1**	**2**	**2**	**2**
CO4	**1**	**2**	**2**	**2**	**2**						**2**		**2**	**2**

Program	B. Tech CSE				
Year	I	**Semester**		I/II	
Course Name	Workshop Practices				
Code	NME4152/NME4252				
Course Type	ESC	**L**	**T**	**P**	**Credit**
Pre-Requisite	Intermediate School Education	0	0	2	1
Course Objectives	**1.** To gain the practical knowledge of making male-female join, lap and butt join, half lap corner joint etc. **2.** To perform experimental analysis of upsetting, drawing down, punching, bending etc. in black smithy shop. **3.** To apply the practical knowledge of making Plane turning, Step turning, Taper turning, Threading, Grinding in machine shop.				
Course Outcomes					
CO1	To apply practical knowledge of making different types of joint in carpentry and fitting shop.				
CO2	Able to gain the practical knowledge of bending, upsetting, drawing down and punching of metals.				
CO3	To understand knowledge of joining of metals using various welding methods.				
CO4	To Study of machine tools and operations like Plane turning, Step turning, Taper turning, Threading, grinding of metals.				

S. No.	List of Experiments	Mapped CO
1	**Carpentry Shop:** Study of tools & operations and carpentry joints, Simple exercise using jack plane, to prepare half-lap corner joint, mortise & tennon joints, Simple exercise on wood working lathe.	CO1
2	**Fitting Bench Working Shop:** Study of tools & operations, Simple exercises involving fitting work, Make perfect male-female joint, Use of drills/taps.	CO1
3	**Black Smithy Shop:** Study of tools & operations, Simple exercises base on black smithy operations such as upsetting, drawing down, punching, bending, fullering & swaging.	CO2
4	**Welding Shop:** Study of tools & operations of Gas welding & Arc welding, Simple butt and Lap welded joints, Oxy-acetylene flame cutting.	CO3
5	**Sheet-metal Shop:** Study of equipment & operations, Making Funnel complete with 'soldering', Fabrication of tool-box, tray, electric panel box etc.	CO2
6	**Machine Shop:** Study of machine tools and operations, Plane turning, Step turning, Taper turning, Threading, Grinding of turning equipment.	CO4
7	**Foundry Shop:** Study of tools & operations, Pattern making, Mould making with the use of a core, Method of material pouring and Casting.	CO4

Online Resources

1. https://cgpit-bardoli.edu.in/engineering-graphics-eg-lab/

Course Articulation Matrix														
PO-PSO	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**	**PSO1**	**PSO2**
CO 1	**3**	**3**	**2**	**3**	**2**							**1**		
CO 2	**3**	**3**	**3**	**3**	**3**							**1**		
CO 3	**3**	**2**	**3**	**3**	**2**							**1**		
CO 4	**2**	**3**	**2**	**2**	**3**							**1**		

Program	B. Tech CSE				
Year	I	**Semester**	I/II		
Course Name	Basic Electrical Engineering				
Code	NEE4101/NEE4201				
Course Type	ESC	**L**	**T**	**P**	**Credit**
Pre-Requisite	Intermediate with PCM	3	1	0	4
Course Objectives	1. This course provides comprehensive idea about circuit analysis. 2. The subject gives the knowledge about combinational circuits. 3. Subject gives the knowledge about the analysis and design of new electrical circuits. 4. Other logical working principles of machines and common Measuring instruments.				
Course Outcomes					
CO1	To understand basic theorem of electrical engineering.				
CO2	To understand the basic concepts of magnetic, AC & DC circuits.				
CO3	To explain the working principle, construction, applications of DC & AC machines & measuring instruments.				
CO4	To gain knowledge about the fundamentals of electric components, devices.				

Module	Course Contents	Contact Hrs.	Mapped CO
1	**Electric Circuit:** Introduction to linear and nonlinear circuits, circuit elements, various sources and source transformation, Star delta transformation, solution of D.C. circuits using Kirchhoff's laws- Mesh Analysis and Nodal Analysis, Signal wave forms, Passive elements specifications. **Basic theorems:** Thevenin, Norton, Maximum Power, Superposition, Millman's Theorem, Tellegen's Theorem applied to DC networks.	30 Hours	CO1, CO2
2	**A. C. Circuits:** A.C. voltage and currents, average and r.m.s. values, Form factor and peak factor, Phasor representation of sinusoidal quantities, phasor in polar, rectangular and exponential forms. Analysis of single phase series, parallel and series-parallel circuits, Active & reactive and apparent power, p.f., Volt-amperes, frequency response and Q-factor. Analysis of balanced three phase a.c. circuits, Introductory concept, voltage, current and power in three phase balanced circuits. Star-delta connections. Measurement of three phase power by Wattmeter Method.	30 Hours	CO2
3	**Measuring Instruments & Electromagnetic and Transformer:** Types of instruments, construction, working principles & applications, PMMC, MI, Single phase dynamometer, Ammeter, Voltmeter, Wattmeter, Induction type Energy meter, Use of shunt and multiplier. Magnetic circuit concept, B-H curves characteristics of magnetic materials, Practical magnetic circuits. Magnetic circuits with D.C. and A.C. excitation, Hysteresis and eddy current losses, Magnetic force. Self and mutual inductances, Faraday`s laws, Lenz`s Law,	30 Hours	CO3

	Statically and dynamically induced emfs, Energy stored in magnetic fields. Principle of Transformer operation, emf equation, Equivalent circuit of transformer, Losses and efficiency, Introduction of Auto Transformer and its applications.		
	Electrical Machines: Basic concepts of rotating electric machines, DC machines (motor and generator), working principle, types, EMF and torque equations characteristics and application of DC motor. Three phase induction motors, types, principle of operation, applications. Single phase induction motors, principle of operation, starting methods, applications. Synchronous machines (motor and generator), principle of operation and applications.	30 Hours	CO4

Suggested Readings

1. Fundamental of Electric Circuits' by Charles K Alexander and Matthew N.O. Sadiku, Tata McGraw Hill Publication.
2. Electrical Engineering Fundamentals' by Vincent Del Toro, PHI Publication.
3. Basic Electrical Technology' by Kothari and I.J. Nagrath, Tata McGraw Hill.

Online Resources

1. https://archive.nptel.ac.in/courses/108/108/108108076/
2. https://nptel.ac.in/courses/108105112
3. https://archive.nptel.ac.in/courses/108/105/108105112/
4. https://archive.nptel.ac.in/courses/108/104/108104139/

Course Articulation Matrix														
PO-PSO	**PO 1**	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO 9**	**PO10**	**PO11**	**PO12**	**PSO1**	**PSO2**
CO1	3	3	3	3	2									
CO2	3	3	3	3	3									
CO3	3	1	2	1	2	3								
CO4	2	2	2	2	1	2								

Program	B. Tech CSE(AI)				
Year	I	**Semester**	II		
Course Name	Programming Concepts with Python				
Code	NCS4201				
Course Type	ESC	**L**	**T**	**P**	**Credit**
Prerequisite	Basic Knowledge of computer fundamentals and Programming Concepts.	3	0	0	3
Course Objectives	**1.** To have a strong foundation on Python Programming. **2.** Develop analytical ability on different real world situations. **3.** Easy mapping and respective conversion of real world problems to Python programs. **4.** Capability to work with large amounts of data for analytical purposes using Python.				
Course Outcomes					
CO1	Understand and write simple Python programs.				
CO2	Analysis of conditions in a problem and implement it in a program.				
CO3	Development of Python blocks using functions and data structures and their evaluation using function calls.				
CO4	Apply input/output with files in Python for secondary storage management and to apply OOPs concepts for analysis of real world problems.				

Module	Course Contents	Contact Hrs.	Mapped CO
1	**Introduction and Conditional Statements:** Programming Cycle for Python, Python IDE, Interacting with Python Programs, Elements of Python, Type Conversion. **Basics:** Expressions, Assignment Statement, Arithmetic Operators, Operator Precedence, Boolean Expression. **Conditionals:** Conditional statement in Python (if-else statement, its working and execution), Nested-if statement and Elif statement in Python, Expression Evaluation & Float Representation.	30 Hours.	CO1
2	**Loop , Function and Strings:** **Loops:** Purpose and working of loops, While loop including its working, For Loop, Nested Loops, Break and Continue. **Function:** Parts of A Function, Execution of A Function, Keyword and Default Arguments, Scope Rules. **Strings:** Length of the string and perform Concatenation and Repeat operations in it, Indexing and Slicing of Strings. **Python Data Structure:** Tuples, Unpacking Sequences,Lists,Mutable Sequences, List Comprehension, Sets, Dictionaries.	30 Hours.	CO2
3	**Sieve Of Eratosthenes & File I/0:** **Sieve of Eratosthenes:** Generate prime numbers with the help of an algorithm given by the Greek Mathematician named Eratosthenes, whose algorithm is known as Sieve of Eratosthenes. **File I/O:** File input and output operations in Python Programming. **Exceptions and Assertions Modules :** Introduction, Importing Modules. **Abstract Data Types:** Abstract data types and ADT interface in Python Programming. **Classes:**	30 Hours.	CO3/CO4

	Class definition and other operations in the classes, Special Methods (such as init, str, comparison methods and Arithmetic methods etc.), Class Example, Inheritance, Inheritance and OOP.		

Suggested Readings:

1.Allen B. Downey, "Think Python: How to Think like a Computer Scientist", 2nd edition, Updated for Python 3, Shroff/O'Reilly Publishers, 2016.

2.Guido van Rossum and Fred L. Drake Jr, ―An Introduction to Python – Revised and updated for Python 3.2, Network Theory Ltd., 2011.

3.John V Guttag ―Introduction to Computation and Programming Using Python'', Revised and expanded Edition, MIT Press, 2013.

Online Resources:

1. https://nptel.ac.in/courses/106106145

2. https://onlinecourses.swayam2.ac.in/cec22_cs20/preview

Course Articulation Matrix

PO-PSO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	1	2	1	3							1	1	1
CO2	3	2	2	2	3							2	2	2
CO3	3	3	2	2	3							2	2	2
CO4	3	2	2	2	3							2	2	2

Program	B Tech CSE				
Year	I	**Semester**	I/II		
Course Name	Basics of Artificial Intelligence				
Code	NCS4102/NCS4202				
Course Type	ESC	**L**	**T**	**P**	**Credit**
Pre-Requisite	Basic Knowledge of computer	3	0	0	3
Course Objectives	**1.** Study of historical perspectives of AI and its foundations. **2.** Understanding the fundamental principles of AI. **3.** Study of advanced AI techniques; like soft computing and nature inspired computing. **4.** Understanding different AI approaches like problem solving, inference, perception, knowledge representation and learning.				
Course Outcomes					
CO1	Demonstrate fundamental understanding of the history of artificial intelligence (AI) and its foundations.				
CO2	Apply basic principles of AI in solutions that require problem solving, inference, perception, knowledge representation, and learning.				
CO3	Demonstrate advanced AI techniques; like soft computing and nature inspired computing				
CO4	Demonstrate awareness and a fundamental understanding of various applications of AI techniques.				

Module	**Course Contents**	**Contact Hrs.**	**Mapped CO**
1	Introduction to Artificial Intelligence (AI): definition, foundation and history of AI, types of AI, intelligent agents, structure of intelligent agents, introduction to soft computing, introduction and operations on fuzzy sets, nature inspired computing and algorithms.	30 Hours	CO1
2	AI terminologies & basic concepts, searching for solutions, search strategies: informed and uninformed, local and global search algorithms for optimistic problems, adversarial search, searching techniques for games, Alpha Beta pruning.	30 Hours	CO2

3	Knowledge representation and reasoning, propositional logic, theory of first order logic, inference mechanism in first order logic, forward and backward chaining, probabilistic reasoning, utility theory, Bayesian Networks. Applications and future of Artificial Intelligence, ethical issues, impact of AI on public life: understanding application of AI in Healthcare, Gaming, Finance, Data Security, Social Media, Travel & Transport, Automotive Industry, Robotics, AI in Entertainment, Agriculture, E-commerce and Education.	30 Hours	CO3, CO4

Suggested Readings

1. Stuart Russell and Peter Norvig, Artifcial Intelligence: A Modern Approach, Pearson Education, Inc., 2010.
2. Nils J. Nilsson, "Artificial Intelligence: A new Synthesis", Harcourt Asia Pvt. Ltd., 2000.
3. Elaine Rich and Kevin Knight, "Artificial Intelligence", Tata McGraw-Hill, 2003.
4. George F. Luger, "Artificial Intelligence-Structures and Strategies For Complex Problem Solving", Pearson Education / PHI, 2002.
5. F. O. Karry, C. D. Silva, Soft Computing and Intelligent Systems Design, Pearson, 2009.

Online Resources

1. https://onlinecourses.nptel.ac.in/noc21_ge20/preview
2 https://www.youtube.com/@IITDelhiJuly

Course Articulation Matrix														
PO-PSO	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**	**PSO1**	**PSO2**
CO1	**2**	**2**	**1**									**2**	**2**	
CO2	**2**	**2**	**1**									**2**	**2**	
CO3	**2**	**2**	**1**									**2**	**2**	
CO4	**2**	**2**	**1**									**2**	**2**	

Program	B. Tech CSE(AI)				
Year	I	**Semester**	I/II		
Course Name	BASIC ELECTRICAL ENGINEERING LAB				
Code	NEE4151/NEE4251				
Course Type	ESC	**L**	**T**	**P**	**Credit**
Pre-Requisite	INTERMEDIATE WITH PCM	0	0	2	1
Course Objectives	**1.** Understanding and application of network theorems and analysis of D.C. circuits. **2.** Fundamental understanding of Transformer, AC and DC circuit concepts. **3.** Understanding three-phase ac circuit devices for measurement and a three-phase system. **4.** Study and application of AC and DC Machines.				
Course Outcomes					
CO1	To have basic knowledge of various electrical equipment.				
CO2	To Understand the concept of Network Theorems and D.C Circuits.				
CO3	Know about concept of Three Phase AC Circuits and three phase system.				
CO4	Study and application of AC and DC Machines.				

S. No.	List of Experiments	Mapped CO
1	Study of Electrical Equipment used in daily life.	CO1
2	Transistor input-output characteristic.	CO1
3	Full wave rectifier circuit using diodes.	CO2
4	Verification of KCL & KVL.	CO2
5	Verification of Thevenin's theorem & Norton's theorem.	CO2
6	Verification of Superposition theorem.	CO2
7	Measurement of active power in 3 -phase circuit using TWO wattmeter methods.	CO3
8	Study of dc shunt motor speed control using (1) Armature control (2) Field Control.	CO4
9	Measurement of load test and Calculating efficiency of DC Machine.	CO4
10	Determination of equivalent circuit parameters of a single phase transformer by O.C. and S.C. tests and estimation of voltage regulation and efficiency at various loading conditions and verification by load test.	CO4

Virtual Lab Source:

1. https://ems-iitr.vlabs.ac.in/exp/lab-equipment-familiarization/
2. https://vlab.amrita.edu/?sub=3&brch=110&sim=245&cnt=526
3. http://vlabs.iitkgp.ernet.in/be/exp7/index.html
4. https://vlab.amrita.edu/?sub=1&brch=75&sim=217&cnt=1
5. http://vlabs.iitkgp.ernet.in/asnm/index.html#
6. http://vlabs.iitkgp.ernet.in/asnm/index.html#
7. http://vlabs.iitkgp.ernet.in/asnm/exp7/index.html
8. https://em-coep.vlabs.ac.in/exp/speed-control-dc-motor/index.html
9. https://em-coep.vlabs.ac.in/exp/load-test-dc-motor/
10. https://ems-iitr.vlabs.ac.in/exp/circuit-parameters-oc-test/index.html

Course Articulation Matrix														
PO-PSO CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	**3**	**2**	**3**	**1**	**3**								**1**	**2**
CO2	**3**	**2**	**3**	**2**	**2**								**1**	**2**
CO3	**3**	**3**	**2**	**3**	**3**								**2**	**1**
CO4	**3**	**2**	**3**	**2**	**2**								**1**	**2**
CO5	**3**	**3**	**2**	**1**	**2**								**2**	**1**

Program	B.Tech: CSE (AI)				
Year	I	Semester		II	
Course Name	Python Programming Lab				
Code	NCS4251				
Course Type	ESC	L	T	P	Credit
Pre-Requisite		0	0	2	1
Course Objectives	**1.** Describe the core syntax and semantics of Python programming language. **2.** Illustrate the process of structuring the data using lists, dictionaries, tuples, strings and sets. **3.** Discover the need for working with the functions, modules and packages. Infer the Object-oriented Programming concepts in Python. **4.** Familiarize the advanced concepts like regular expressions, date and time. Able to handle abnormal termination of the python scripts				
Course Outcomes					
CO1	Interpret the fundamental Python syntax and semantics and able to solve, test and debug python programs				
CO2	Fluency in the use of Python control flow statements and determine the methods to create and manipulate Python programs by utilizing the data structures like lists, dictionaries, tuples, strings and sets				
CO3	Express proficiency in the handling of functions, modules, packages and handle abnormal termination of the programs.				
CO4	Articulate the Object-Oriented Programming concepts such as encapsulation, inheritance and polymorphism as used in Python.				

S. No.	List of Experiments	Mapped CO
1	To write a Python program to compute the GCD of two numbers.	**CO1**
2	To write a Python program to find the most frequent words in a text file.	**CO1**
3	To write a python program find the square root of a number (Newton's method).	**CO2**
4	To write a python program exponentiation (power of a number).	**CO2**
5	To write a python program find the maximum of a list of numbers.	**CO3**
6	To write a python program to perform Matrix Multiplication.	**CO4**
7	To write a python program linear search.	**CO3**
8	To write a python program Binary search.	**CO2**
9	To write a python program selection sort.	**CO4**
10	To write a python program merge sort.	**CO4**

Online Resources

1. https://pythoniitk.vlabs.ac.in/
2. https://www.vlab.co.in/participating-institute-iit-kanpur

Course Articulation Matrix														
PO-PSO	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PO 6**	**PO7**	**PO8**	**PO9**	**PO1 0**	**PO11**	**PO1 2**	**PSO1**	**PSO2**
CO1	**2**	**2**	**3**		**1**								**1**	**1**
CO2	**2**	**2**	**2**	**2**	**2**								**1**	**2**
CO3	**2**	**1**	**3**	**3**	**1**								**2**	**1**
CO4	**2**	**2**	**2**	**2**	**1**								**1**	**1**

Program	B. Tech CSE				
Year	I	**Semester**		I/II	
Course Name	Engineering Graphics Lab				
Code	NME4153/NME4253				
Course Type	ESC	**L**	**T**	**P**	**Credit**
Pre-Requisite	Intermediate School Education	0	0	2	1
Course Objectives	**1.** To gain the practical knowledge of different types of line and different type of projection. **2.** To draw the projection of point on VP & HP and projection of line like line inclined to one plane, inclined with the plane, true length and true inclination. **3.** To understand the use of Computer aided drafting in engineering graphics design.				
Course Outcomes					
CO1	Able to gain the knowledge of types of projection, orthographic projection, first and third angle projection.				
CO2	To understand the projection of lines, Planes like circle and polygons in different positions				
CO3	To draw Isometric scale, Isometric axes, Isometric Projection from orthographic drawing.				
CO4	Able to understand the software's basic commands of drafting entities like line, circle, polygon, polyhedron, cylinders.				

S. No.	List of Experiments	Mapped CO
1	1. **Scales**: Representative factor, plain scales, diagonal scales, scales of chords.	CO1
2	**2. Projection**: Types of projection, orthographic projection, first and third angle projection.	CO1
3	**3. Projection of points:** The principle of orthographic projections of a point on HP and VP, Conventional representation, Projection of a point in all the quadrants.	CO1
4	**4. Projection of Lines:** Line inclined to one plane, inclined with both the plane, True Length and True Inclination, Traces of straight lines.	CO2
5	**5. Projection of planes and solids**: Projection of Planes like circle and polygons in different positions; Projection of polyhedrons like prisms, pyramids and solids of revolutions like cylinder, cones in different positions.	CO2
6	**6. Section of Solids:** Section of right solids by normal and inclined planes; Intersection of cylinders.	CO3
7	**7. Isometric Projections:** Isometric scale, Isometric axes, Isometric Projection from orthographic drawing.	CO3
8	**8. Perspective Projection:** Nomenclature of Perspective Projection, Method of drawing perspective views, Visual Ray Method, using Top and Front, Top and Side views.	CO3
9	**9. Computer Aided Drafting (CAD)-**I: Introduction, benefit, software's basic commands of drafting entities like line, circle, polygon, polyhedron, cylinders.	CO4
10	**Computer Aided Drafting (CAD)-**II: Transformations and editing commands like move, rotate, mirror, array; solution of projection problems on CAD.	CO4

Online Resources

1. https://cgpit-bardoli.edu.in/engineering-graphics-eg-lab/

Course Articulation Matrix														
PO-PSO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	3	2	3	3	2								
CO2	2	2	3	2	2	3						1		
CO3	3	2	3	3	3	2						1		
CO4	3	3	3	2	3	2						1		

Program	B. Tech CSE				
Year	II	**Semester**	III		
Course Name	Discrete Mathematics				
Code	NCS4301				
Course Type	PCC	**L**	**T**	**P**	**Credit**
Pre-Requisite	Basics knowledge of functions and set theory	3	0	0	3
Course Objectives	**1.** To introduce Discrete Mathematical Structures (DMS) used in theoretical computer science. **2.** Investigate functions as relations and their properties **3**. Investigate use of Groups, Rings, Fields & Lattice **4.** Investigate proportional logic and relations for problem solving				
Course Outcomes					
CO1	Explore application of Set Theory, Relations, Functions & Natural Numbers				
CO2	To apply the basic principles Algebraic Structures				
CO3	To analyse the simple mathematical proofs by logic and relations				
CO4	To introduce Generating function and Combinatorics				

Module	Course Contents	Contact Hrs.	Mapped CO
1	**Set Theory, Relations, Functions & Natural Numbers** Set Theory: Introduction, Combination of sets, Multisets, Ordered pairs, Proofs of some general identities on sets. Relations: Definition, Operations on relations, Properties of relations, Composite Relations, Equality of relations, Recursive definition of relation, Order of relations. Functions: Definition, Classification of functions, Operations on functions, Natural Numbers: Introduction, Mathematical Induction, Induction with Nonzero Base cases, Proof Methods, Proof by contradiction.	30 Hours	CO1
2	**Groups, Rings, Fields & Lattice** Algebraic Structures: Definition, Groups, Subgroups and order, Cyclic Groups, Cosets, Lagrange's theorem, Normal Subgroups, Definition and elementary properties of Rings and Fields, Integers Modulo n; Partial order sets: Definition, Partial order sets, Combination of partial order sets, Hasse diagram. Lattices: Definition, Properties of lattices, Bounded, Complemented, Modular, Complete lattice	30 Hours	CO2
3	**Proposition Logic** Propositional Logic: Proposition, well-formed formula, Truth tables, Tautology, Satisfiability; Contradiction; Algebra of proposition; Theory of Inference; Predicate Logic: First order predicate-well- formed formula of predicate, quantifiers, Inference theory of predicate logic. **Recurrence Relation & Combinatorics** Recurrence Relation & Generating function: Recursive definition of functions, Recursive algorithms, Method of solving recurrences. Combinatorics: Introduction; Counting Techniques: Pigeonhole Principle	30 Hours	CO3, CO4

Suggested Readings

1. Kenneth H. Rosen, “Discrete Mathematics and Its Applications”, McGraw- Hill

2. R.P. Grimaldi, “Discrete and Combinatorial Mathematics”, Addison Wesley.

3. Jean Paul Trembley, R Manohar, “Discrete Mathematical Structures with Application to Computer Science,” McGraw-Hill.

Online Resources

1. https://archive.nptel.ac.in/courses/106/108/106108227/

2. https://archive.nptel.ac.in/courses/106/105/106105192/

Course Articulation Matrix														
PO-PSO	**PO1**	**PO 2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO 9**	**PO10**	**PO1 1**	**PO12**	**PSO1**	**PSO2**
CO1	3	1	3	2									3	
CO2	3	1	3	1									1	
CO3	3	1	3	2									2	
CO4	2	1	2	2									3	

Program	B. Tech CSE				
Year	II	**Semester**	III		
Course Name	Data Structure Using 'C'				
Code	NCS4302				
Course Type	PCC	**L**	**T**	**P**	**Credit**
Pre-Requisite	Fundamentals of computer knowledge	3	1	0	4
Course Objectives	**1.** To introduce the basis and advanced data structures **2.** To understand various data operations performed on in data structures **3.** To understand various sorting and searching techniques in data structures **4.** To analyse the performance of data structures algorithms				
Course Outcomes					
CO1	Understand the applications of data structures including the ability to implement algorithms for the creation, insertion, deletion, searching and sorting of each data structure.				
CO2	Apply knowledge of underlying data structures needed for solving problems and programming.				
CO3	Analyse the application of data structures for storage and retrieval of ordered and unordered data.				
CO4	Understanding the graph representation and traversal				

Module	Course Contents	Contact Hrs.	Mapped CO
1	**Introduction** Introduction: Basic Terminology, Data types and its classification, Algorithm complexity notations like big Oh, Time- Space trade-off. Abstract Data Type (ADT). **Array**: Array , Definition, Representation and Analysis of Arrays, Single and Multidimensional Arrays, Address calculation, Array as Parameters, Sparse Matrices, Recursion- definition and processes, simulating recursion, Backtracking, Recursive algorithms, Tail recursion, Removal of recursion, Tower of Hanoi.	30 Hours	CO1
2	**Stack and Linked List** Stack, Array Implementation of stack, Linked Representation of Stack, Application of stack: Conversion of Infix to Prefix and Postfix Expressions And Expression evaluation, Queue, Array and linked implementation of queues, Circular queues, D-queues and Priority Queues. Linked list, Implementation of Singly Linked List, Two-way Header List, Doubly linked list, Linked List in Array. Generalized linked list, Application: Garbage collection and compaction, Polynomial Arithmetic.	30 Hours	CO2
3	**Tree, Searching, Sorting and Hashing** Trees: Basic, terminology, Binary Trees, algebraic Expressions, Complete Binary Tree, Extended Binary Trees, Array and Linked Representation of Binary trees, Traversing Binary trees, Threaded Binary trees, Binary Search Tree(BST), AVL Trees, B-trees. Application: Algebraic Expression, Huffman coding Algorithm. Internal and External sorting, Insertion Sort, Bubble Sort, selection	30 Hours	CO3

	sort, Quick Sort, Merge Sort, Heap Sort, Radix sort, Searching Hashing: Sequential search, binary search, Hash Table, Hash Functions, Collision Resolution Strategies, Hash Table Implementation. Symbol Table, Static tree table, Dynamic Tree table.		
4	**Graphs** Graphs: Terminology, Sequential and linked Representations of Graphs: Adjacency Matrices, Adjacency List, Adjacency Multi-list, Graph Traversal: Depth First Search and Breadth First Search, Connected Component, Spanning Trees, Minimum Cost Spanning Trees: Prims and Kruskal algorithm. Transitive Closure and Shortest Path algorithm: Warshall Algorithm and Dijkstra Algorithm.	30 Hours	CO4

Suggested Readings

1. Aaron M. Tenenbaum, Yedidyah Langsam and Moshe J. Augenstein, "Data Structures Using C and C++", PHI, 2000.
2. Horowitz and Sahani, "Fundamentals of Data Structures",Galgotia Publication, 1982.
3. Jean Paul Trembley and Paul G. Sorenson, "An Introduction to Data Structures with Applications", McGraw-Hill, 1984
4. R. Kruse Et Al, "Data Structures and Program Design in C", Pearson Education, 2006
5. Lipschutz, "Data Structures", Schaum's Outline Series, TMH, 2014
6. GAV Pai, "Data Structures and Algorithms", TMH, 2009

Online Resources

1. https://archive.nptel.ac.in/courses/106/102/106102064/

Course Articulation Matrix														
PO-PSO	**PO1**	**PO2**	**PO 3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**	**PSO1**	**PSO2**
CO1	**1**	**2**	**1**										**1**	
CO2	**1**	**1**	**2**										**1**	
CO3	**2**	**1**	**2**										**1**	
CO4	**2**	**2**	**2**										**1**	

Program	B. Tech CSE				
Year	II	**Semester**	III		
Course Name	Digital Logic Design				
Code	NCS4303				
Course Type	ESC	**L**	**T**	**P**	**Credit**
Pre-Requisite	Basic of computer fundamentals	3	0	0	3
Course Objectives	**1.** To Introduce the concept of digital and binary systems **2.** Able to design and analyse combinational logic circuits. **3.** Able to design and analyse sequential logic circuits. **4.** To reinforce theory and techniques taught in the classroom through experiments and projects in the laboratory.				
Course Outcomes					
CO1	Define different number systems, binary addition and subtraction, 2's complement representation and operations with this representation.				
CO2	Understand the different switching algebra theorems and apply them for logic functions.				
CO3	Define the Karnaugh map for a few variables and perform an algorithmic reduction of logic functions and combinational circuits				
CO4	Understand sequential circuits, like counters and shift registers, and to perform simple projects with them.				

Module	Course Contents	Contact Hrs.	Mapped CO
1	**Digital Design and Binary Numbers:** Binary Arithmetic, Negative Numbers and their Arithmetic, Floating point representation, Binary Codes, Cyclic Codes, Error Detecting and Correcting Codes, Hamming Codes. Min term and Max term Realization of Boolean Functions, **Gate-level minimization:** The map method up to four variable, don't care conditions, SOP and POS simplification, NAND and NOR implementation, Quine Mc - Cluskey Method (Tabular method).	30 Hours	CO1
2	**Combinational Logic:** Combinational Circuits, Analysis Procedure, Design Procedure, Binary Adder-Subtractor, Code Converters, Parity Generators and Checkers, Decimal Adder, Binary Multiplier, Magnitude Comparator, Decoders, Encoders, Multiplexers, Hazards and Threshold Logic. **Memory and Programmable Logic Devices:** Semiconductor Memories, RAM, ROM, PLA, PAL, Memory System design.	30 Hours	CO2, CO4
3	**Synchronous Sequential Logic:** Sequential Circuits, Storage Elements: Latches, Flip Flops, Analysis of Clocked Sequential circuits, state reduction and assignments, design procedure. Registers and Counters: Shift Registers, Ripple Counter, Synchronous Counter, Other Counters. **Asynchronous Sequential Logic:** Analysis procedure, circuit with latches, design procedure, reduction of state and flow table, race free state assignment, hazards.	30 Hours	CO3

Suggested Readings

1. Donald D. Givone, “Digital Principles and Design”, Tata MCGraw Hill.
2. Marcovitz : Introduction to logic Design ,Tata Mcgraw-hill Education (India) Pvt. Ltd.
3. Raj Kamal, ‖Digital Systems Principle and Design‖, Pearson Education.
4. Balbaniam, Carison, ‖Digital Logic Design Principles‖, Wiley Publications.
5. R.P. Jain, ―Modern Digital Electronics‖, McGraw Hill.

Online Resources

1. https://nptel.ac.in/courses/106105185
2. https://nptel.ac.in/courses/108106177

Course Articulation Matrix														
PO-PSO	**PO1**	**PO2**	**PO3**	**PO4**	**PO 5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO1 2**	**PSO1**	**PSO2**
CO1	**3**	**1**	**1**	**2**	**2**									
CO2	**2**	**2**	**2**	**1**	**2**									
CO3	**2**	**1**	**2**	**1**	**2**									
CO4	**3**	**2**	**2**	**2**	**3**									

Program	B. Tech CSE				
Year	II	**Semester**	III		
Course Name	Core and Advance Java				
Code	NCS4304				
Course Type	PCC	**L**	**T**	**P**	**Credit**
Pre-Requisite	Basic Programming Knowledge	3	0	0	3
Course Objectives	**1.** To impart the core language features of Java and its Application Programming Interfaces (API). **2.** To demonstrate the use of threads, exceptions, files and collection frameworks in Java. **3.** Understand the principles of inheritance, packages and interfaces. **4.** Gain knowledge in the concepts of exception handling, applet, swing and JDBC.				
Course Outcomes					
CO1	Understand to use the syntax and semantics of java programming language and basic concepts of OOP.				
CO2	Analyze reusable programs using the concepts of Inheritance, Multithreading, Polymorphism, Interfaces.				
CO3	Evaluate the concepts of Packages, String Handling and Exception handling to develop efficient and error free codes.				
CO4	Apply the concept of packages, inheritance and interfaces to event driven GUI and web related applications which mimic the real word scenarios.				

Module	Course Contents	Contact Hrs.	Mapped CO
1	**INTRODUCTION TO CORE JAVA PROGRAMMING** History and evolution, Features of java environment, Difference from C and C++, The java architecture, Java Development Kit, Types of java programs, A sample java program, Compilation and Execution, Variable Declaration, Data types in java, Java Tokens, Variable Declaration, Type casting and conversion, Arrays, Operators in java, Operators-Introduction, Operator Precedence, Control Statements, Introduction to classes, Instance Variables, Class Variables, Instances Methods, Constructors, Declaring Object, Garbage collection, Method Overloading, Constructor Overloading, this reference, Using objects in methods, Recursion, Access modifiers, Inner class.	30 Hours	CO1
2	**INHERITANCE, ABSTRACT CLASSES AND INERFACES, EXCEPTION HANDLING AND MULTITHRAEDED PROGRAMMING** Inheritance, Super class variables and subclass Objects, The super reference, Constructor chaining, Method overriding, The final keyword, Abstract Classes and Interfaces, The abstract classes, The abstract methods, Defining interface, Implementing interface, Extending interface, Interface References ,Exception handling, Hierarchy of exception classes, Types of exception, Exception classes, Uncaught exceptions, Handling Exception, User defined Exception ,Multithreaded Programming, The java Thread model, The runnable interface, The thread	30 Hours	CO2

	class, Thread creation, Thread's Life cycle, Thread scheduling, Synchronization and Deadlock, Inter-thread communication, Joining threads, Suspending, resuming and stopping threads.		
3	**PACKAGES, AWT, LAYOUT MANAGEMENT AND EVENT HANDLING, SWING, HANDLING STRING, INPUT OUTPUT CLASSES** Packages and access modifier, Recommended package naming convention, The Package Declaration, The CLASSPATH variable, The import statement, The java language packages , Importance of Package Design , Access Protection, Handling strings, Create Strings, Operations on strings, Character Extraction method, String comparison method, Searching and modifying strings, Data conversions and ValueOf( ) methods, the StringBuffer classes and its methods, Wrapper classes, Input and output classes, Hierarchy of classes in java.io package, File classes, InputStream and OutputStream classes. Applet Life Cycle, Running Applets, Methods of Applet class, Component Classes, Container Classes, Frame Window in an Applet, Menus Layout management and event handling, Event Listener interface, Swing packages, Structure of swing application, swing containers, JDBC architecture - JDBC connection.	30 Hours	CO3, CO4

Suggested Readings

1. E. Balagurusamy-2014- Programming with Java Third Edition- McGraw Hill Companies.
2. Patrick Naughton and HerbertzSchildt, "Java-2: The Complete Reference", TMH, 1999.
3. Paul Dietel and Harvey Deitel, "Java How to Program", PHI, 8th Ed., 2010.

Online Resources

1. **https://archive.nptel.ac.in/courses/106/105/106105191/**
2. **https://cse.iitkgp.ac.in/~dsamanta/java/index.htm**

Course Articulation Matrix

PO-PSO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	2	1	2	1	3							3	3	2
CO2	2		2	1	2							3	3	
CO3	2			1	2							2	2	
CO4	3	2	2		3							1	2	2

Program	B.Tech CSE				
Year	II	Semester	III		
Course Name	Data Structure Lab				
Code	NCS4352				
Course Type	PCC	L	T	P	Credit
Pre-Requisite	Basic knowledge of C language	0	0	2	1
Course Objectives	**1.** Understand various data representation techniques in the real world. **2.** Implement linear and non-linear data structures. **3.** Analyze various algorithms based on their time and space complexity. **4.** Develop real-time applications using suitable data structure.				
Course Outcomes					
CO1	Understand the concept of data structures and apply algorithm for solving problems like Sorting, searching, insertion and deletion of data.				
CO2	Understand linear data structures for processing of ordered or unordered data.				
CO3	Explore various operations on dynamic data structures like single linked list, circular linked list and doubly linked list				
CO4	Understand the binary search trees, hash function, and concepts of collision and its resolution methods				

S. No.	List of Experiments	Mapped CO
1	Implementation of List using Dynamic memory Allocation.	CO1
2	Implementation of Queue.	CO1
3	Implementation of Searching and Sorting Algorithms.	CO1
4	Array implementation of Stack.	CO2
5	Array implementation of Queue.	CO2
6	Array implementation of Circular Queue.	CO2
7	Array implementation of List	CO2
8	Implementation of Stack	CO3
9	Implementation of Circular Queue	CO3
10	Implementation of Tree Structures	CO4
11	Implementation of Binary Tree.	CO4
12	Implementation of Tree Traversal.	CO4
13	Implementation of Binary Search Tree.	CO4
14	Implementation of Insertion in BST.	CO4
15	Implementation of Deletion in BST.	CO4
16	Graph Implementation, BFS.	CO4
17	Graph Implementation, DFS.	CO4
18	Graph Implementation, Minimum cost spanning tree.	CO4
19	Graph Implementation, shortest path algorithm.	CO4

Online Resources

1. https://cse01-iiith.vlabs.ac.in/
2. https://cse.iitkgp.ac.in/~rkumar/pds-vlab/index1.html

Course Articulation Matrix														
PO-PSO	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PO 6**	**PO7**	**PO8**	**PO9**	**PO1 0**	**PO11**	**PO1 2**	**PSO1**	**PSO2**
CO1	**2**	**1**	**2**	**2**	**1**								**1**	**1**
CO2	**2**	**2**	**1**	**1**										
CO3	**2**	**2**	**2**	**3**	**2**									
CO4	**2**	**3**	**2**	**2**	**1**								**1**	**1**

Program	B. Tech CSE				
Year	II	**Semester**	III		
Course Name	Digital Logic Design Lab				
Code	NCS4353				
Course Type	ESC	**L**	**T**	**P**	**Credit**
Pre-Requisite	Basic knowledge of Hardware Devices	0	0	2	1
Course Objectives	1. To study the basic of various number systems, negative number representation, binary. 2. To study the combinational logic design of various logic and switching devices and their realization. 3. To study the sequential logic circuits design both in synchronous and asynchronous modes. 4. To study some of the programmable logic devices and their use in realization of switching functions.				
Course Outcomes					
CO1	Understand various types of number systems and their conversions.				
CO2	Design and implement variety of logical devices using combinational circuits concepts.				
CO3	Demonstrate and compare the construction of programmable logic devices and different types of ROM.				
CO4	Analyze sequential circuits like Registers and Counters using flip-flops.				

S. No.	List of Experiments	Mapped CO
1	Verification, Simplification and Realization of Boolean Expressions using Logic gates/Universal gates.	CO1
2	Realization of Binary to Gray code conversion and vice versa.	CO1
3	Realization of Half/Full adder and Half/Full Subtractors using logic gates.	CO2
4	Realization of parallel adder/Subtractors using 7483 chips.	CO2
5	BCD to Excess-3 code conversion and vice versa.	CO1
6	MUX/DEMUX–use of 74153, 74139 for arithmetic circuits and code converter.	CO2
7	Realization of One/Two-bit comparator and study of 7485 magnitude comparator.	CO3
8	Truth table verification of Flip-Flops: a. JK Master slave (ii) T type (iii) D type	CO4
9	Realization of 3-bit counters as a sequential circuit and MOD–N counter design (7476, 7490, 74192, 74193)	CO4
10	Perform Shift left; Shift right, SIPO, SISO, PISO, PIPO operations using 74S95.	CO4
11	Wiring and testing of Ring counter/Johnson counter	CO4
12	Wiring and testing of Sequence generator.	CO2

Online Resources

1. https://cse15-iiith.vlabs.ac.in/
2. https://nptel.ac.in/courses/117106086

Course Articulation Matrix														
PO-PSO	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**	**PSO1**	**PSO2**
CO1	**2**	**3**	**3**	**2**	**1**									
CO2	**2**	**2**	**3**	**2**										
CO3			**3**											
CO4	**3**	**2**	**3**	**2**										

Program	B. Tech CSE				
Year	II	**Semester**	III		
Course Name	Core and Advance Java Lab				
Code	NCS4354				
Course Type	PCC	**L**	**T**	**P**	**Credit**
Pre-Requisite	Basic coding Skills	0	0	2	1
Course Objectives	**1.** To write programs using abstract classes. **2.** To write programs for solving real world problems using java collection frame work. **3.** To write multithreaded programs. **4.** To write GUI programs using swing controls in Java..				
Course Outcomes					
CO1	Understand the programming concepts using Java.				
CO2	Able to write programs using Java Socket Programming and Applet.				
CO3	Able to write multithreaded programs and Strings.				
CO4	Able to write GUI programs using AWT controls in Java.				

S. No.	List of Experiments	Mapped CO
1	WAP that describes a class person. It should have instance variables to record name, age and salary. Create a person object. Set and display its instance variables.	CO1
2	Write a Java program to demonstrate Method overloading.	CO1
3	Write a java programs to demonstrate hierarchical inheritance.	CO1
4	Write a Java program to understand how to accept input using Scanner or BufferedReader and print output using System.out.println statement.	CO1
5	Write java program to create a user defined Exception class known as PayOutOfBoundsException. Organization does not offer basic salary less than 8000. If entered salary is less than 8000 then program should create an Exception of Type PayOutOfBoundsException. Program should calculate gross salary by considering salary parameters such as DA, HRA, CA, TA, Professional tax, TDS, PF etc.	CO2
6	Write java programs to create user defined threads by extending thread class and by implementing runnable.	CO3
7	Write a Java program to test if a given string contains the specified sequence of char values.	CO3
8	Write a java program where client sends a text and server receives and prints it using Java socket programming.	CO2
9	Write an Applet displaying line, rectangle, rounded rectangle, filled rectangle, filled rounded rectangle, circle, ellipse, arc, filled arc and polygon, all in different colors.	CO2
10	Write java program to create a registration form using AWT.	CO4

Online Resources

1. https://nptel.ac.in/courses/106/105/10610519

Course Articulation Matrix														
PO-PSO	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO1110**	**PO111**	**PO112**	**PSO1**	**PSO2**
CO1	**3**	**2**	**1**		**2**							**2**	**2**	
CO2	**3**	**2**	**2**		**3**							**3**	**3**	
CO3	**3**	**3**	**1**		**2**							**2**	**2**	
CO4	**3**	**3**	**3**		**3**							**3**	**3**	

Program	B.TECH: CSE/CSE-AI/CSE-CCML/CSE-IOTBC				
Year	II	**Semester**		III/IV	
Course Name	INDIAN CONSITUTION				
Code	NVC4301/NVC4401				
Course Type	CQAC	**L**	**T**	**P**	**Credit**
Pre-Requisite	The basic knowledge of Indian Constitutions	1	0	0	1
Course Objectives	**1.** To realise the significance of constitution of India to students from all walks of life and help them to understand the basic concepts of Indian constitution. To Know the need and importance of protecting traditional **2.** To identify the importance of fundamental rights as well as fundamental duties. **3.** To understand the functioning of Union, State and Local Governments in Indian federal system **4.** To learn procedure and effects of emergency, composition and activities of election commission and amendment procedure.				
Course Outcomes					
CO1	Understand the concept of Indian constitution.				
CO2	Identify the powers and functions of Supreme Court and High court.				
CO3	Analyse the role Governor and Chief Minister.				
CO4	Explain the district administration role and importance.				

Module	Course Contents	Contact Hrs.	Mapped CO
1	**Introduction to Indian Constitution** Constitution meaning of the term - The making of the Indian Constitution - Sources and constitutional history – Philosophy of Constituent Assembly - Citizenship, Preamble, Fundamental Rights and Duties, Directive Principles of State Policy. Union Government and its Administration Structure: President and Vice President: Role, power and position, PM and Council of ministers, Cabinet and Central Secretariat, LokSabha, RajyaSabha, The Supreme Court and High Court: Powers and Functions.	30 Hours	CO1, CO2
2	**The States and The Union Territories** State Government and its Administration: Governor - Role and Position - CM and Council of ministers, State Secretariat: Organisation, Structure and Functions – Relation between the Union and the States. **Local Administration** District's Administration Head - Role and Importance, Municipalities - Mayor and role of Elected Representative – Pachayati Raj: Functions PRI: Zilla Panchayat, Elected officials and their roles - Block level Organizational Hierarchy, Village level - Role of Elected and Appointed officials - Importance of grass-root democracy	30 Hours	CO3, CO4

Suggested Readings

1. Durga Das Basu, Introduction to the Constitution of India, Prentice – Hall of India Pvt.Ltd.. New Delhi
2. SubashKashyap, Indian Constitution, National Book Trust
3. J.A. Siwach, Dynamics of Indian Government & Politics
4. D.C. Gupta, Indian Government and Politics
5. H.M.Sreevai, Constitutional Law of India, 4th Edition, Universal Law Publication.

Online Resources

1. https://onlinecourses.nptel.ac.in/noc20_lw03/preview

Course Articulation Matrix														
PO-PSO	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**	**PSO1**	**PSO2**
CO1		**2**					**2**	**3**	**1**	**2**		**3**	**1**	
CO2		**3**					**1**	**2**	**3**	**2**		**1**	**2**	
CO3		**1**					**2**	**2**	**2**	**1**		**2**	**1**	
CO4		**2**					**1**	**3**	**2**	**2**		**2**	**2**	

Program	B. Tech CSE				
Year	II	**Semester**	IV		
Course Name	Database Management System				
Code	NCS4401				
Course Type	PCC	**L**	**T**	**P**	**Credit**
Pre-Requisite	Fundamentals of computer	3	1	0	4
Course Objectives	**1.** To introduce the basics of Database Management System **2.** Understanding the fundamental relational system, data model. **3.** Understanding the fundamental of architecture, and manipulations. **4.** To develop Understanding of Transaction Processing System, Concurrency control, and Recovery procedures in database.				
Course Outcomes					
CO1	Understand terms related to database design and management.				
CO2	Constructing conceptual data model.				
CO3	Understand the functional dependencies, normalization and using SQL				
CO4	Understand and applying issues of transaction processing and concurrency control				

Module	Course Contents	Contact Hrs.	Mapped CO
1	**Database System Concepts, Database Users, and Architecture** Introduction to Database System with example, Characteristics of the Database Approach, Users of Database System, Advantages and disadvantages of Using a DBMS, Implications of the Database Approach, Data Models, Schemas, and Instances, DBMS Architecture and Data Independence, Database Languages and Interfaces, The Components of Database System, Classification of Database Management Systems	30 Hours	CO1
2	**Data Modelling & Relational Database Management System** Data Modelling Using the Entity-Relationship Model, concepts, notation for ER diagram, mapping constraints, keys, Concepts of Super Key, candidate key, primary key, Entity Types, Entity Sets, and Attributes, Relationships, Relationship Types, Roles, and Structural Constraints, Strong vs Weak Entity Types, ER Diagrams, Naming Conventions, and Design Issues, Enhanced Entity-Relationship Modelling, Subclasses, Super classes, and Inheritance, Specialization and Generalization, Constraints and Characteristics of Specialization and Generalization, Modelling of UNION Types Using Categories, The Relational Data Model, Relational Constraints, and the Relational Algebra, Relational Model Concepts, Relational Constraints and Relational Database Schemas, Update Operations and Dealing with Constraint Violations, Basic Relational Algebra Operations, Additional Relational Operations, Examples of Queries in Relational Algebra	30 Hours	CO2
3	**SQL and Database Design Theory and Methodology** Structured Query Language- The Relational Database Standard, Data Definition, Constraints, and Schema	30 Hours	CO3

	Changes in SQL, Types of SQL Commands, SQL Operators and their Procedure, Insert, Delete, and Update Statements in SQL, Queries and Subqueries, Aggregate Functions, Joins, Unions, Intersection, Minus, Views (Virtual Tables) in SQL, Cursors, Triggers and PL/SQL, Functional Dependencies and Normalization for Relational Databases, Informal Design Guidelines for Relation Schemas, Functional Dependencies, Normal Forms Based on Primary Keys, General Definitions of Second and Third Normal Forms, Boyce-Codd Normal Form, Multivalued Dependencies and Fourth Normal Form, Join Dependencies and Fifth Normal Form		
4	**Transaction Processing, Concurrency Control and Database Recovery** Transaction Processing Concepts, Introduction to Transaction Processing, Transaction states and State Diagram, Transaction and System Concepts, Desirable Properties of Transactions, Schedules and Recoverability, Serializability of Schedules, Concurrency Control Techniques, Locking Techniques for Concurrency Control, Concurrency Control Based on Timestamp Ordering, Multiversion Concurrency Control Techniques, Validation (Optimistic) Concurrency Control Techniques, Granularity of Data Items and Multiple Granularity Locking, Database Recovery Techniques, Recovery Concepts, Recovery Techniques Based on Deferred Update, Recovery Techniques Based on Immediate Update, Shadow Paging, The ARIES Recovery Algorithm, Database Backup and Recovery from Catastrophic Failures	30 Hours	CO4

Suggested Readings

1. Data base System Concepts, Silberschatz, Korth, McGraw hill, Sixth Edition.

2. Fundamentals of Database Systems, Elmasri Navathe Pearson Education.

3. Data base Management Systems, Raghurama Krishnan, Johannes Gehrke, TATA McGrawHill 3rd Edition.

Online Resources

1. https://onlinecourses.nptel.ac.in/noc22_cs51/preview

2. https://www.udemy.com/topic/database-management/

Course Articulation Matrix														
PO-PSO	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**	**PSO1**	**PSO2**
CO1	1	2	1										1	1
CO2	2	2	2		2								2	2
CO3	2	1	3		2								2	2
CO4	2	2	2		3								2	2

Program	B. Tech CSE				
Year	II	Semester	IV		
Course Name	Operating Systems				
Code	NCS4402				
Course Type	PCC	**L**	**T**	**P**	**Credit**
Pre-Requisite	Basic Knowledge of Computer System.	3	1	0	4
Course Objectives	**1.** Understand the structure and functions of OS and analyse Processes, Threads and Scheduling algorithms. **2.** Analyse O.S concepts that include architecture mutual exclusion algorithms, deadlock detection algorithms and agreement. **3.** Understand the principles of concurrency and Deadlocks. **4.** Analyse various memory management schemes. Study I/O management and File systems.				
Course Outcomes					
CO1	Understanding of the concepts, structure and design of OS and Learning about Processes, Threads and Scheduling algorithms.				
CO2	Understand the principles of concurrency and Deadlock.				
CO3	Evaluate various memory management schemes.				
CO4	Analyse and Implement a prototype file system.				

Module	Course Contents	Contact Hrs.	Mapped CO
1	**Introduction to Operating System and Process Concept** Operating system and functions, Classification of Operating systems, Operating System Structure, Operating System Services, System call and System program, Process concept, Process state, Process control block, Context switching, Operation on process, Threads and their management, Benefits of multithreading, Types of threads, Threading issues, CPU-scheduling, Scheduling criteria, Scheduling Algorithms, Concurrent Processes, Inter Process Communication models and Schemes	30 Hours	CO1
2	**Process Synchronization and Deadlock** Process synchronization, Producer/Consumer Problem, Critical Section Problem, Peterson's solution, Synchronization of hardware, Semaphore, Classical-problem of synchronization, Deadlock, Deadlock characterization, Deadlock Prevention, Deadlock Avoidance, Resource allocation graph algorithm, Banker's algorithm, Deadlock detection, Recovery from deadlock	30 Hours	CO2
3	**Memory Management** Memory Management, Multiprogramming with fixed partitions, Multiprogramming with variable partitions, Paging, Segmentation, Paged segmentation, Virtual memory concepts, Demand paging, Performance of demand paging, Page replacement algorithms, Thrashing	30 Hours	CO3
4	**I/O Management and File System** File System Structure, File System Implementation, Directory Implementation and Allocation Methods, Free space Management, Kernel I/O Subsystems, Disk Structure, Disk Scheduling, Disk Management, Swap-Space	30 Hours	CO4

	Management		

Suggested Readings

1. Silberschatz, Galvin and Gagne, “Operating Systems Concepts”, Wiley Publication

2. Sibsankar Halder and Alex A Aravind, “Operating Systems”, Pearson Education

3. Harvey M Dietel, “An Introduction to Operating System”, Pearson Education

4. D M Dhamdhere, “Operating Systems: A Concept-based Approach”, TMH

5. William Stallings, “Operating Systems: Internals and Design Principles”, Pearson Education

Online Resources

1. https://onlinecourses.nptel.ac.in/noc21_cs72/preview

2. https://www.coursera.org/specializations/codio-introduction-operating-systems

Course Articulation Matrix														
PO-PSO	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**	**PSO1**	**PSO2**
CO1	1	1	1	2	3							1	1	
CO2	2	3	2	1	1								1	2
CO3	2	2	1	1	2							2	2	1
CO4	2	1	2	3	2								1	

Program	B. Tech CSE				
Year	II	**Semester**	IV		
Course Name	Software Engineering				
Code	NCS4403				
Course Type	PCC	**L**	**T**	**P**	**Credit**
Pre-Requisite	Basics of Computer Application.	3	0	0	3
Course Objectives	**1.** Study the basic concepts and functions of Software Engineering. **2.** To understand the phases in a software project. **3.** To understand the fundamental concepts of requirement engineering and analysis Modeling. **4.** Learn various Designing and Testing techniques.				
Course Outcomes					
CO1	Understand and implementation of different software development process Models. Extracting and analyzing software requirements specifications for different projects.				
CO2	Analyze with software prototypes and to select, use Software metrics. Defining the basic concepts and importance of Software project management concepts like cost estimation, scheduling and reviewing the progress.				
CO3	Evaluate the written reports and software Documentation evaluated by both peer and faculty. Applying different testing and debugging techniques and analyzing their effectiveness.				
CO4	Apply the concepts of software quality and reliability on the basis of International quality standards.				

Module	Course Contents	Contact Hrs.	Mapped CO
1	**INTRODUCTION :** Introduction to Software Engineering, Software Engineering Approaches, Defining the Problem, Developing a solution strategy, Planning and development process, Software Life Cycle Models, Visual Modelling, Software Development Methods, Software Cost Estimation, Staffing Level Estimation, Estimating Software Maintenance Cost.	30 Hours	CO1
2	**Software Requirement:** Software Requirement Specification**,** Formal Requirement Speciation**,** Formal Requirement Verification**,** Axiomatic Specification**,** Algebraic Specification. **Computer-aided software engineering (CASE),** Software reuse, Component-based software development, Extreme programming	30 Hours	CO2
3	**Software Design:** Software Design Paradigms**,** Function Oriented Software Design**,** Object Oriented Design**,** UML, Design Patterns**,** User Design Interface Pattern, Coding**,** Software Testing**,** Unit Testing**,** Integration and System Testing**,** Debugging Techniques. **Software Quality and Maintenance:** Software Quality & Maintenance, Software quality standards, SEI CMM and ISO-9001, Software reliability and fault-tolerance, Software Project Management, Software project planning, Software monitoring and control, Software maintenance	30 Hours	CO3, CO4

Suggested Readings

1. Rajib Mall, “Fundamentals of Software Engineering”, Prentice Hall India.
2. Pankaj Jalote, “An integrated approach to Software Engineering”, Springer/Narosa.
3. Roger S. Pressman, “Software Engineering: A practitioner's approach”, McGraw Hill.
4. Ian Sommerville, “Software Engineering”, Addison-Wesley.

Online Resources

1. https://nptel.ac.in/courses/106105182
2. https://onlinecourses.swayam2.ac.in/cec20_cs07

Course Articulation Matrix														
PO-PSO	**PO 1**	**PO 2**	**PO 3**	**PO 4**	**PO 5**	**PO 6**	**PO 7**	**PO 8**	**PO 9**	**PO10**	**PO11**	**PO12**	**PSO 1**	**PSO 2**
CO1	2	1											2	
CO2			2	1									2	
CO3					3									1
CO4												1		1

Program	B. Tech CSE				
Year	II	**Semester**	IV		
Course Name	Computer Organization & Architecture				
Code	NCS4404				
Course Type	PCC	**L**	**T**	**P**	**Credit**
Pre-Requisite	Knowledge of Digital Logic Design	3	1	0	4
Course Objectives	**1.** To Study of the basic structure and operation of a digital computer system. **2.** To understand how computer are constructed by a set of functional units. **3.** Ability to analyse memory hierarchy and its impact on computer cost/performance. **4.** Analyzing fundamental issues in architecture design and their impact on application performance.				
Course Outcomes					
CO1	Identify the basic structure and function unit of a digital computer.				
CO2	Understanding and analyze the effect of addressing modes and instructions				
CO3	Understanding Control Unit and ALU				
CO4	Understanding Interrupts and I/O				

Module	Course Contents	Contact Hrs.	Mapped CO
1	**Computer Evolution & Arithmetic** A Brief History of computers: Von Neumann Architecture, Hardware Architecture, Computer Components, Interconnection Structures, Bus Interconnection, Register Transfer Language, Bus and Memory Transfers, Bus Architecture, Bus Arbitration Techniques, Arithmetic Logic, Shift Micro operation, Arithmetic Logic Shift Unit, Arithmetic Algorithms (Addition, subtraction, Booth Multiplication, Division).	30 Hours	CO1
2	**Control Unit** Control Design: Hardwired & Micro Programmed, Performing of arithmetic or logical operations, Multiple Bus organization, Hardwired Control, Micro programmed control, Microinstruction, Micro program sequencing, Wide-Branch addressing, Microinstruction with Next-address field, Prefetching, Microinstruction, Pipeline control: Instruction pipelines, Pipeline performance.	30 Hours	CO2
3	**Processor Organization and Input-Output Organization** Processor Design: General register organization, Stack organization, Addressing mode, Instruction format, Data transfer & manipulations, Program Control, Reduced Instruction Set, Computer Memory Organization: Basic concept and hierarchy, semiconductor RAM memories,2D&2 1/2D memory organization, ROM memories, Cache memories, Concept and design issues & performance, Address mapping and replacement, Auxiliary memories: Magnetic disk, Magnetic tape and optical disks, Virtual memory, Concept implementation.	30 Hours	CO3

4	**Interrupts** Interrupt hardware, Types of interrupts and exceptions, Modes of Data Transfer: Programmed I/O, Interrupt initiated I/O, Direct Memory Access: I/O channels and processors, Serial Communication: Synchronous & asynchronous communication, Standard communication interfaces	30 Hours	CO4

Suggested Readings

1. Patterson, "Computer Organization and Design", Elsevier Publication.

2. Vravice, Hmacher & Zaky,"Computer Organization", TMH.

3. Moris Mano,"Computer System Architecture", PHI.

4. John P Hays,"Computer Organization", McGraw Hill.

5. Tannenbaum, "Structured Computer Organization", PHI.

6. P Pal Chaudhry," Computer Organization & Design", PHI.

Online Resources

1. https://nptel.ac.in/courses/106102062

2. https://archive.nptel.ac.in/courses/106/105/106105163/

Course Articulation Matrix														
PO-PSO	**PO 1**	**PO 2**	**PO 3**	**PO 4**	**PO 5**	**PO 6**	**PO 7**	**PO 8**	**PO 9**	**PO10**	**PO 11**	**PO 12**	**PSO 1**	**PSO 2**
CO1	**2**	**1**												
CO2	**2**	**1**	**1**	**1**										
CO3	**2**	**1**	**1**	**1**										
CO4	**2**	**1**	**1**	**1**										

Program	B. Tech CSE (AI)				
Year	II	Semester		IV	
Course Name	Database Management System Lab				
Code	NCS4451				
Course Type	PCC	L	T	P	Credit
Pre-Requisite	Fundamentals of computer knowledge	0	0	2	1
Course Objectives	**1.** Students are able to designing, developing database. **2.** Students are able to querying a database. **3.** Students are able to take backup and rollback database **4.** Students are able to write functions and procedure				
Course Outcomes					
CO1	Infer database language commands to create simple database				
CO2	Analyze the database using queries to retrieve records				
CO3	Applying PL/SQL for processing database				
CO4	Develop solutions using database concepts for TCL Commands				

S. No.	List of Experiments	Mapped CO
1	Write the queries for Data Definition and Data Manipulation Language.	CO1
2	Write SQL queries using logical operations (=, <,>, etc).	CO1
3	Write SQL queries using SQL operators.	CO2
4	Write SQL query using character, number, date and group functions.	CO1
5	Write SQL queries for extracting data from more than one table.	CO4
6	Write SQL queries for sub queries, nested queries.	CO2
7	Write programme by the use of PL/SQL.	CO3
8	Concepts for ROLL BACK, COMMIT.	CO4
9	Create VIEWS and understand its concept	CO3
10	Create CURSORS and understand its concept.	CO3

Online Resources

1. http://vlabs.iitkgp.ernet.in/se/4/theory/
2. https://vsit.edu.in/vlab.html

Course Articulation Matrix														
PO-PSO	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**	**PSO1**	**PSO2**
CO1	3	3	1		2								1	1
CO2	3	2	2	1	1								2	1
CO3	2	3	1	1	2							2	2	1
CO4	3	3		1	2								3	1

Program	B. Tech CSE				
Year	II	**Semester**		IV	
Course Name	Software Engineering Lab				
Code	NCS4453				
Course Type	PCC	**L**	**T**	**P**	**Credit**
Pre-Requisite	A course on Programming for Problem Solving.	0	0	2	1
Course Objectives	**1.**To introduce the object-oriented programming concepts **2**. To understand object-oriented programming concepts, and apply them in solving problems. **3.**To introduce the principles of inheritance and polymorphism; and demonstrate how they relate to the design of abstract classes **4.**To introduce the implementation of packages and interfaces				
Course Outcomes					
CO1	Ability to translate end-user requirements into system and software requirements				
CO2	Ability to generate a high-level design of the system from the software requirements				
CO3	To have hands on experience in developing a software project by using various software engineering principles and methods in each of the phases of software development.				
CO4	To have hands on experience in developing a software project by using various software engineering principles and methods in each of the phases of software development.				

S. No.	List of Experiments	Mapped CO
1	Class Diagram Of Online Railway Reservation System	CO1
2	Class Diagram Of Library Management System	CO1
3	Use-Case Model For Student Admission System In A University	CO3
4	Develop Use-Case Diagram For Library Where A Member Can Perform Two Operation Issue Book And Return It A Book Is Issue To A Member After Verifying His Credential	CO1
5	Use-Case Diagram For A Travel Agent	CO1
6	UML Sequence Diagram For Information System For Online Book Store	CO4
7	UML Class And Sequence Diagram For Car Manufacturing	CO1
8	State Transition Diagram For Online Air Reservation System	CO3
9	Deployment Diagram For Different Scenarios Of Railway System	CO2
10	Develop test cases for various white box and black box testing techniques	CO3

Online Resources

1. http://vlabs.iitkgp.ernet.in/se/7/
2. http://vlabs.iitkgp.ernet.in/se/

Course Articulation Matrix														
PO-PSO	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**	**PSO1**	**PSO2**
CO1	**3**	**3**	**3**	**1**	**3**							**2**	**3**	**1**
CO2	**3**	**3**	**3**	**1**	**3**							**2**		
CO3	**3**	**3**	**2**	**2**	**3**							**2**	**3**	**2**
CO4	**3**	**3**	**2**	**1**	**3**							**2**		

Program	B.TECH: CSE/CSE-AI/CSE-CCML/CSE-IOTBC				
Year	II	**Semester**		III/IV	
Course Name	NSS/YOGA				
Code	NCC4351/NCC4451				
Course Type	CQAC	**L**	**T**	**P**	**Credit**
Pre-Requisite	Fundamental Concepts of Yoga	2	0	0	0
Course Objectives	**1.** To enable the student to have good health. **2.** To practice mental hygiene. **3.** To possess emotional stability. **4.** To integrate moral values. And To attain higher level of consciousness.				
Course Outcomes					
CO1	To Understand the Concept of Yoga and its Historical Development.				
CO2	To Analyse the relevance of Yoga in modern age and its scope.				
CO3	To Apply, the Concept of Yoga in different texts.				
CO4	To evaluate the difference between Yogic and non-yogic system of exercises.				

Module	Course Contents	Contact Hrs.	Mapped CO
1	**General Introduction of Yoga:** Yoga it's Origin, Meaning, Definition & Objectives, Historical Development of Yoga, Relevance of Yoga in modern age and scope, Misconceptions about Yoga and their solutions, Difference between yogic and non-yogic system of exercises.	30 Hours	CO1, CO2
2	**Yoga Practices**. **1.Asanas** Yoga Stretching, Surya namaskar (Warming-up), Standing Asana, Sitting Asana, Prone position Asana, Supine position Asana, Meditative Asana, Relaxation Asana **2.Pranayam-** • Surya Anuloma Viloma/Surya Bhedana Pranayama • Chandra Anuloma Viloma/Chandra Bhedana Pranayama • Ujjayi Pranayama • Kumbhaka Pranayama • Sampoorna Yoga Shwasana (Full Yogic Breathing) **3.Meditation and Mudras**	30 Hours	CO3, CO4

Suggested Readings

1. Prof. Ramharsh Singh – Yoga Avam Yoga Chikitsa, Chaukhambha Sanskrit Pratishthan, Delhi-07 2.
2. K.S. Joshi - Yoga in Daily Life, Orient Paper Back Publication, New Delhi, 1985
3. Vijnananand Saraswati - Yoga Vigyan, Yoga Niketan Trust, Rishikesh, 1998.
4. Rajkumari Pandey-Bhartiya Yoga Parampara ke Vividh Ayam, Radha Publication, New Delhi, 2008

Online Resources

1. Yoga and Positive Psychology for Managing Career and Life - Course (nptel.ac.in) https://nptel.ac.in/courses/106105218
2. NPTEL :: Management - NOC:Yoga and Positive Psychology for Managing Career and Life.

Course Articulation Matrix														
PO-PSO	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**	**PSO1**	**PSO2**
CO1							**2**	**2**				**2**		**2**
CO2							**2**	**2**				**2**		**2**
CO3							**1**	**2**				**2**		**2**
CO4							**2**	**2**				**2**		**2**

Program	B. Tech CSE				
Year	III	**Semester**	V		
Course Name	Microprocessor and Interfacing				
Code	NCS4502				
Course Type	PCC	**L**	**T**	**P**	**Credit**
Pre-Requisite	Computer organisation and Architecture	3	1	0	4
Course Objectives	**1.** To understand basic architecture of 16 bit and 32 bit microprocessor. **2.** To implement interfacing from microprocessors based system to peripheral device**s.** **3.** To learn how the hardware and software components of a microprocessor based system work together to implement system-level features; **4.** To understand techniques for faster execution of instructions and improve speed of operation and performance of microprocessor.				
Course Outcomes					
CO1	Design and conduct experiments related to microprocessor based system design and to analyze their outcomes.				
CO2	Design, debug and test a small scale microprocessor system				
CO3	Design system using memory chips and peripheral chips for 16 bit 8086 microprocessor.				
CO4	Identify, formulate, and solve engineering problems in microprocessor based system design.				

Module	Course Contents	Contact Hrs.	Mapped CO
1	**Introduction: Memory & Microprocessor** Introduction: Memory Unit-Primary Memory: RAM,SRAM, DRAM, ROM, PROM, EPROM and EEPROM, Secondary Memory: Magnetic Memory,Tap, disc; cache memory; Real and virtual memory; Addressing capacity of CPU; Evolution of Microprocessor and its types; Microprocessor architecture and operation of its components; Addressing modes Interrupts; Data transfer schemes;Instruction and data flow; Timer and timing diagram;Interfacing devices; Architectural advancement of microprocessors; Typical microprocessor development schemes.	30 Hours	CO1
2	**8085 Microprocessor** 8 bit Microprocessor: Internal architecture; PIN diagram; interrupt and machine cycle; Instruction sets: Addressing modes; Instruction Classification; machine control and assembler directives; Technical features of: The Pentium, Pentium Pr Micro Processor, Pentium II, Pentium III, Pentium – IV Microprocessor	30 Hours	CO2
3	8086 Microprocessor & Assembly Language Programming 16-bit Microprocessor: Architecture of 8086 microprocessor, Register organization, Bus interface unit, Execution unit, Memory addressing, Operating modes; Instruction sets: Instruction format, Types of instructions; Introduction to 8086 family: Procedure and macros, connection, Timing and Troubleshooting, Interrupts. Programming: Assembly language programming based on Intel 8085/8086:	30 Hours	CO3

	Instructions- data transfer, arithmetic, logic, branch operations, looping, counting, indexing, programming techniques, counters and time delays, stacks, subroutines, Conditional calls and returns instructions; Introduction to Debugging program; Modular programming; Structured programming; Top-down; Bottom-up design; MACRO microprogramming.		
4	**Peripheral Interfacing** Introduction to Peripheral Devices 8237 4.2 DMA Controller;8255 programmable peripheral interface; 8253/8254 programmable timer/counter; 8259 programmable interrupt controller; 8251 USART and RS232C.	30 Hours	CO4

Suggested Readings

1. Gaonkar, Ramesh S: "Microprocessor Architecture, Programming and Applications with 8085", Penram International Publishing.
2. Ray A K , Bhurchandi K M : "Advanced Microprocessors and Peripherals", TMH
3. Hall D V: "Microprocessor Interfacing", TMH
4. Liu and Gibson G A: "Microcomputer System: The 8086/8088 family'', PHI
5. Aditya P Mathur: "Introduction to Microprocessor", TMH
6. Brey, Barry B: "INTEL Microprocessors", PHI
7. Renu Singh & B. P. Singh, "Microprocessor, Interfacing and Applications", 8. M Rafiqzzaman, "Microprocessors, Theory and Applications", Prentice Hall,1992

Online Resources

1. https://archive.nptel.ac.in/courses/108/105/108105102/

Course Articulation Matrix														
PO-PSO	**PO1**	**PO 2**	**PO3**	**PO4**	**PO 5**	**PO6**	**PO7**	**PO 8**	**PO9**	**PO10**	**PO11**	**PO12**	**PSO 1**	**PSO2**
CO1	**1**			**1**	**2**								**2**	**1**
CO2		**2**	**1**		**2**								**2**	
CO3	**2**	**1**	**2**											**3**
CO4		**2**	**1**		**2**							**2**	**1**	**2**

Program	B. Tech CSE				
Year	III	**Semester**	V		
Course Name	Computer Networks				
Code	NCS4503				
Course Type	PCC	**L**	**T**	**P**	**Credit**
Pre-Requisite	Knowledge of Computer Operations	3	0	0	3
Course Objectives	**1.** To understand the organization of computer networks with the concept of layered approach **2.** To understand the working of computer networks hardware like LAN, Switch, Hub etc. **3.** To understand the concept of data communication **4.** To understand the concept of various routing and protocols used in data communication				
Course Outcomes					
CO1	Explain basic concepts of OSI reference model and TCP/IP model and networks devices and transmission media, Analog and digital data transmission				
CO2	Describe the functions Data link layer and Network layer				
CO3	Describe the functions Transport, Session and Presentation layer				
CO4	Describe the functions Application Layer				

Module	Course Contents	Contact Hrs.	Mapped CO
1	**Introduction** Introduction: Network objectives and applications; network structure and architecture; OSI reference model; network services; network standardization; examples of network, TCP/IP model **Physical layer:** Fundamentals of data communication; transmission media; analog transmission; digital transmission; switching; ISDN; terminal handling; Broadcast channels and medium access: LAN protocols	30 Hours	CO1
2	**Data link layer and Network layer** **Data link layer:** Design issues; error detection and corrections; elementary data link protocols; sliding window protocols. Examples; **Network layer**: Design issues; routing algorithms; congestion control; internetworking. Examples. CSMA with collision detection; collision free protocols; IEEE standard 802 for LANs; comparison of LANs; Fiber optic network and FDDI.	30 Hours	CO2
3	**Transport, Session and Presentation layer** **Transport layer:** Design Issues; connection management; example of a simple transport protocol. **Session layer:** Design issues; remote procedure call; examples, Presentation layer: Design issues; data compression and encryption; network security and privacy.	30 Hours	CO3, CO4

	Examples; **Application Layer** Design issues; File transfer and file access; electronic mail; virtual terminals; other applications, Case study based on available network software.		

Suggested Readings

1. Andrew S. Tanenbaum "Computer Networks" Prentice Hall of India

2. William Stallings "Local Networks" Maxwell Macmillan International Edition.

3. B.A. Frozen "Data Communication and Networking". Tata McGraw Hill.

Online Resources

1. https://nptel.ac.in/courses/106105183

2. https://archive.nptel.ac.in/courses/106/105/106105081/

Course Articulation Matrix														
PO-PSO	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**	**PSO1**	**PSO2**
CO1	**1**	**1**											**1**	**1**
CO2	**2**	**1**	**1**										**1**	**1**
CO3	**2**	**1**	**1**										**1**	**1**
CO4	**2**	**1**	**1**									**1**	**1**	**1**

Program	B. Tech CSE					
Year	III	**Semester**	V			
Course Name	Automata Theory and Formal Languages					
Code	NCS4504					
Course Type	PCC	**L**	**T**	**P**	**Credit**	
Pre-Requisite	Discrete Mathematics, Data Structure	3	1	0	4	
Course Objectives	**1.** To illustrate finite state machines to solve problems in computing **2.** To explain the hierarchy of problems arising in the computer sciences. **3.** To familiarize Regular grammars, context frees grammar. **4.** To determine the decidability and intractability of computational problems.					
Course Outcomes						
CO1	Apply the knowledge of automata theory, grammars & regular expressions for solving the problem					
CO2	Analyse the give automata, regular expression & grammar to know the language it represents					
CO3	Design Automata & Grammar for pattern recognition and syntax checking.					
CO4	Identify limitations of some computational models and possible methods of proving them					

Module	Course Contents	Contact Hrs.	Mapped CO
1	**Fundamentals:** Formal Languages, Strings, Alphabets, Languages, Chomsky Hierarchy of languages. **Finite Automata:** Introduction to Finite State machine, Acceptance of strings and languages, Deterministic finite automaton (DFA) and Non-deterministic finite automaton (NFA), Equivalence of NFA and DFA – Equivalence of NDFAs with and without €-moves, Minimization of finite automata, Equivalence between two DFA's, Finite automata with output – Moore and Mealy machines, conversion of Moore to Mealy and Mealy to Moore.	30 Hours	CO1
2	**Regular Languages:** Regular expressions, Identity rules, Conversion of a given regular expression into a finite automaton, Conversion of finite automata into a regular expression, Pumping lemma for regular sets, Closure properties of regular sets**.** **Context Free Grammars:** Context free grammars and languages, Derivation trees, Leftmost and rightmost derivation of strings and Sentential forms, Ambiguity, left recursion and left factoring in context free grammars, Minimization of context free grammars, Normal forms for context free grammars, Chomsky normal form, Greibach normal form, Pumping Lemma for Context free Languages, Closure and decision properties of context free languages.	30 Hours	CO2
3	**Pushdown Automata:** Introduction to Pushdown automata, Acceptance of context free languages, Acceptance by final state and acceptance by empty state and its equivalence,	30 Hours	CO3

	Equivalence of context free grammars and pushdown automata, Inter-conversion.		
4	**Turing Machine (TM):** Problems That Computers Cannot Solve, The Turing Machine, Programming Techniques for Turing Machines ,Extensions to the Basic Turing Machine, Restricted Turing Machines, Turing Machines and Computers, Definition of Post's Correspondence Problem, A Language That Is Not Recursively Enumerable, An Undecidable Problem That Is RE, Context sensitive languages and Chomsky hierarchy, Other Undecidable Problems	30 Hours	CO4

Suggested Readings

1. Introduction to Languages and Automata Theory By John C Martin, Tata McGraw-Hill

2. Introduction to computer theory By Deniel I. Cohen ,Joh Wiley & Sons, Inc

3. Computation: Finite and Infinite By Marvin L. Minsky Prentice-Hall

Online Resources

1. https://nptel.ac.in/courses/106104028/theory of computation.

2.https://lagunita.stanford.edu/courses/coursev1:ComputerScience+Automata+SelfPaced/about

Course Articulation Matrix														
PO-PSO	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**	**PSO1**	**PSO2**
CO1	**3**	**3**	**3**	**2**	**1**							**1**	**2**	**1**
CO2	**3**	**3**	**2**	**2**	**1**							**2**	**1**	**1**
CO3	**3**	**3**	**2**	**2**	**2**							**2**	**3**	**1**
CO4	**3**	**2**	**1**	**1**	**2**							**2**	**2**	**1**

Program	B. Tech CSE				
Year	III	**Semester**	V		
Course Name	Computer Graphics				
Code	NCS4505				
Course Type	PCC	**L**	**T**	**P**	**Credit**
Pre-Requisite	C programming, Data structures, Linear Algebra in Mathematics	2	1	0	3
Course Objectives	**1.** Identify and explain the core concepts of computer graphics. **2.** To learn various line and circle drawing algorithm. **3.** To learn the basic principles of 3D Computer graphics. **4.** Providing an understanding of mapping from world coordinate to device coordinate, clipping and projection.				
Course Outcomes					
CO1	Understand the basics of computer graphics, different graphics systems and applications of computer graphics.				
CO2	Apply the 2D graphics transformations, composite transformation and Clipping concepts.				
CO3	Analyse the concept of graphics primitives such as lines and circle based on different algorithms.				
CO4	Evaluate the concepts of and techniques used in 3D computer graphics, including viewing transformations.				

Module	Course Contents	Contact Hrs.	Mapped CO
1	**INRODUCTION TO COMPUTER GRAPHICS, GRAPHIC DISPLAYS, LINE AND CIRCLE DRAWING ALGORITHM** Introduction and Line Generation: Types of computer graphics, Graphic Displays- Random scan displays, Raster scan displays, Frame buffer and video controller, Points and lines, Line drawing algorithms, Circle generating algorithms, Midpoint circle generating algorithm, and parallel version of these algorithms	30 Hours	CO1
2	**TRANSFORMATIONS, WINDOWING AND CLIPPING** Transformations: Basic transformation, Matrix representations and homogenous coordinates, Composite transformations, Reflections and shearing. Windowing and Clipping: Viewing pipeline, Viewing transformations, 2-D Clipping algorithms- Line clipping algorithms such as Cohen Sutherland line clipping algorithm, Liang Bar sky algorithm, Line clipping against non-rectangular clip windows; Polygon clipping – Sutherland Hodge man polygon clipping, Weiler and Atherton polygon clipping, Curve clipping, Text clipping.	30 Hours	CO2
3	**3-D TRANSFORMATION** Three Dimensional: 3-D geometric primitives, 3-D Object representation, 3-D Transformation, 3-D viewing, projections, 3-D Clipping. **CURVES AND SURFACES, HIDDEN LINES AND SURFACES AND BASIC ILLUMINATION MODEL** Curves and Surfaces: Quadric surfaces, Spheres, Ellipsoid, Blobby objects, Introductory concepts of Spline, Bspline	30 Hours	CO3, CO4

	and Bezier curves and surfaces. Hidden Lines and Surfaces: Back Face Detection algorithm, Depth buffer method, A-buffer method, Scan line method, basic illumination models– Ambient light, Diffuse reflection, Specular reflection and Phuong model,		

Suggested Readings

1. Donald Hearn and M Pauline Baker, "Computer Graphics with OpenGL", Pearson education
2. Donald Hearn and M Pauline Baker, "Computer Graphics C Version", Pearson Education
3. Amrendra N Sinha and Arun D Udai," Computer Graphics", Tata MCGraw Hill.
4. R.K. Maurya, "Computer Graphics " Wiley Dreamtech Publication.
5. Rogers, " Procedural Elements of Computer Graphics", McGraw Hill
6. Mukherjee, Fundamentals of Computer graphics & Multimedia, PHI Learning Private Limited, Delhi India.

Online Resources

1. https://nptel.ac.in/courses/106106090
2. https://nptel.ac.in/courses/106102063

Course Articulation Matrix														
PO-PSO	**PO 1**	**PO 2**	**PO 3**	**PO 4**	**PO 5**	**PO 6**	**PO 7**	**PO 8**	**PO 9**	**PO 10**	**PO 11**	**PO 12**	**PSO1**	**PSO2**
CO1	**3**	**1**	**2**		**2**							**1**	**3**	**2**
CO2	**3**	**1**	**2**		**2**							**1**	**2**	**2**
CO3	**3**	**1**	**3**	**2**	**2**							**1**	**3**	**2**
CO4	**3**		**3**	**2**	**1**								**3**	**2**

Program	B. Tech CSE				
Year	III	**Semester**	V		
Course Name	Computer Graphics Lab				
Code	NCS4555				
Course Type	PCC	**L**	**T**	**P**	**Credit**
Pre-Requisite	C programming, Data structures, Linear Algebra in Mathematics	0	0	2	1
Course Objectives	**1**. The main objective of the course is to introduce students with fundamental concepts and theory of computer graphics. **2.**It presents the important drawing algorithm, polygon fitting, clipping and 2D transformation curves and an introduction to 3D transformation. **3**.It provides the basics of OpenGL application programming interface which allows students to develop programming skills in CG**.** **4.**To teach students theory, technology, procedures, and skills in computer graphics and multimedia				
Course Outcomes					
CO1	Explain the applications, areas, and graphic pipeline, display, and hardcopy technologies.				
CO2	Apply and compare the algorithms for drawing 2D images also explain aliasing, anti-aliasing, and half toning techniques.				
CO3	Discuss OpenGL application programming Interface and apply it for 2D & 3D computer graphics.				
CO4	Analyze and apply clipping algorithms and transformation on 2D images.				

S. No.	List of Experiments	Mapped CO
1	To implement DDA algorithm for Line and Circle.	CO2
2	To implement Brenham's algorithms for line, circle, and ellipse drawing	CO2
3	To implement Mid-Point Circle algorithm using C.	CO2
4	To implement Mid-Point Ellipse algorithm using C.	CO2
5	To perform 2D Transformations such as translation, rotation, scaling, reflection and sharing.	CO1
6	To implement Cohen–Sutherland 2D clipping and window–viewport mapping.	CO4
7	To implement Liang Barksy Line Clipping Algorithm.	CO4
8	To perform 3D Transformations such as translation, rotation, and scaling.	CO3
9	To perform animation using any Animation software	CO3
10	To perform basic operations on image using any image editing software and draw different shapes such as hut, face, kite, fish etc.	CO3

Online Resources

1. https://cse18-iiith.vlabs.ac.in/
2. https://legends2k.github.io/note/cg_resources/

Course Articulation Matrix														
PO-PSO	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**	**PSO1**	**PSO2**
CO1	**2**	**3**	**3**		**3**							**3**	**3**	**2**
CO2	**2**		**3**										**3**	**3**
CO3		**3**	**2**											**3**
CO4	**2**	**2**	**2**										**2**	

Program	B. Tech CSE				
Year	III	**Semester**	V		
Course Name	Computer Networks Lab				
Code	NCS4553				
Course Type	PCC	**L**	**T**	**P**	**Credit**
Pre-Requisite	Basic of Networking.	0	0	2	1
Course Objectives	**1.** Understanding the concepts of Networking. **2.** Studying about different Stuffing Concepts. **3.** Gaining knowledge of different Topologies. **4.** Applying the various concepts in the real world.				
Course Outcomes					
CO1	1. Understand the concepts of Network Cables and Network Commands.				
CO2	2. Analyze the use of Local Area Networks.				
CO3	3. Evaluate the performance of different programs related to Networking.				
CO4	4. Design and Apply different Topologies through simulation.				

S. No.	List of Experiments	CO Mapping
1	Study of different type of Network cables and practically implement the cross wired cable.	CO1
2	Study and implementation of basic network command and network configuration commands.	CO1
3	Connect the computers in local area network.	CO2
4	To write a socket program for implementation of echo.	CO2
5	Write a program in C to perform character stuffing.	CO3
6	Write a program in C to perform Bit stuffing.	CO3
7	Implement CRC (Cyclic redundancy check) in C.	CO3
8	Write a program in C to implement sliding window protocol.	CO3
9	To create Scenario and Study the performance of Ring topology through simulation.	CO4
10	To create Scenario and Study the performance of Bus topology through simulation.	CO4

Online Resources

1. http://vlabs.iitkgp.ac.in/ant/1/

Course Articulation Matrix														
PO-PSO	**PO 1**	**PO 2**	**PO 3**	**PO 4**	**PO 5**	**PO 6**	**PO 7**	**PO 8**	**PO 9**	**PO 10**	**PO 11**	**PO 12**	**PSO1**	**PSO2**
CO1	3	2	2	1	2							1	2	1
CO2	2	3	2	2	1							1	2	3
CO3	3	2	2	1	3							1	3	2
CO4	3	2	2	1	2							2	3	1

Program	B.TECH:CSE/CSE-AI/CSE-CCML/CSE-IOTBC				
Year	III	**Semester**	V		
Course Name	ESSENCE OF INDIAN TRADITIONAL KNOWLEDGE				
Code	NVC4501				
Course Type	CQAC	**L**	**T**	**P**	**Credit**
Pre-Requisite	The Concepts Of Indian Traditional Knowledge And To Make ThemUnderstand The Importance of Roots Of Knowledge System.	1	0	0	1
Course Objectives	**1.** To Understand the concept of Traditional knowledge and its importance **2.** To Know the need and importance of protecting traditional **3.** To Apply, Know the various enactments related to the protection of traditional knowledge **4.** To Understand the concepts of Intellectual property to protect the traditional.				
Course Outcomes					
CO1	To Understand and elucidate the basic knowledge of traditional knowledge to develop the physical and social changes in traditional knowledge systems.				
CO2	To Analyse the significance of traditional knowledge protection to communicate the traditional knowledge information				
CO3	To Apply toRecognize the role of government on traditional knowledge to measure its impact on the global economy.				
CO4	To Evaluate and Summarize the strategies of patents and global legal FORA for excel protection of Indian traditional knowledge				

Module	Course Contents	Contact Hrs.	Mapped CO
1	**INTRODUCTION TO TRADITIONAL KNOWLEDGE** *Introduction to Indian Traditional Knowledge:* Understanding the concept and significance of Indian Traditional Knowledge, Historical background, and evolution of traditional knowledge in India. *Intellectual Property Rights (IPR):* Overview of Intellectual Property Rights and its importance in the context of traditional knowledge, Different types of IPRs: Copyright, Trademarks, Patents, and Geographical Indications. *Traditional Knowledge and Traditional Cultural Expressions (TCEs):* Introduction to Traditional Cultural Expressions and the challenges in their protection, Examination of international frameworks like the WIPO Intergovernmental Committee on Intellectual Property and Genetic Resources, Traditional Knowledge, and Folklore. *Traditional Knowledge and Traditional Ecological Knowledge (TEK)* Understanding the relationship between traditional	30 Hours	CO1, CO2

	knowledge and traditional ecological knowledge, Analysis of the role of TEK in environmental conservation and sustainable development.		
2	**TRADITIONAL KNOWLEDGE AND IPR LAWS IN INDIA** *Traditional Knowledge and IPR Laws:* Study of the legal framework for the protection of traditional knowledge in India, Examination of relevant laws and regulations, such as the Traditional Knowledge Digital Library (TKDL), Traditional Knowledge and Patent Law: Understanding the challenges and issues surrounding the patenting of traditional knowledge, Analysis of case studies highlighting the controversies and debates in the field. *Traditional Knowledge and Copyright Law:* Exploring the relationship between traditional knowledge and copyright law, Discussion on the issues of cultural appropriation and protection of traditional expressions. *Traditional Knowledge and Geographical Indications (GI):*Overview of Geographical Indications and their significance in protecting traditional knowledge, Case studies on the successful registration and protection of traditional products and practices. *Traditional Knowledge, IPR, and the Future*: Analysis of the current trends and future prospects for the protection and preservation of Indian traditional knowledge, Examination of emerging issues such as digital platforms and traditional knowledge dissemination.	30 Hours	CO3, CO4

Suggested Readings

1. Traditional Knowledge System in India, by Amit Jha, 2009.
2. Traditional Knowledge System and Technology in India by Basanta Kumar Mohanta and Vipin Kumar Singh, Pratibha Prakashan 2012.
3. Traditional Knowledge System in India by Amit Jha Atlantic publishers, 2002.
4. Sampath, P. G. (2012). Traditional Knowledge Systems and Intellectual Property Rights. Routledge.
5. Sharma, G., & Kumar, V. (Eds.). (2016). Indian Traditional Knowledge and Intellectual Property Rights: Innovations in Traditional Knowledge Preservation. Springer.
6. Ganguli, P. (2010). Indian Traditional Knowledge and Intellectual Property Rights: Indigenous Community Initiatives. Ane Books Pvt Ltd.

Online Resources

1. https://aec.edu.in/knowledge/
2. https://www.iare.ac.in/?q=node/3745

Course Articulation Matrix														
PO-PSO	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**	**PSO1**	**PSO2**
CO1								**1**	**2**	**2**		**2**		**1**
CO2								**2**	**2**	**4**		**3**		**2**
CO3								**1**	**1**	**4**		**2**		**2**
CO4								**2**	**2**	**3**		**1**		**2**

Program	B. Tech CSE				
Year	III	**Semester**	VI		
Course Name	Design & Analysis of Algorithms				
Code	NCS4602				
Course Type	PCC	**L**	**T**	**P**	**Credit**
Pre-Requisite	Data Structure	3	1	0	4
Course Objectives	**1.** Analyse the asymptotic performance of algorithms. **2.** Proving correctness of algorithms. **3.** Demonstrate a familiarity with major algorithms and data structures. **4**. Apply important algorithmic design paradigms and methods of analysis.				
Course Outcomes					
CO1	Analyse the problem and design an efficient algorithm to solve it by using & modifying classical design techniques or creating a new solution technique				
CO2	Evaluate and compare those using standard mathematical techniques and select the best solution				
CO3	Understand the mathematical criterion for deciding whether an algorithm is efficient, and know many practically important problems that do not admit any efficient algorithms.				
CO4	Apply the different kind of complexities and develop non deterministic solution to problems having large complexities.				

Module	Course Contents	Contact Hrs.	Mapped CO
1	**Introduction and Advanced Data Structure:** Notion of Algorithm, Analysis of algorithms, Designing of Algorithms, Growth of Functions, Master's Theorem Asymptotic Notations and Basic Efficiency Classes, Shorting and Searching Algorithm: Insertion Sort Selection Sort and Bubble Sort Divide and conquer - Merge sort , Quick Sort, Heap Sort, Sequential Search and Binary Search	30 Hours	CO1
2	**Advanced Data Structures**: Red-Black Trees, B – Trees, Binomial Heaps, and Fibonacci Heaps. **Greedy Methods** with Examples Such as Optimal Reliability Allocation, Knapsack, Minimum Spanning Trees – Prim's and Kruskal's Algorithms, Single Source Shortest Paths - Dijkstra's and Bellman Ford Algorithms.	30 Hours	CO2
3	**Dynamic Programming** with Examples Such as Knapsack. All Pair Shortest Paths – Warshal's and Floyd's Algorithms, Resource Allocation Problem, Matrix chain multiplication Backtracking, Branch and Bound with Examples Such as Travelling Salesman Problem, Graph Coloring, n-Queen Problem, Hamiltonian Cycles and Sum of Subsets.	30 Hours	CO3
4	**Selected Topics:** String Matching-The naive method, Rabin-Karp method, Boyer-Moore, Knuth-Morris-Pratt(KMP) Theory of NP-Completeness, Approximation Algorithms and Randomized Algorithms	30 Hours	CO4

Suggested Readings

1. Thomas H. Coreman, Charles E. Leiserson and Ronald L. Rivest, “Introduction to Algorithms”, Printice Hall of India.
2. E. Horowitz & S Sahni, "Fundamentals of Computer Algorithms",
3. Aho, Hopcraft, Ullman, “The Design and Analysis of Computer Algorithms” Pearson Education, 2008.
4. LEE "Design & Analysis of Algorithms (POD)",McGraw Hill

Online Resources

1. https://nptel.ac.in/courses/106106131

Course Articulation Matrix														
PO-PSO	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**	**PSO1**	**PSO2**
CO1	1	3	3	1	3								1	3
CO2	1	1	1	2	3								1	3
CO3	2	2	1	2	2								2	2
CO4	1	2	1	3	1								1	2

Program	B. Tech CSE				
Year	III	**Semester**	VI		
Course Name	Compiler Design				
Code	NCS4604				
Course Type	PCC	**L**	**T**	**P**	**Credit**
Pre-Requisite	Automata Theory	3	1	0	4
Course Objectives	**1.** To apply the theory of language translation to build compilers and interpreters. **2.** Building of translators both from scratch and using compiler generators. **3.** Identifies and explores the main issues of the design of translators. **4.** The construction of a compiler/interpreter for a small language				
Course Outcomes					
CO1	Understand different phases and passes of the compiler and use the compiler tools like LEX, YACC, etc.				
CO2	Analyse the concepts of parser and its types.				
CO3	Understanding translation and applying it.				
CO4	Applying code generation and optimization on target machine				

Module	Course Contents	Contact Hrs.	Mapped CO
1	**Introduction to Compiler:** Phases and passes, Bootstrapping, Finite state machines and regular expressions and their applications to lexical analysis, Optimization of DFA-Based Pattern Matchers implementation of lexical analyzers, lexical-analyzer generator, LEX compiler, Formal grammars and their application to syntax analysis, BNF notation, ambiguity, YACC. The syntactic specification of programming languages: Context free grammars, derivation and parse trees, capabilities of CFG. **Basic Parsing Techniques:** Parsers, Shift reduce parsing, operator precedence parsing, top down parsing, predictive parsers.	30 Hours	CO1
2	**Automatic Construction of efficient Parsers:** LR parsers, the canonical Collection of LR(0) items, constructing SLR parsing tables, constructing Canonical LR parsing tables, Constructing LALR parsing tables, using ambiguous grammars, an automatic parser generator, implementation of LR parsing tables. Parse trees & syntax trees, three address code, quadruple & triples, translation of assignment statements, Boolean expressions, statements that alter the flow of control, postfix translation, translation with a top down parser.	30 Hours	CO2, CO3
3	**Syntax-directed Translation:** Syntax-directed Translation schemes, Implementation of Syntax directed Translators, Intermediate code, postfix notation. **More about translation:** Array references in arithmetic expressions, procedures call, declarations and case statements. **Symbol Tables:** Data structure for symbols tables, representing scope information. Run-Time Administration:	30 Hours	CO3

	Implementation of simple stack allocation scheme, storage allocation in block structured language.		
4	**Error Detection & Recovery:** Lexical Phase errors, syntactic phase errors semantic errors. **Code Generation:** Design Issues, the Target Language. Addresses in the Target Code, Basic Blocks and Flow Graphs, Optimization of Basic Blocks, Code Generator. Code optimization: Machine-Independent Optimizations, Loop optimization, DAG representation of basic blocks, value numbers and algebraic laws, Global Data-Flow analysis.	30 Hours	CO4

Suggested Readings

1. Aho, Sethi& Ullman, "Compilers: Principles, Techniques and Tools", Pearson Education.
2. K. Muneeswaran,CompilerDesign,FirstEdition,Oxford University Press.
3. J.P. Bennet, "Introduction to Compiler Techniques", Second Edition, McGraw-Hill,2003.
4. HenkAlblas and Albert Nymeyer, "Practice and Principles of Compiler Building with C", PHI, 2001.
5. V Raghvan, " Principles of Compiler Design", McGraw-Hill.
6. Kenneth Louden," Compiler Construction", Cengage Learning.
7. Charles Fischer and Ricard LeBlanc," Crafting a Compiler with C", Pearson Education.

Online Resources

1. https://nptel.ac.in/courses/106104123

2. https://nptel.ac.in/courses/106105190

Course Articulation Matrix														
PO-PSO	**PO1**	**PO2**	**PO 3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO 8**	**PO9**	**PO10**	**PO11**	**PO1 2**	**PSO1**	**PSO2**
CO1	3	2	1	1	1							1	2	1
CO2	3	3	2	1	2							2	1	2
CO3	3	3	2	2	3							2	2	1
CO4	3	2	1	1	1							1	1	1

Program	B. Tech CSE				
Year	III	Semester		VI	
Course Name	Algorithms Lab				
Code	NCS4652				
Course Type	PCC	L	T	P	Credit
Pre-Requisite	Command on Programming Language	0	0	2	1
Course Objectives	**1.** Analyze the asymptotic performance of algorithms. **2.** Write rigorous correctness proofs for algorithms. **3.** Demonstrate a familiarity with major algorithms and data structures. **4.** Apply important algorithmic design paradigms and methods of analysis.				
Course Outcomes					
CO1	Implement various search techniques				
CO2	Implement various sorting techniques.				
CO3	Implement backtracking strategy.				
CO4	Implement various greedy and dynamic programming techniques.				

S. No.	List of Experiments	Mapped CO
1	Program for Recursive Binary & Linear Search.	CO1
2	Implement Merge Sort.	CO2
3	Implement Quick Sort (Divide & Conquer).	CO2
4	Implement Heap Sort.	CO2
5	Implement Knapsack problem (Greedy ALGO.).	CO4
6	Implement Insertion Sort.	CO2
7	Implement Shortest path by Dijkstra Algorithm.	CO1
8	Implement 8- Queen problem (Back Tracking).	CO3
9	Implement Prim's Algorithms.	CO1
10	Implement Kruskal's Algorithm.	CO4

Online Resources

1. https://cse01-iiith.vlabs.ac.in/exp/sorting/
2. http://ebootathon.com/labs/beta/csit/DAA/exp1/simulation.html

Course Articulation Matrix														
PO-PSO	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**	**PSO1**	**PSO2**
CO1	**3**	**2**	**1**	**3**	**1**							**1**	**2**	**3**
CO2	**3**	**2**	**3**	**1**	**1**							**1**	**2**	**3**
CO3	**1**	**3**	**2**	**2**	**1**								**1**	
CO4	**1**	**2**	**3**	**1**	**2**							**2**	**2**	**2**

Program	B Tech CSE				
Year	III	**Semester**		VI	
Course Name	Compiler Design Lab				
Code	NCS4654				
Course Type	Lab	**L**	**T**	**P**	**Credit**
Pre-Requisite	Concept of Data Structures and Theory of Automata & Formal Languages.	0	0	2	1
Course Objectives	1. To understand the various phases in the design of a compiler 2. To understand the design of top-down and bottom-up parsers 3.To understand syntax directed translation schemes. 4.To introduce lex and yacc tools.				
Course Outcomes					
CO1	Ability to design, develop, and implement a compiler for any language.				
CO2	Implement a parser for different context free grammars.				
CO3	Implement code optimization techniques.				
CO4	Able to use lex and yacc tools for developing a scanner and a parser.				

S. No.	List of Experiments	CO Mapped
1	Implementation of LEXICAL ANALYZER for IF STATEMENT.	CO1
2	Implementation of LEXICAL ANALYZER for ARITHMETIC EXPRESSION.	CO4
3	Construction of NFA from REGULAR EXPRESSION.	CO2
4	Construction of DFA from NFA.	CO2
5	Implementation of SHIFT REDUCE PARSING ALGORITHM.	CO3
6	Implementation of OPERATOR PRECEDENCE PARSER.	CO3
7	Implementation of RECURSIVE DESCENT PARSER	CO4
8	Implementation of LALR PARSER	CO1
9	Implementation of CODE OPTIMIZATION TECHNIQUES.	CO2
10	Implementation of CODE GENERATOR.	CO2

Online Resources

1. https://nptel.ac.in/courses/106108113

2. https://github.com/topics/compiler-design?o=desc&s=updated

Course Articulation Matrix														
PO-PSO	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO 10**	**PO 11**	**PO 12**	**PSO 1**	**PSO 2**
CO1	**3**	**3**	**3**	**3**					**3**	**3**		**3**	**3**	
CO2	**3**	**3**		**3**					**2**	**3**			**3**	
CO3	**3**	**3**	**2**	**3**					**3**	**3**		**3**	**3**	
CO4	**3**	**3**		**2**	**3**				**3**	**3**			**2**	

Program	B. Tech CSE				
Year	IV	Semester		VII	
Course Name	Distributed Systems				
Code	NCS4701				
Course Type	PEC	L	T	P	Credit
Pre-Requisite	Operating System	3	1	0	4
Course Objectives	**1.** To learn issues related to clock synchronization and the need for global state in Distributed system. **2.** Have knowledge and understanding of the main principles, techniques and Methods involved when dealing with distributed systems. **3.** To get the knowledge of how distributed objects communicate by means of Remote invocation. **4.** To learn distributed mutual exclusion and Deadlock detection algorithms.				
Course Outcomes					
CO1	Understand the foundations and issues of distributed systems.				
CO2	Analyze distributed applications work and requirements they aim to satisfy				
CO3	Evaluate the various synchronization issues and global state for distributed system.				
CO4	Apply distributed applications work, techniques and infrastructures they are built upon.				

Module	Course Contents	Contact Hrs.	Mapped CO
1	**Introduction to distributed systems:** Definitions and Examples of Distributed systems; System Models: Architectural modelsand Fundamental models; limitations of distributed systems. **Logical Clocks:** Lamport‘s clocks, Vector logical clock, NTP; Message Passing System: Causal ordering of messages, Sates of a Distributed system, Local and Global State, Consistent and inconsistent states; Termination detection.	30 Hours	CO1
2	**Mutual Exclusion:** Requirements of Mutual Exclusion, Classification of distributed mutual exclusion: Non-token based Quorum Based and Token Based mutual exclusion with examples; Performance metric for distributed mutual exclusion algorithms. **Deadlock Detection:** System models, Preliminaries, Deadlock prevention, Deadlock avoidance, Deadlock detection & resolution. **Agreement Protocols:** Classification of Agreement Problem: Byzantine agreement problem, Consensus problem, Interactive consistency Problem; Solution to Byzantine Agreement problem; Application of Agreement problem.	30 Hours	CO2
3	**Resource Management:** Distributed File Systems, Issues in distributed File System, Mechanism for building distributed file systems ; Distributed Shared Memory, Design issues in Distributed Shared Memory, Algorithm for Implementation of Distributed Shared Memory.	30 Hours	CO3

4	**Failure Recovery:** Backward and Forward recovery, Recovery in Concurrent systems: Checkpoints; Recovery in Distributed Database Systems; Fault Tolerance: Issues in Fault Tolerance, Voting Protocols.	30 Hours	CO4

Suggested Readings

1. Singhal&Shivaratri, "Advanced Concept in Operating Systems", McGraw Hill
2. Ramakrishna, Gehrke," Database Management Systems", McGraw Hill
3. Vijay K.Garg Elements of Distributed Compuitng , Wiley
4. Coulouris, Dollimore, Kindberg, "Distributed System: Concepts and Design", Pearson Education
5. Tenanuanbaum, Steen," Distributed Systems", PHI

Online Resources

1. https://onlinecourses.nptel.ac.in/noc21_cs87/preview
2. https://archive.nptel.ac.in/courses/106/106/106106168/

Course Articulation Matrix														
PO-PSO	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PO 6**	**PO7**	**PO8**	**PO9**	**PO1 0**	**PO11**	**PO1 2**	**PSO1**	**PSO2**
CO1	**1**	**2**	**1**	**1**	**2**							**2**	**2**	**1**
CO2	**1**	**2**	**2**	**2**	**2**							**2**	**2**	**2**
CO3	**1**	**2**	**2**	**2**	**2**							**2**	**2**	**1**
CO4	**2**	**2**	**2**	**2**	**2**							**2**	**2**	**2**

Program	B. Tech CSE				
Year	IV	**Semester**		VII	
Course Name	Soft Computing				
Code	NCS4702				
Course Type	PCC	**L**	**T**	**P**	**Credit**
Pre-Requisite	Discrete Mathematics	2	1	0	3
Course Objectives	**1.** Learn the basic concept of fuzzy set theory. **2.** Understand the working principle of various AI techniques and heuristic search algorithms. **3.**Learn about the architecture of artificial neural networks and implement them in fuzzy environment. **4**. Study the concept behind genetic algorithm and its various operations. learn different levels of CPN Networks and ART algorithms.				
Course Outcomes					
CO1	Apply the algorithms which can work as an intelligent production system.				
CO2	Understand various learning methods in artificial neural networks, like: supervised and unsupervised learning.				
CO3	Familiar about the various mutation and cross over techniques of genetic algorithm for producing new strings.				
CO4	Design and Implement different predicate logic rules for solving any specific AI problem.				

Module	Course Contents	Contact Hrs.	Mapped CO
1	**Artificial Intelligence** Soft Computing; Introduction of soft computing, soft computing vs. hard computing, various types of soft computing techniques; Artificial neural networks, Fuzzy logic, Genetic Algorithms. Applications of soft computing. Artificial Intelligence; Introduction of AI. Production systems; Types of production systems, Characteristics of production systems. Search Algorithms; Breadth first search, Depth first search. Heuristic Search Algorithms; Hill Climbing, Best first Search, A* algorithm, AO* Algorithms. Knowledge representation issues. Prepositional and predicate logic. Forward Reasoning and backward reasoning. Weak & Strong Slot & filler structures. Natural Language Processing (NLP).	30 Hours	CO1
2	**Neural networks** Structure of Biological neuron; Neuron, Nerve Structure and synapse. Artificial Neuron and its model. Activation functions. Neural network architecture; Single layer feed forward networks, multilayer feed forward networks, Recurrent networks. Various learning techniques; Perceptron training algorithm; Linear separability, Widrow & Hebb's learning rule/Delta rule. ADALINE v/s MADALINE. Introduction of MLP and BPN. Error back propagation algorithm (EBPA); Characteristics and application of EBPA, momentum factor and limitation of EBPA. Difference between ANN and human brain.	30 Hours	CO2

	Characteristics and applications of ANN. Associative Memory and its characteristics. Counter propagation network (CPN); Architecture of CPN, functioning & characteristics of CPN. Hopfield/ Recurrent network. Hopfield v/s Boltzman machine. Adaptive Resonance Theory (ART); Architecture of ART, Classification and training of ART.		
3	**Fuzzy logic** Basic concepts of fuzzy logic. Fuzzy sets versus Crisp sets. Fuzzy set theory and operations. Properties of fuzzy sets and crisp sets. Fuzzy relations and Crisp relations. Fuzzy to Crisp conversion. Membership functions. Fuzzyfications & Defuzzifications. Fuzzy preposition. Fuzzy inference System. Fuzzy Rule Base. Fuzzy reasoning and decision making. Fuzzy Logic Controller (FLC). Formation, decomposition & aggregation of fuzzy rules. Industrial applications of Fuzzy.	30 Hours	CO3, CO4

Suggested Readings

1. S. Rajsekaran & G.A. Vijayalakshmi Pai, "Neural Networks, Fuzzy Logic and GeneticAlgorithm: Synthesis and Applications" Prentice Hall of India.
2. Sivanandani, Deepa, "Principles of Soft Computing", Wiley India (2007)
3. Jang J.S.R. Sun C.T. and Mizutani E., "Neuro-Fuzzy and Soft computing", Prentice Hall
4. Timothy J. Ross. "Fuzzy Logic with Engineering Applications", McGraw Hill.
5. Laurene Fausett. 'Fundamentals of Neural Networks", Prentice Hall
6. D.E. Goldbery, "Genetic Algorithms: Search, Optimization and Machine Learning". Addison Wesley.

Online Resources

1. https://archive.nptel.ac.in/courses/106/105/106105173/
2. https://www.youtube.com/watch?v=K9gjuXjJeEM

Course Articulation Matrix														
PO-PSO	**PO 1**	**PO 2**	**PO 3**	**PO 4**	**PO 5**	**PO 6**	**PO 7**	**PO 8**	**PO 9**	**PO10**	**PO11**	**PO12**	**PSO 1**	**PSO 2**
CO 1	**3**	**2**	**3**	**2**	**3**							**1**	**2**	**2**
CO 2	**3**	**2**	**1**	**2**	**2**							**3**	**1**	**2**
CO 3	**3**	**1**	**2**	**3**	**1**							**2**	**2**	**1**
CO 4	**2**	**2**	**3**	**1**	**1**							**1**	**2**	**2**

Program	B. Tech. CSE				
Year	IV	**Semester**	VII		
Course Name	Distributed Systems Lab				
Code	NCS4751				
Course Type	PCC	**L**	**T**	**P**	**Credit**
Pre-Requisite	NA	**0**	**0**	**2**	**1**
Course Objectives	**1.** Understand the concepts of Distributed Systems. **2.** Design the programs related to Distributed Systems. **3.** Analyze the performance of the programs. **4.** Apply the concepts of Distributed Systems in real world.				
Course Outcomes					
CO1	Understand the design principles in distributed systems and the architectures for distributed systems.				
CO2	Apply various distributed algorithms related to clock synchronization, concurrency control, deadlock detection, load balancing, voting etc.				
CO3	Analyze fault tolerance and recovery in distributed systems and algorithms for the same.				
CO4	Evaluate different distributed algorithms over current distributed platforms.				

S. No.	List of Experiments	CO Mapping
1	Simulate the functioning of Lamport's Logical Clock in 'C'.	CO2
2	Simulate the Distributed Mutual Exclusion in 'C'.	CO1
3	Implement a Distributed Chat Server using TCP Sockets in 'C'.	CO1
4	Implement RPC mechanism for a file transfer across a network in 'C'	CO2
5	Implement 'Java RMI' mechanism for accessing methods of remote systems.	CO3
6	Simulate Balanced Sliding Window Protocol in 'C'.	CO3
7	Implement CORBA mechanism by using 'C++' program at one end and 'Java program on the other.	CO4
8	Program to implement edge chasing distributed deadlock detection algorithm.	CO3
9	Program to implement locking algorithm.	CO4
10	Program to implement termination detection.	CO4

Online Resources

1. https://www.vlab.co.in/broad-area-computer-science-and-engineering

Course Articulation Matrix														
PO-PSO	**PO 1**	**PO 2**	**PO 3**	**PO 4**	**PO 5**	**PO 6**	**PO 7**	**PO 8**	**PO 9**	**PO 10**	**PO 11**	**PO 12**	**PSO 1**	**PSO 2**
CO1	3	2	3	2	2						2	3	3	2
CO2	2	3	2	3	2						2	2	2	1
CO3	2	3	1	2	2						2	3	3	2
CO4	3	2	2	2	2						2	3	3	2

Program	B. Tech CSE				
Year	IV	**Semester**	VIII		
Course Name	Essentials of Machine Learning				
Code	NCS4801				
Course Type	PCC	**L**	**T**	**P**	**Credit**
Pre-Requisite	Python, Probability and Statistics	3	0	0	3
Course Objectives	**1.** Acquire knowledge on setting hypotheses for problems. **2**. Appling machine learning techniques to solve problems. **3.** Evaluate the performance of machine learning algorithms. **4.** Identify an object or person in a digital image and take appropriate action.				
Course Outcomes					
CO1	Understanding machine learning strategies, hypothesis testing and python.				
CO2	Understanding and Appling Supervised learning techniques.				
CO3	Analyse and Appling Advanced Supervised Learning techniques				
CO4	Understanding and Appling Unsupervised learning techniques.				

Module	Course Contents	Contact Hrs.	Mapped CO
1	**Introduction to Machine** Learning Introduction, Supervised, Unsupervised, reinforcement, Learning, Version Spaces, Finite and, Infinite Hypothesis Spaces, Tests of Hypotheses Using Statistics, Z-test, P- test, F test, Chi-square, Analysis of Variance (ANOVA)	30 Hours	CO1
2	**Supervised Learning Algorithms** Learning a Class from Examples, Linear, Non-linear, Multi-class and Multi-label classification, Decision Trees: ID3, Classification and Regression Trees (CART), Regression: Linear Regression, Multiple Linear Regression, Logistic Regression. **Advanced Supervised Learning** Neural Networks: Introduction, Perceptron, Multilayer Perceptron, Support vector machines: Linear and Non-Linear, Kernel Functions, K-Nearest Neighbors.	30 Hours	CO2, CO3
3	**Unsupervised Learning** Introduction to clustering, Hierarchical: AGNES, DIANA, Partitional: K-means clustering, K-Mode Clustering, Self-Organizing Map, Expectation Maximization, Gaussian Mixture Models, Principal Component Analysis (PCA), Locally Linear Embedding (LLE), Factor Analysis	30 Hours	CO4

Suggested Readings

1.Mehryar Mohri, AfshinRostamizadeh, AmeetTalwalkar "Foundations of Machine Learning", MIT Press, 2012.
2.Tom Mitchell, "Machine Learning", McGraw Hill, 3"iEdition,1997.
3.Charu C. Aggarwal, "Data Classification Algorithms and Applications", CRC Press, 2014.
4.Stephen Marsland, "Machine Learning — An Algorithmic Perspective", 2nd Edition, CRC Press, 2015.

5.Kevin P. Murphy "Machine Learning: A Probabilistic Perspective", The MIT Press, 2012
6.Hiawei Han and MichelineKamber and Jian Pei, "Data Mining —Concepts and Techniques", 3rd Edition,Morgan Kaufmann Publications, 2012.

Online Resources

1.https://nptel.ac.in/courses/106106139

Course Articulation Matrix													
PO-PSO	**PO 1**	**PO 2**	**PO 3**	**PO 4**	**PO 5**	**PO 6**	**PO 7**	**PO 8**	**PO 9**	**PO 10**	**PO 11**	**PO 12**	**PS O1**	**PS O2**
CO1	**2**	**2**										**1**	**3**	**2**
CO2	**2**	**2**										**1**	**2**	**2**
CO3	**2**	**2**	**3**									**1**	**3**	**2**
CO4	**2**	**2**	**2**		**2**							**1**	**3**	**2**

Program	B. Tech				
Year		**Semester**			
Course Name	Database Administration				
Code	OE43211				
Course Type	OE	**L**	**T**	**P**	**Credit**
Pre-Requisite	Oracle Database	3	1	0	4
Course Objectives	**1**.To Understand the concept of Database Management **2**. To introduce students to the basic database management administration concepts and practice on the Oracle environment. **3**.To explain what a database management system is as well as their components and models. **4**.To Create and understand the application of user roles, privileges, and the security of the database.				
Course Outcomes					
CO1	Understand the database approach and the file system approach. Explain what a database management system is as well as their components and models.				
CO2	Evaluate how relational algebra / relational calculus is used to construct queries for data definition commands and data manipulation commands in SQL.				
CO3	Apply the process of normalization and design normalized relations				
CO4	Analyze what tables, indexes, and views are as well as their importance and effect.				

Module	Course Contents	Contact Hrs.	Mapped CO
1	Design, model and install any database management systems by using Oracle database as sample. Plan, design, construct, control and manage database instances, database network environment	30 Hours	CO1
2	storage structures,usersecurity,database backup and recovery, database maintenance.Define and devise transaction management, concurrency control, crash recovery components	30 Hours	CO2
3	Examine and perform data base administration roles and operations by using Oracle database system as a sample.	30 Hours	CO3
4	Compare and contrast by examining the database systems and new trends in data storage, data retrieval and maintenance techniques.	30 Hours	CO4

Suggested Readings

1.Physical Database Design, Lightstone/Teorey/Nadeau,MorganKaufman,2007, Publisher: ELSEVIER
2.Database Design and Implementation, Edward Sciore,Wiley,2008
3.Databases and Transaction Processing, Lewis, Bernstein, Kifer, Addison Wesley, 2001

Online Resources

1. https://nptel.ac.in/courses/106105175

Course Articulation Matrix													
PO-PSO	**PO 1**	**PO 2**	**PO 3**	**PO 4**	**PO 5**	**PO 6**	**PO 7**	**PO 8**	**PO 9**	**PO 10**	**PO 11**	**PO 12**	**PS O1**	**PS O2**
CO1	**2**	**2**										**1**	**3**	**2**
CO2	**2**	**2**										**1**	**2**	**2**
CO3	**2**	**2**	**3**									**1**	**3**	**2**
CO4	**2**	**2**	**2**		**2**							**1**	**3**	**2**

Program	B. Tech				
Year		**Semester**			
Course Name	Computational Intelligence				
Code	OE43221				
Course Type	OE	**L**	**T**	**P**	**Credit**
Pre-Requisite	Statistics Artificial Intelligence	3	1	0	4
Course Objectives	**1.** To know the fundamentals of rule based systems and fuzzy expert systems. **2.** To acquire the knowledge of artificial neural networks. **3.** To understand the concepts of evolutionary computations. **4.** To expose the concepts of hybrid intelligent systems.				
Course Outcomes					
CO1	Understand the concepts of Computational Intelligence.				
CO2	Analyse the searching techniques used in problem solving.				
CO3	Evaluate the learning of models used in Computational Intelligence.				
CO4	Apply the Computational Intelligence techniques.				

Module	Course Contents	Contact Hrs.	Mapped CO
1	**Introduction** Introduction to Artificial Intelligence-Search-Heuristic Search-A* algorithm-Game Playing- Alpha-Beta Pruning-Expert systems-Inference-Rules-Forward Chaining and Backward Chaining- Genetic Algorithms. **Knowledge Representation And Reasoning** Proposition Logic, First Order Predicate Logic, Unification. Forward Chaining, Backward Chaining.	30 Hours	CO1
2	Resolution, Knowledge Representation, Ontological Engineering, Categories and Objects, Events, Mental Events and Mental Objects, Reasoning Systems for Categories, Reasoning with Default Information, Prolog Programming. **Uncertainty** Non monotonic reasoning-Fuzzy Logic, Fuzzy rules, fuzzy inference, Temporal Logic, Temporal Reasoning, Neural Networks, Neuro-fuzzy Inference.	30 Hours	CO2
3	**Learning** Probability basics, Bayes Rule and its Applications, Bayesian Networks, Exact and Approximate Inference in Bayesian Networks, Hidden Markov Models, Forms of Learning, Supervised Learning, Learning Decision Trees, Regression and Classification with Linear Models, Artificial Neural Networks, Nonparametric Models, Support Vector Machines, Statistical Learning, Learning with Complete Data, Learning with Hidden Variables, The EM Algorithm, Reinforcement Learning.	30 Hours	CO3
4	**Intelligence And Applications** Natural language processing, Morphological Analysis, Syntax analysis, Semantic Analysis, Language Models, Information Retrieval, Information Extraction, Machine Translation, Machine Learning.	30 Hours	CO4

Suggested Readings

1. Andries P Engelbrecht, "Computational Intelligence: An Introduction", Wiley-Blackwell
2. Eberhart, "Computational Intelligence", Elsevier, First Edition
3. Amit Konar, "Computational Intelligence: Principles, Techniques and Applications", Springer

Online Resources

1. https://www.udemy.com/course/cipython/
2. https://nptel.ac.in/courses/106102220
3. https://nptel.ac.in/courses/106105077

Course Articulation Matrix													
PO-PSO	**PO 1**	**PO 2**	**PO 3**	**PO 4**	**PO 5**	**PO 6**	**PO 7**	**PO 8**	**PO 9**	**PO 10**	**PO 11**	**PO 12**	**PSO 1**	**PSO 2**
CO1	**3**	**2**	**2**	**2**	**3**							**1**	**2**	**2**
CO2	**1**	**3**	**2**	**3**	**2**							**2**	**2**	**2**
CO3	**3**	**3**	**3**	**2**	**3**							**1**	**1**	**1**
CO4	**3**	**3**	**1**	**2**	**3**							**1**	**2**	**2**

Program					
Year	II	**Semester**		III	
Course Name	Programming with Python				
Code	NVC43241				
Course Type	VOC	**L**	**T**	**P**	**Credit**
Pre-Requisite	C Programming	2	0	0	2
Course Objectives	**1.** To have strong foundation on Python Programming. **2.** Develop analytical ability on different real world situations. **3.** Mapping and respective conversion of real world problems to Python Programs. **4.** Capability to work with large amount of data for analytical purpose Using Python.				
Course Outcomes					
CO1	Understand and write simple Python programs.				
CO2	Analysis of conditions in a problem and implement it in program.				
CO3	Design of Python blocks using functions and their evaluation using function call.				
CO4	Apply input/output with files in Python for secondary storage management and to apply OOPs concepts for analysis of real world problems.				

Module	Course Contents	Contact Hrs.	Mapped CO
1	**Introduction:** The Programming Cycle for Python, Python IDE, Interacting with Python Programs, Elements of Python, Type Conversion. Basics: Expressions, Assignment Statement, Arithmetic Operators, Operator Precedence, Boolean Expression. **Conditionals:** Conditional statement in Python (if-else statement, its working and execution), Nested-if statement and elif statement in Python, Expression Evaluation & Float Representation.	30 Hours	CO1, CO2
2	**Loops:** Purpose and working of loops, While loop including its working, For Loop, Nested Loops, Break and Continue. **Function:** Parts of A Function, Execution of A Function, Keyword and Default Arguments, Scope Rules. **Strings:** Length of the string and perform Concatenation and Repeat operations in it. Indexing and Slicing of Strings.	30 Hours	CO3, CO4

Suggested Readings

1. Allen B. Downey, "Think Python: How to Think like a Computer Scientist", 2nd edition, Updated for Python 3, Shroff/O'Reilly Publishers, 2016 (http://greenteapress.com/wp/thinkpython/)

2.Guido van Rossum and Fred L. Drake Jr, ―An Introduction to Python – Revised and updated for Python 3.2, Network Theory Ltd., 2011.

3. John V Guttag ―Introduction to Computation and Programming Using Python‘‘, Revised and expanded Edition, MIT Press, 2013

Online Resources:

1. https://onlinecourses.nptel.ac.in/noc20_cs70/preview

2. https://onlinecourses.nptel.ac.in/noc21_cs78/preview.

Course Articulation Matrix														
PO-PSO	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**	**PSO1**	**PSO2**
CO 1	1	1	2	1	1							1	1	1
CO 2	1	2	2	2	1							2	2	2
CO 3	1	1	2	2	1							2	2	2
CO 4	1	2	2	2	1							2	2	2

Program					
Year	I	**Semester**		II	
Course Name	Artificial Intelligence				
Code	NVC43242				
Course Type	VOC	**L**	**T**	**P**	**Credit**
Pre-Requisite	Data Structures & Algorithms, Fundamentals of Mathematics	2	0	0	2
Course Objectives	**1.** Understand the basics of the theory and practice of Artificial Intelligence as a discipline and about intelligent agents. **2.** The student will learn to apply knowledge representation techniques and problem solving strategies to common AI applications **3.** Study the concept behind genetic algorithm and its various operations. **4.** Learn the basic concept of fuzzy set theory.				
Course Outcomes					
CO1	Understand the evolution and various approaches of AI.				
CO2	Implementation of data stoarage,processing,visualization, and its use in regression, clustering etc.				
CO3	Analyze the concepts of neural networks.				
CO4	Apply the concepts of face, object, speech recognition and robots.				

Module	Course Contents	Contact Hrs.	Mapped CO
1	**An overview to AI** The evolution of AI to the present, various approaches to AI, what should all engineers know about AI? Other emerging technologies, AI and ethical concerns, Existing sets of principles for AI, AI in the Organization Structure. **Data & Algorithm** History of Data, Data storage and importance of and its acquisition, the stages of data processing, data visualization, regression, prediction & classification, clustering & recommender systems.	30 Hours	CO1, CO2
2	**Artificial Neural Networks** Deep learning, Recurrent Neural Networks, Convolutional Neural Networks, The Universal Approximation Theorem, Generative Adversarial Networks, Speech recognition, Natural language understanding, Natural language generation,Chatbots,Machine Translation. **Applications** Image and face recognition, Object recognition, Speech Recognition besides Computer Vision, Robots, Applications, Investments in AI and AI in start-ups, AI Strategy and Governance (agenda).	30 Hours	CO3, CO4

Suggested Readings

1. S. Russell and P. Norvig, "Artificial Intelligence: A Modern Approach‖, Prentice Hall, Third Edition, 2009.
2. I. Bratko,-Prolog: Programming for Artificial Intelligence‖, Fourth edition, Addison-Wesley Educational Publishers Inc., 2011.
3. M. Tim Jones,-Artificial Intelligence: A Systems Approach (Computer Science) ‖, Jones and Bartlett Publishers, Inc.; First Edition, 2008.

4. Nils J. Nilsson, ―The Quest for Artificial Intelligence‖, Cambridge University Press, 2009.
5. William F. Clocksin and Christopher S. Mellish,‖ Programming in Prolog: Using the ISO Standard‖, Fifth Edition, Springer, 2003.
6. Gerhard Weiss, ―Multi Agent Systems‖, Second Edition, MIT Press, 2013.
7. David L. Poole and Alan K. Mackworth,-Artificial Intelligence: Foundations of Computational Agents‖, Cambridge University Press, 2010.

Online Resources

1. https://nptel.ac.in/courses/109106184
2. https://onlinecourses.nptel.ac.in/noc22_cs83/preview

Course Articulation Matrix														
PO-PSO	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**	**PSO1**	**PSO2**
CO1	**1**	**2**	**1**	**2**	**2**							**2**	**2**	**1**
CO2	**2**	**1**	**2**	**3**	**2**							**2**	**1**	**2**
CO3	**2**	**2**	**2**	**2**	**2**							**1**	**1**	**2**
CO4	**2**	**2**	**2**	**2**	**2**							**1**	**1**	**2**

Program					
Year	II	**Semester**	IV		
Course Name	Cyber Crime and Computer Forensics				
Code	NVC43243				
Course Type	VOC	**L**	**T**	**P**	**Credit**
Pre-Requisite	Basic Knowledge of Cyber Laws	2	0	0	2
Course Objectives	**1.** Acquainting students with Cyber Crimes. **2.** Providing the students the understanding of Issues in Internet Governance. **3.** To understand the different aspects of computer forensic. **4.** Making the student aware of Digital Evidences and working of various Agencies for investigation of cyber-crimes in India.				
Course Outcomes					
CO1	Understand the basic concept of cybercrime and computer forensics.				
CO2	Analyze the virus, cyber-attacks and hacking in cyber applications.				
CO3	Evaluate the different computer forensic tools and techniques.				
CO4	Apply different methods for digital evidence related to system security.				

Module	Course Contents	Contact Hrs.	Mapped CO
1	**Definition of Cyber Crime:** Introduction of Cyber Crime, Nature and Scope of Cyber Crime, Types of Cyber Crime, Social Engineering, Categories of Cyber Crime, Property Cyber Crime. Introduction to internet crimes: hacking and cracking, credit card and ATM frauds, emerging digital crimes and modules. Introduction to Cyber Crime Investigation, Investigation Tools, Discovery, Digital Evidence Collection, Evidence Preservation, E-Mail Investigation, E-Mail Tracking, IP Tracking, E-Mail Recovery.	30 Hours	CO1, CO2
2	**Computer forensics analysis and Tools:** Introduction to Computer Forensics Forensic Software and Hardware, Analysis and Advanced Tools, Forensic Technology and Practices, Forensic Ballistics and Photography, Face, Iris and	30 Hours	CO3, CO4

	Fingerprint Recognition, Audio Video Analysis, Windows System Forensics, Linux System Forensics, Network Forensics. **Email Security And Firewalls**: PGP ,S/MIME, Internet Firewalls for Trusted System- Roles of Firewalls, Firewall related terminology, Types of Firewalls, Firewall designs SET for E-Commerce Transactions.		

Suggested Readings

1. Angus M. Marshall, "Digital forensics: Digital evidence in criminal investigation", John – Wiley and Sons, 2008**.**

2. Bernadette H Schell, Clemens Martin, "Cybercrime", ABC – CLIO Inc, California, 2004. "Understanding Forensics in IT ", NIIT Ltd, 2005.

3. Nelson Phillips and EnfingerSteuart, "Computer Forensics and Investigations", Cengage Learning, New Delhi, 2009**.**

Online Resources

1. https://onlinecourses.swayam2.ac.in/cec20_lb06

2. https://nptel.ac.in/courses/106106178

Course Articulation Matrix														
PO-PSO	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**	**PSO1**	**PSO2**
CO1	1	2		1								1	2	
CO2	1	2	2	1								1	2	
CO3	2	1	2	2	2							2	2	2
CO4	1	1	1	2	2							2	2	2

Program					
Year	III	**Semester**		V	
Course Name	Meta-Verse and Virtual Reality				
Code	NVC43244				
Course Type	VOC	**L**	**T**	**P**	**Credit**
Pre-Requisite		2	0	0	2
Course Objectives	1. Understand how Augmented Reality/Virtual Reality (AR/VR) interfaces are used to interact in the Meta-verse. 2. To create AR/VR interfaces using free software tools. 3. Use AR/VR interfaces as part of a business solution to enable potential customers to interact with a company's products and services in the Meta-verse. 4. Understand how all these fit into the Meta-verse as a whole, so as to create viable business solutions in the Meta-verse.				
Course Outcomes					
CO1	Definition of the Meta-verse & the interplay between Web 3.0 and Block chain				
CO2	Use of NFTs in Meta-verse & Industries using the Meta-verse technology				
CO3	Describe how VR systems work and list the applications of VR.				
CO4	Explain the concepts of motion and tracking in VR systems.				

Module	**Course Contents**	**Contact Hrs.**	**Mapped CO**
1	Introduction and class policies, What is the Meta-verse? Demo of the Meta-verse ,The Meta-verse vs. Web 3.0 AR/VR and the Meta-verse Applications of the Meta-verse advantages and Challenges of the Meta-verse Types of the Meta-verse Block chain and the Meta-verse Crypto currency and the Meta-verse NFTs and the Meta-verse	30 Hours	CO1, CO2
2	Introduction to Virtual Reality ,Representing the Virtual World ,The Geometry of Virtual Worlds & The Physiology of Human Vision, Visual Perception & Rendering ,Motion & Tracking	30 Hours	CO3, CO4

Suggested Readings

1. Virtual Reality, Steven M. LaValle, Cambridge University Press, 2016.
2. Doug A Bowman, Ernest Kuijff, Joseph J LaViola, Jr and Ivan Poupyrev, "3D User Interfaces, Theory and Practice", Addison Wesley, USA, 2005.

Online Resources:

1. https://elearn.nptel.ac.in/shop/iit-workshops/completed/metaverse/
2. https://archive.nptel.ac.in/courses/106/106/106106138/

Course Articulation Matrix														
PO-PSO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	1	1	2	1	1							1	1	1
CO2	1	2	2	2	1							2	2	2
CO3	1	1	2	2	1							2	2	2
CO4	1	2	2	2	1							2	2	2

Program	B. Tech CSE				
Year	III	**Semester**	VI		
Course Name	Advanced Computer Architecture				
Code	NCS4601				
Course Type	PCC	**L**	**T**	**P**	**Credit**
Pre-Requisite	Computer Organization and Architecture	3	1	0	4
Course Objectives	**1.**Provide in-depth coverage of current and emerging trends in computer architectures, focusing on performance and the hardware software interface. **2**.The course emphasis is on analyzing fundamental issues in architecture design and their impact on application performance. **3**.Distinguish the performance of pipeline and non- pipelining environment in processor. **4.**Understand the concept of parallel processing and its application. analyze the performance of different scalar computers.				
Course Outcomes					
CO1	Understand advanced issues in design of computer processors, caches, and memory.				
CO2	Apply and Implement the concept of parallel processing and its application.				
CO3	Evaluate to describe the challenges faced in the implementation of this high performance system.				
CO4	Apply knowledge of processor design to improve performance in algorithms and software systems.				

Module	Course Contents	Contact Hrs.	Mapped CO
1	**Introduction** Introduction Parallel Computing, Parallel Computer Model, Program and Network Properties, Parallel Architectural Classification Schemes. Flynn's & Feng's Classification. Performance Metrics and Measures, Multiprocessor System and Interconnection Networks. Speedup Performance Laws.	30 Hours	CO1
2	**Pipelining and Memory Hierarchy** Instruction Set Principle, ILP: Basics, Exploiting ILP, Limits of ILP. Linear and Nonlinear Pipeline Processors, Super Scalar and Super Pipeline Design. Memory Hierarchy Design, Advanced Optimization of Cache Performance, Memory Technology and Optimization, Cache Coherence and Synchronization Mechanisms.	30 Hours	CO2
3	**Thread and Process Level Parallel Architecture** Multithreaded Architectures, Clustering, Instruction Level Data Parallel Architecture. Associative and Neural Architecture, Data Parallel Pipelined, Systolic Architectures, Vector Architectures.	30 Hours	CO3
4	**Parallel Algorithms**: Parallel Reduction, Prefix Sums, Pre-order Tree Traversal, Merging two Sorted lists; Matrix Multiplication: Row Column Oriented Algorithms, Parallel Algorithm Design Strategies.	30 Hours	CO4

Suggested Readings

1. Kai Hwang," Advance Computer Architecture", TMH
2. Matthew, "Beginning Linux Programming", SPD/WROX
3. Hennessy and Patterson, "Computer Architecture: A Quantitative Approach", Elsevier
4. Dezso and Sima, "Advanced Computer Architecture", Pearson
5. Quinn, "Parallel Computing: Theory & Practice", TMH
6. Quinn, "Parallel Programming in C with MPI and Open MP", TMH

Online Resources

1. https://onlinecourses.nptel.ac.in/noc23_cs07/preview
2. https://onlinecourses.nptel.ac.in/noc22_cs10/preview

Course Articulation Matrix														
PO-PSO	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**P8**	**PO9**	**PO 10**	**PO11**	**PO12**	**PSO1**	**PSO2**
CO1	**2**	**2**	**2**	**2**	**2**							**2**	**3**	**3**
CO2	**2**	**2**	**2**	**2**	**1**							**2**	**3**	**3**
CO3	**2**	**2**	**3**	**3**	**2**							**2**	**2**	**2**
CO4	**2**	**2**	**3**	**3**	**2**							**2**	**2**	**2**

Program	B. Tech CSE				
Year	III	**Semester**	VI		
Course Name	Software Project Management				
Code	NPEC43212				
Course Type	PEC	**L**	**T**	**P**	**Credit**
Pre-Requisite	Software Engineering	3	0	0	3
Course Objectives	**1.** To understand the importance of software project management. **2.** To analyse basic project management skills with a strong emphasis on issues and problems associated with delivering successful IT projects. **3.** To apply, the module is designed to provide an understanding of the particular issues encountered in handling IT projects and to offer students methods, techniques and 'hands-on' experience in dealing with them. **4.** To evaluate the Planning and tracking in the implementation of the software project management process.				
Course Outcomes					
CO1	To Understand the Participation in software development project as a project manager.				
CO2	To Analyse and describe the key phases of project management.				
CO3	To Apply theoretical knowledge on project management and software development into practice..				
CO4	To Learn the Project Scheduling, tracking, Risk analysis, Quality management and Project Cost estimation using different techniques				

Module	Course Contents	Contact Hrs.	Mapped CO
1	**PROJECT EVALUATION AND PROJECT PLANNING:** Fundamentals of Software Project Management (SPM) - Need Identification - Vision and Scope document - Project Management Cycle - SPM Objectives - Management Spectrum- SPM Framework Planning fundamentals - major issues in software project planning – planning activities - Project master schedule - software risk management – risk monitoring – risk analysis. **PROJECT LIFE CYCLE AND EFFORT ESTIMATION** Software process and Process Models – Choice of Process models - Rapid Application development – Agile methods – Dynamic System Development Method – Extreme Programming– Managing interactive processes – Basics of Software estimation – Effort and Cost estimation techniques – COSMIC Full function points - COCOMO II - a Parametric Productivity Model.	30 Hours	CO1
2	**PROJECT MANAGEMENT AND CONTROL.** Function organization–project organization– matrix organization–staffing quality replacement–turnover management. Directing a software engineering project – issues – activities conflict management. Issues in controlling software project- controlling activities threads of control- Work breakdown structures- earned value tracking. Earned	30 Hours	CO2, CO3

	Value Indicators: Budgeted Cost for Work Scheduled (BCWS), Cost Variance (CV), Schedule Variance (SV), Cost Performance Index (CPI), Schedule Performance Index (SPI), Interpretation of Earned Value Indicators, Error Tracking, Software Reviews		
3	**ACTIVITY PLANNING AND RISK MANAGEMENT** Objectives of Activity planning – Project schedules – Activities – Sequencing and scheduling – Network Planning models – Formulating Network Model – Forward Pass & Backward Pass techniques – Critical path (CRM) method – Risk identification – Assessment – Risk Planning –Risk Management – – PERT technique – Monte Carlo simulation – Resource Allocation – Creation of critical paths – Cost schedules.	30 Hours	CO4

Suggested Readings

1. Robert K. Wysocki ―Effective Software Project Management – Wiley Publication, 2011.
2. Gopalaswamy Ramesh, ―Managing Global Software Projects – McGraw Hill Education (India), Fourteenth Reprint 2013.
3. Watts S. Humphrey "Introduction to the Team Software Process(sm)", Carnegie-Mellon University, Addison Wesley Professional, 2000.
4. Software Project Management – Fifth Edition, Tata McGraw Hill, New Delhi, 2012.

Online Resources

1. https://onlinecourses.nptel.ac.in/noc19_cs70/preview.
2. https://nptel.ac.in/courses/106105218

Course Articulation Matrix														
PO-PSO	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**	**PSO1**	**PSO2**
CO1	**3**	**1**	**1**	**2**	**2**							**2**	**1**	**1**
CO2	**1**	**2**	**3**	**2**	**3**							**2**	**2**	**2**
CO3	**1**	**2**	**2**	**2**	**2**							**2**	**2**	**2**
CO4	**1**	**2**	**2**	**2**	**2**							**3**	**2**	**2**

Program	B. Tech CSE				
Year	IV	**Semester**	VI		
Course Name	Cyber Law and Security				
Code	NPEC43212				
Course Type	PEC	**L**	**T**	**P**	**Credit**
Pre-Requisite	Knowledge of Computer Security	3	0	0	3
Course Objectives	1. To introduce the basics of information and web security and computer communication. 2. To familiarize students with Cyber Laws and Security policies and Cryptography. 3. To exhibit knowledge to secure corrupted systems, protect personal data, and secure computer networks in an Organization. 4. To monitoring and analyzing the nature of attacks through cyber/computer forensics software/tools.				
Course Outcomes					
CO1	Understand the information systems, its types, threats, security issues related to it and also about cyber security and risk associated to it.				
CO2	Analyze about Application security, Data security and types of security Threats in network.				
CO3	Understand the importance of secure information system and risk management issues indifferent applications.				
CO4	Understand modern copyright, patent law, skills of ethics, cyber-crime and IT ACT so that they can protect their inventions by making use of these Laws.				

Module	Course Contents	Contact Hrs.	Mapped CO
1	Introduction to information systems, Types of information Systems, Development of Information Systems, Introduction to information security, Need for Information security, Threats to Information Systems, Information Assurance, Cyber Security, and Security Risk Analysis. Classification of Threats and Assessing Damages Security in Mobile and Wireless Computing, Security Challenges in Mobile Devices, authentication Service Security, Security Implication for organizations. Application security (Database, E-mail and Internet), Data Security Considerations- Backups, Archival Storage and Disposal of Data.	30 Hours	CO1
2	Security Technology-Firewall and VPNs, Security Threats-Viruses, Worms, Trojan Horse, Bombs, Trapdoors, Spoofs, E-mail viruses, Macro viruses, Malicious Software, Network and Denial of Services Attacks, Security Threats to E-Commerce-Electronic Payment System, e- Cash, Credit/Debit Cards. Digital Signature, Public Key Cryptography. Developing Secure Information Systems, Application Development Security, Information Security Governance & Risk Management, Security Architecture & Design Security	30 Hours	CO2
3	Issues in Hardware, Data Storage & Downloadable Devices, Physical Security of IT Assets, Access Control, CCTV and intrusion Detection Systems, Backup Security Measures. Laws, Investigation and Ethics, Cyber Crime , Information	30 Hours	CO3, CO4

	Security and Law ,Types & overview of Cyber Crimes, Cyber Law, Issues in E-Business Management Overview of Indian IT Act, Ethical Issues in Intellectual property rights, Copy Right, Patents, Data privacy and protection, Domain Name, Software piracy, Plagiarism, Issues in ethical hacking.		

Suggested Readings

1. Godbole, *"* Information Systems Security*"*, Willey,2008
2. Merkov, Breithaupt, *"* Information Security*"*, Pearson Education,2014
3. Yadav, *"*Foundations of Information Technology*"*, New Age, Delhi, 2006
4. Schou, Shoemaker, *"* Information Assurance for the Enterprise*"*, Tata McGraw Hill, 2006

Online Resources

1. https://nptel.ac.in/courses/106106129
2. https://onlinecourses.swayam2.ac.in/nou19_cs08/preview

Course Articulation Matrix														
PO-PSO	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**	**PSO1**	**PSO2**
CO1	2	1	1									3	2	1
CO2	2	2	1	2	2							3	1	2
CO3	1	1	2	2	2							3	2	2
CO4	2	1	2	2	2							3	2	2

Program	B. Tech CSE					
Year	III	**Semester**	VI			
Course Name	Pattern Recognition					
Code	NPEC43214					
Course Type	PEC	**L**	**T**	**P**	**Credit**	
Pre-Requisite	Probability, Linear algebra, ML, Python	3	0	0	3	
Course Objectives	**1.** Learn the fundamental concepts and applications of pattern recognition. **2.** Understand the fundamental concepts of Pattern Recognition. **3.** Evaluate the learning of the Models. **4.** Develop some applications of pattern recognition.					
Course Outcomes						
CO1	Understand the fundamental pattern recognition and machine learning theories.					
CO2	Analyze certain important pattern recognition techniques.					
CO3	Evaluate systems and algorithms for pattern recognition (signal classification), with focus on sequences of patterns.					
CO4	Applying the pattern recognition theories to applications of interest.					

Module	Course Contents	Contact Hrs.	Mapped CO
1	**Introduction:** Introduction to Pattern Recognition, Basics of pattern recognition, Design principles of pattern recognition system, Learning and adaptation, Pattern recognition approaches, Mathematical foundations – Linear algebra, Probability Theory, Expectation, mean and covariance, Normal distribution, multivariate normal densities, Chi squared test.	30 Hours	CO1
2	**Statistical Pattern Recognition**: Bayesian Decision Theory, Classifiers, Normal density, Discriminant functions. **Parameter Estimation Methods:** Maximum-Likelihood estimation, Bayesian Parameter estimation, Dimension reduction methods, Principal Component Analysis (PCA),Fisher Linear discriminate analysis, Expectation-maximization (EM),Hidden Markov Models (HMM),Gaussian mixture models.	30 Hours	CO2
3	**Nonparametric Techniques and Unsupervised Learning:** Density Estimation, Parzen Windows, K-Nearest Neighbor Estimation, Nearest Neighbor Rule, Fuzzy classification, Clustering, Criterion functions for clustering, Clustering Techniques, Iterative square - error partitioned clustering – K means, Agglomerative hierarchical clustering, Cluster validation.	30 Hours	CO3, CO4

Suggested Readings

1.Richard O. Duda, Peter E. Hart and David G. Stork, “Pattern Classification”, 2nd Edition, John Wiley, 2006.

2. C. M. Bishop, “Pattern Recognition and Machine Learning”, Springer, 2009.

3.S. Theodoridis and K. Koutroumbas, “Pattern Recognition”, 4th Edition, Academic Press, 2009.

Online Resources

1. https://nptel.ac.in/courses/106106046
2. https://nptel.ac.in/courses/106108057
3. https://nptel.ac.in/courses/117106100
4. https://nptel.ac.in/courses/117108048

Course Articulation Matrix														
PO-PSO	**PO1**	**PO 2**	**PO 3**	**PO4**	**PO5**	**PO6**	**PO 7**	**PO8**	**PO9**	**PO 10**	**PO 11**	**PO 12**	**PSO1**	**PSO2**
CO1	**3**	**1**		**1**								**1**	**3**	**2**
CO2	**3**	**2**		**2**								**1**	**2**	**2**
CO3	**3**	**1**	**3**	**2**	**2**							**1**	**3**	**2**
CO4	**3**		**3**	**2**	**1**								**3**	**2**

Program	B. Tech CSE				
Year	III	**Semester**	VI		
Course Name	Quantum Computing				
Code	NPEC43221				
Course Type	PEC	**L**	**T**	**P**	**Credit**
Pre-Requisite	Engineering Mathematics, Data Structures and Algorithms, Python Programming	3	0	0	3
Course Objectives	**1.** To understand the basics of quantum computing. **2.** To understand the mathematics required for quantum computing. **3.** To understand the building blocks of quantum computing and design algorithms. **4.** To understand quantum hardware principles and tools for quantum computing.				
Course Outcomes					
CO1	Understand basic concepts of quantum computing. Appraise various mathematical models required for quantum computing.				
CO2	Analyse various quantum hardware-building principles.				
CO3	Apply various quantum hardware-building principles.				
CO4	Evaluate the various quantum algorithms.				

Module	Course Contents	Contact Hrs.	Mapped CO
1	**Introduction to Quantum Computing & Mathematical Foundations for Quantum Computing** Motivation for studying Quantum Computing Origin of Quantum Computing Quantum Computer vs. Classical Computer Introduction to Quantum mechanics Overview of major concepts in Quantum Computing Qubits and multi-qubits states Bloch Sphere representation Quantum Superposition Quantum Entanglement. **Matrix Algebra:** basis vectors and orthogonality, inner product and Hilbert spaces, matrices and tensors, unitary operators and projectors, Dirac notation, Eigen values and Eigen vectors.	30 Hours	CO1
2	**Building Blocks for Quantum Program** Architecture of a Quantum Computing platform Details of q-bit system of information representation: Block Sphere Multi-qubits States Quantum superposition of qubits (valid and invalid superposition) Quantum Entanglement Useful states from quantum algorithmic perceptive e.g. Bell State Operation on qubits: Measuring and transforming using gates. Quantum Logic gates and Circuit No Cloning Theorem and Teleportation.	30 Hours	CO2
3	**Quantum Algorithms and Error correction** Quantum Algorithms, Shor's Algorithm, Grover's Algorithm. Deutsch's Algorithm, Deutsch -Jozsa Algorithm. Quantum error correction using repetition codes 3 qubit codes, Shor's 9 qubit error correction Code.	30 Hours	CO3, CO4

Suggested Readings

1. Michael A. Nielsen, "Quantum Computation and Quantum Information", Cambridge University Press.
2. David McMahon, "Quantum Computing Explained", Wiley ,2008.
3. Vladimir Silva, Practical Quantum Computing for Developers,2018.

Online Resources

1. https://onlinecourses.nptel.ac.in/noc21_cs103/preview
2. https://www.coursera.org/courses?query=quantum%20computing
3. https://www.cl.cam.ac.uk/teaching/1617/QuantComp/

Course Articulation Matrix														
PO-PSO	**PO1**	**PO2**	**PO3**	**PO4**	**PO 5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO1 2**	**PSO1**	**PSO2**
CO1	**1**	**2**	**2**	**2**	**3**							**1**	**1**	**2**
CO2	**3**	**3**	**1**	**2**	**1**							**1**	**2**	**1**
CO3	**2**	**1**	**2**	**1**	**1**								**2**	**2**
CO4	**1**	**2**	**1**	**3**	**2**							**2**	**1**	**2**

Program	B. Tech CSE				
Year	III	**Semester**	VI		
Course Name	Cloud Computing Essentials				
Code	NPEC43222				
Course Type	PEC	**L**	**T**	**P**	**Credit**
Pre-Requisite	Basic knowledge of network	3	0	0	3
Course Objectives	**1.** To understand the concepts of Cloud Computing. **2.** To learn Cloud Computing Architecture. **3.** To learn Taxonomy of Virtualization Techniques. **4.** To acquire knowledge on Cloud Deployment models.				
Course Outcomes					
CO1	Understand the concept of virtualization and how this has enabled the development of Cloud Computing.				
CO2	To analyze fundamentals of cloud, cloud Architectures and types of services in cloud.				
CO3	To evaluate and Understand scaling, cloud security and disaster management				
CO4	To apply to explore some important cloud computing driven commercial systems.				

Module	Course Contents	Contact Hrs.	Mapped CO
1	Origins of Cloud computing, Cloud components, Evolution of Cloud Computing, Characteristics of Cloud Computing, Underlying Principles of Parallel and Distributed Computing, driving factors towards cloud, Architecture, How Cloud Computing Works, Role of Networks in Cloud computing, protocols used, Role of Web services, Service Models: IaaS, PaaS, SaaS, NaaS, Cloud Clients, Comparing cloud providers with traditional IT service providers.	30 Hours	CO1
2	Introduction, Cloud Reference Model, Architecture, Infrastructure Hardware as a Service, Platform as a Service, Software as a Service, Types of Clouds, Public Clouds, Private Clouds, Hybrid Clouds, Community Clouds, Economics of the Cloud, Open Challenges, Cloud Interoperability and Standards, Scalability and Fault Tolerance. Cloud deployment model: Public clouds, Private clouds, Community clouds, Hybrid clouds, advantages of Cloud computing.Inter Cloud Resource Management, Resource Provisioning and Resource Provisioning Methods Global Exchange of Cloud Resources, Security Overview, Cloud Security Challenges, Software-as-a-Service Security, Security Governance, Virtual Machine Security, IAM, Security Standards.	30 Hours	CO2
3	Hadoop, MapReduce, Virtual Box, Google App Engine, Programming Environment for Google App Engine, Open Stack, Federation in the Cloud, Four Levels of Federation, Federated Services and Applications, Future of Federation. Scientific Applications: Health care, Geoscience and Biology. Business and Consumer Applications- CRM and ERP, Social Networking, Media Applications and Multiplayer Online Gaming.	30 Hours	CO3,CO 4

Suggested Readings

1. Kai Hwang, Geoffrey C. Fox, Jack G. Dongarra, "Distributed and Cloud Computing, From Parallel Processing to the Internet of Things", Morgan Kaufmann Publishers,2012.
2. Ritting house, John W., and James F. Ransome, ―Cloud Computing: Implementation, Management and Security, CRC Press,2017
3. George Reese Cloud Application Architectures, First Edition, O"Reilly Media 2009.
4. Cloud Computing 2nd Edition by Dr. Kumar Saurabh from Wiley India 2012.
5. Cloud Computing (Principles and Paradigms), Edited by Rajkumar Buyya, James Broberg, Andrzej Goscinski, John Wiley & Sons, Inc. 2011
6. Cloud computing for dummies- Judith Hurwitz, Robin Bloor, Marcia Kaufman, Fern Halper, Wiley Publishing, Inc,2010

Online Resources

1. https://onlinecourses.nptel.ac.in/noc21_cs14/preview

2. https://archive.nptel.ac.in/courses/106/105/106105167

Course Articulation Matrix														
PO-PSO	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO 7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**	**PSO1**	**PSO2**
CO1	**3**	**2**	**1**		**1**								**2**	**2**
CO2	**2**	**3**	**2**	**2**								**2**	**3**	**3**
CO3	**1**	**2**	**1**	**1**	**2**							**1**	**3**	**3**
CO4	**2**	**1**	**3**	**1**									**3**	**3**

Program	B. Tech CSE				
Year	III	**Semester**	VI		
Course Name	Big Data Analytics				
Code	NPEC43223				
Course Type	PEC	**L**	**T**	**P**	**Credit**
Pre-Requisite	Machine Learning, statistics, Probability	3	0	0	3
Course Objectives	**1.** Optimize business decisions and create competitive advantage with Big data analytics **2.** Understand several key big data technologies used for storage, analysis and manipulation of data. **3.** Recognize the key concepts of Hadoop framework, map reduce. **4.** To learn Basic methodologies of PIG and HIVE.				
Course Outcomes					
CO1	Understand what Big Data, importance and various sources of data. Describe the elements of big data-volume, variety, velocity and veracity.				
CO2	Analyse the Big Data framework like Hadoop and NOSQL to efficiently store and process Big Data to generate analytics				
CO3	Design of Algorithms to solve Data Intensive Problems using Map Reduce Paradigm				
CO4	Demonstrate and evaluate an ability to use frameworks like pig and hive to process Big Data and Analytics.				

Module	Course Contents	Contact Hrs.	Mapped CO
1	**ESSENTIALS OF BIG DATA AND ANALYTICS:** Data, Characteristics of data and Types of digital data, Sources of data, Working with unstructured data, Evolution and Definition of big data, Characteristics and Need of big data, Challenges of big data; Overview of business intelligence, Data science and Analytics, Meaning and Characteristics of big data analytics, Need of big data analytics, Classification of analytics, Challenges to big data analytics, Importance of big data analytics, Basic terminologies in big data environment.	30 Hours	CO1
2	**HADOOP :** Introducing Hadoop, Need of Hadoop, limitations of RDBMS, RDBMS versus Hadoop, Distributed computing challenges, History of Hadoop , Hadoop overview, Use case of Hadoop, Hadoop distributors, HDFS (Hadoop Distributed File System) , Processing data with Hadoop, Managing resources and applications with Hadoop YARN (Yet another Resource Negotiator), Interacting with Hadoop Ecosystem.	30 Hours	CO2
3	**MAPREDUCE PROGRAMMING:** Introduction , Mapper, Reducer, Combiner, Partitioner, Searching, Sorting, Compression, Real time applications using MapReduce, Data serialization and Working with common serialization formats, Big data serialization formats. **INTRODUCTION TO PIG and HIVE** Introducing Pig: Pig architecture, Benefits, Installing Pig, Properties of Pig, Running Pig, Getting started with Pig Latin, Working with operators in Pig, Working with functions in	30 Hours	CO3, CO4

	Pig. Introducing Hive: Getting started with Hive, Hive Services, Data types in Hive, Built-in functions in Hive, Hive DDL.		

Suggested Readings

1.Seema Acharya, Subhashini Chellappan, ―Big Data and Analytics, Wiley Publications,2nd Edition,2014DT Editorial Services, ―Big Data, Dream Tech Press, 2ndEdition, 2015.
2.Tom White, ―Hadoop: The Definitive Guide, O'Reilly, 3rd Edition, 2012.
3.Black Book Big Data, dreamtech publications , 1st Edition, 2017.

E-Text Books

1.https://www.books.google.co.in/books?id=rkWPojgfeM8C&printsec=frontcover&dq=HIGH+PERFORMANCE+COMPUTING.
2.http://www.datameer.com/pdf/big-data-analytics-ebook.pdf?mkt_tok.

Online Resources

1. https://nptel.ac.in/courses/106104189

Course Articulation Matrix														
PO-PSO	**PO 1**	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO 9**	**PO10**	**PO11**	**PO12**	**PSO1**	**PSO2**
CO1	3	1		1								1	3	3
CO2	3	2		2								1	3	3
CO3	3	1	3	2	2							1	3	3
CO4	3		3	2	1							2	3	3

Program	B. Tech CSE				
Year	III	**Semester**		VI	
Course Name	Internet of Things				
Code	NPEC43224				
Course Type	PEC	**L**	**T**	**P**	**Credit**
Pre-Requisite	Basic knowledge of AI and Computer Network	3	0	0	3
Course Objectives	**1.** Describe the IoT and Cloud architectures **2.** Determine the right sensors and communication protocols to use in a particular IoT system. **3.** Deploy Cloud Services using different cloud technologies. **4.** Implement cloud computing elements such virtual machines, web apps, mobile services, etc.				
Course Outcomes					
CO1	Understand general concepts of Internet of Things (IoT) (Understand) and Recognize various devices, sensors and applications.				
CO2	To analyse various M2M and IoT architectures.				
CO3	Apply design concept to IoT solutions.				
CO4	Evaluate design issues in IoT applications and Create IoT solutions using sensors, actuators and Devices.				

Module	Course Contents	Contact Hrs.	Mapped CO
1	**Introduction to IoT**: Sensing, Actuation, Networking Basics, Communication Protocols, Sensor Networks, Machine-to-machine Communications, IoT Definition, Characteristics. IoT Functional Blocks, Physical design of IoT, Logical design of IoT, Communication models & APIs.	30 Hours	CO1
2	**M2M to IoT**-The Vision-Introduction, From M2M to IoT, M2M towards IoT-the global context, A use case example, Differing Characteristics. Definitions, M2M Value Chains, IoT Value Chains, An emerging industrial structure forIoT. **M2M vs IoT An Architectural Overview**– Building architecture, Main design principles and needed capabilities, An IoT architecture outline, and standards considerations. Reference Architecture and Reference Model of IoT.	30 Hours	CO2, CO3
3	**IoT Reference Architecture**- Getting Familiar with IoT Architecture, Various architectural views of IoT such as Functional, Information, Operational and Deployment. Constraints affecting design in the IoT world- Introduction, Technical design Constraints. **Domain-specific applications of IoT**: Home automation, Industry applications, Surveillance applications, Other IoT applications, developing IoT solutions	30 Hours	CO4

Suggested Readings

1. Vijay Madisetti and Arsh deep Bahga, “Internet of Things (A Hands-on Approach)”, 1st Edition, VPT, 2014

2. Francis da Costa, “Rethinking the Internet of Things: A Scalable Approach to Connecting Everything”, 1st Edition, Apress Publications, 2013.
3. CunoPfister, Getting Started with the Internet of Things,OReillyMedia,2011, ISBN: 978-1-4493-9357

Online Resources

1. https://onlinecourses.nptel.ac.in/noc22_cs53

2. https://onlinecourses.swayam2.ac.in/arp19_ap52/preview

Course Articulation Matrix														
PO-PSO	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PO 6**	**PO7**	**PO8**	**PO9**	**PO1 0**	**PO11**	**PO1 2**	**PSO1**	**PSO2**
CO1	**2**	**1**	**1**		**1**								**2**	**1**
CO2	**3**	**2**	**1**	**2**	**2**								**1**	**2**
CO3		**3**	**2**	**1**	**2**								**2**	**1**
CO4	**1**		**2**	**1**	**1**								**2**	**1**

Program	B. Tech CSE				
Year	IV	**Semester**	VII		
Course Name	Full Stack Development				
Code	NPEC43231				
Course Type	PEC	**L**	**T**	**P**	**Credit**
Pre-Requisite	HTML DBMS	3	0	0	3
Course Objectives	**1.** Understanding the fundamentals of web development tools to become and industry-ready engineer who can readily deploy in a project. **2**. Apply basic programming principles to the construction of websites **3.** Design user interactions on web pages **4**. Create servers and databases for functionality.				
Course Outcomes					
CO1	Understand basics of HTTP, HTML, CSS, Web Sockets, JSON, DOM, AJAX basics JavaScript, and jQuery.				
CO2	Apply frontend and backend scenarios to read, write and update data stored in MongoDB.				
CO3	Analyze AngularJS, AngularJS Expressions, AngularJS Modules, AngularJS Data Binding, AngularJS Scopes, AngularJS Directives & Events, AngularJS Controllers, AngularJS Filters.				
CO4	Evaluate strong expertise to develop front end application using Angular JS.				

Module	Course Contents	Contact Hrs.	Mapped CO
1	**Basic Concepts:** Basics of Hyper Text Transfer Protocol (HTTP), Some Basics of Hyper Text Mark-up Language (HTML), Some Basics of Cascading Style Sheets (CSS), Introduction to Bootstrap, Bootstrap Basics, Bootstrap Grids, Bootstrap Themes, Bootstrap CSS, Basics of Web Sockets, Opening Handshake, Sending and Receiving Data, Closing the Connections, Object Oriented Design, JSON, DOM, AJAX.	30 Hours	CO1
2	**JavaScript:** JavaScript Objects, JavaScript Scope, JavaScript Events, JavaScript Strings, JavaScript Numbers, JavaScript Math, JavaScript Arrays, JavaScript Boolean, JavaScript Comparisons, JavaScript Conditions, JavaScript Switch, JavaScript Loops, JavaScript Type Conversion, JavaScript RegExp, JavaScript Errors, JavaScript Debugging, JavaScript Hoisting, JavaScript Strict Mode, JavaScript Functions, JavaScript Objects, JavaScript Forms, JavaScript HTML DOM, JavaScript BOM. **jQuery:** Syntax, jQuery Selectors, jQuery Events, jQuery Effects, jQuery HTML, jQuery Traversing, jQuery AJAX, Introduction to jQuery Mobile	30 Hours	CO2, CO4
3	**Angular JS:** Introduction to AngularJS, AngularJS Expressions, AngularJS Modules, AngularJS Data Binding, AngularJS Scopes, AngularJS Directives & Events, AngularJS Controllers, AngularJS Filters, AngularJS Services, AngularJS HTTP, AngularJS Tables, AngularJS Select, Fetching Data from MySQL, AngularJS Validation,	30 Hours	CO3, CO4

	AngularJS API, AngularJS Animations, AngularJS i18n, and i10n; **Node.js:** Introduction to Express Framework, Node Core, Node Modules, File System, Debugger, Automation and Deployment; Introduction to React**.** **MongoDB:** Introduction to MongoDB, Environment, Create Database, Drop Database, Create Collection, Drop Collection, Read Operations, Write Operations, Data Modelling, Administration, Security, Aggregation, Indexes, Storage, Replication		

Suggested Readings

1. The Full Stack Developer: Your Essential Guide to the Everyday Skills Expected of a Modern Full Stack Web Developer, Chris Northwood.

2. Modern Full-Stack Development: Using TypeScript, React, Node.js, Webpack, and Docker, Frank Zammetti.

Online Resources

1.https://nptel.ac.in/courses/106/105/106105191

Course Articulation Matrix														
PO-PSO	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**	**PSO1**	**PSO2**
CO1	**1**											**2**	**2**	**1**
CO2	**1**				**1**							**1**	**2**	
CO3	**1**	**2**			**1**							**1**	**2**	
CO4	**1**		**2**		**1**							**1**	**2**	

Program	B. Tech CSE				
Year	IV	**Semester**	VII		
Course Name	Computer Vision				
Code	NPEC43232				
Course Type	PCC	**L**	**T**	**P**	**Credit**
Pre-Requisite	Machine Learning, Computer Graphics	3	0	0	3
Course Objectives	1. Acquire knowledge Image Processing **2**. Appling Filtering and edge detection **3.** Appling deep leering for recognition and feature detection on image and videos				
Course Outcomes					
CO1	Understanding basics of Image Processing and Photometric				
CO2	Understanding Image Filtering and edge detection.				
CO3	Understanding application of deep learning in image processing and recognition				
CO4	Understanding feature detection and motion.				

Module	**Course Contents**	**Contact Hrs.**	**Mapped CO**
1	Introduction to image processing, Image formation: Geometric primitives and transformations, Photometric image formation, digital camera, Image processing: Point operators, More neighborhood operators, Fourier transforms, Pyramids and wavelets, Geometric transformations, Model fitting and optimization, Variational methods and regularization, Markov random fields	30 Hours	CO1
2	Linear Filtering: Filter Kernels, Linear Filter Experiments, Linear Convolution Filtering, Selecting a Region-of-Interest, Adding Noise to Image, Mean Filtering, Median Filtering, Rank Order Filtering, Normal Distribution Filtering, Edges, Lines, Corners, Gaussian Kernel and Voronoï Meshes, Linear Function, Edge Detection, Double Precision Laplacian Filter, Enhancing Digital Image Edges, Gaussian Kernel, Gaussian Filter, Image Gradient Approach to Isolating Image Edges Motion estimation: Translational alignment, Parametric motion, Optical flow, Layered motion Computational photography, High dynamic range imaging, Super-resolution, denoising, and blur removal, Image matting and compositing, Video matting, Texture analysis and synthesis	30 Hours	CO2
3	Deep Learning: Supervised learning, Unsupervised learning, Deep neural networks, Convolutional neural networks, More complex models Feature detection and matching: Edges and contours, Contour tracking, Lines and vanishing points, Segmentation Recognition: Instance recognition, Image classification,	30 Hours	CO3 CO4

	Object detection, Semantic segmentation, Pose estimation, Video understanding, Vision and language		

Suggested Readings

1. Richard Szeliski, "Computer Vision: Algorithms and Applications", 2nd Edition, September 30, 2022 Springer
2. James F James F. Peters, "Foundations of Computer Vision, Computational Geometry, Visual Image, Structures and Object Shape Detection", 124, Springer
3. E. R. Davies, "Computer and Machine Vision: Theory, Algorithms, Practicalities", Fourth Edition, 2012, Elsevier
4. Ramesh Jain, Rangachar Kasturi, Brian G. Schunck,"MACHINE VISION", McGraw-Hill, Inc., ISBN 0-07-032018-7, 1995

Online Resources

1. https://onlinecourses.nptel.ac.in/noc21_ee23/preview

Course Articulation Matrix														
PO-PSO	**PO1**	**PO2**	**PO3**	**PO4**	**PO 5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO1 2**	**PSO1**	**PSO2**
CO1	**3**	**3**	**3**	**3**	**2**							**2**	**3**	**3**
CO2	**3**	**3**	**3**	**3**	**3**							**2**	**2**	**3**
CO3	**3**	**3**	**3**	**3**	**3**							**2**	**3**	**3**
CO4	**3**	**3**	**3**	**3**	**2**							**2**	**3**	**3**

Program	B. Tech CSE				
Year	IV	**Semester**	VII		
Course Name	Essentials of Blockchain				
Code	NPEC43233				
Course Type	PEC	**L**	**T**	**P**	**Credit**
Pre-Requisite	Distributed Systems, Computer Networking, Cryptography.	3	0	0	3
Course Objectives	**1.** Student to be able to design, build, and deploy smart contracts and distributed applications. **2.** Students should be able to understand different types of Decentralized applications developed using block chain technology. **3.** Describe the basic bit coin and block chain application. **4.** To study about crypto currencies and their functions.				
Course Outcomes					
CO1	Understand about the distributed database and function.				
CO2	Analyse the basic concepts and structural aspects of block chain and application.				
CO3	To Understand the distributed consensus and Nakamoto consensus.				
CO4	Explain the fundamental characteristics of Crypto currency and bit coin.				

Module	Course Contents	Contact Hrs.	Mapped CO
1	**Basics:** 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.	30 Hours	CO1
2	**Blockchain:** Introduction, Advantage over conventional distributed database, Block chain Network, Mining Mechanism, Distributed Consensus, Merkle Patricia Tree, Gas Limit, Transactions and Fee, Anonymity, Reward, Chain Policy, Life of Block chain application, Soft & Hard Fork, Private and Public block chain **Distributed Consensus:** Nakamoto consensus, Proof of Work, Proof of Stake, Proof of Burn, Difficulty Level, Sybil Attack, Energy utilization and alternate.	30 Hours	CO2, CO3
3	**Crypto currency:** History, Distributed Ledger, Bitcoin protocols - Mining strategy and rewards, Ethereum - Construction, DAO, Smart Contract, GHOST, Vulnerability, Attacks, Sidechain, Namecoin Crypto currency **Regulation:** Stakeholders, Roots of Bit coin, Legal Aspects-Crypto currency Exchange, Black Market and Global Economy. **Applications:** Internet of Things, Medical Record Management System, Domain Name Service and future of Block chain.	30 Hours	CO4

Suggested Readings

1. Andreas M. Antonopoulos, Mastering Bitcoin: Unlocking Digital Crypto currencies, "O'Reilly Media, Inc.", 03-Dec-2014 - Business & Economics.
2. Dr. Gavin Wood, “ETHEREUM: A Secure Decentralized Transaction Ledger,”Yellow paper.2014.
3. Antony Lewis, The Basics of Bitcoins and Block chains: An Introduction to Crypto currencies and the Technology that Powers Them(Cryptography, Crypto Trading, Digital Assets, NFT) Paperback – April 13,2021
4. Joseph J. Bambara, Paul R. Allen, Block Chain: A Practical Guide to Developing Business, Law And Technology.

Online Resources

1. https://onlinecourses.nptel.ac.in/noc22_cs44/preview
2. https://nptel.ac.in/courses/106104220

Course Articulation Matrix														
PO-PSO	**PO 1**	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**	**PSO1**	**PSO2**
CO1	**2**		**2**	**2**	**1**							**2**	**2**	**2**
CO2	**2**	**1**	**1**	**1**	**2**							**2**	**2**	**2**
CO3	**2**	**2**	**2**	**1**	**1**							**2**	**3**	**3**
CO4	**2**	**2**	**2**	**1**	**2**							**2**	**3**	**3**

Program	B. Tech CSE				
Year	IV	**Semester**	VII		
Course Name	Natural Language Processing				
Code	NPEC43234				
Course Type	PEC	**L**	**T**	**P**	**Credit**
Pre-Requisite	Basic Knowledge of ML	3	0	0	3
Course Objectives	**1.** Study the basic concepts of NLP. **2.** Understand the basic concepts of context free grammar and Parsing methods of NLP. **3.** Students will learn the basic NLP Models and Algorithms. **4.** Develop background in statistical and machine learning approaches to NLP.				
Course Outcomes:					
CO1	Understand the concept of Natural Language Processing.				
CO2	Analyze the different experimental methodology for training and evaluating empirical NLP systems.				
CO3	Evaluate the various tools and techniques in natural language processing.				
CO4	Apply NLP algorithms in to Machine Learning Techniques.				

Module	Course Contents	Contact Hrs.	Mapped CO
1	**Introduction of NLP:** Introduction to Natural Language Understanding; The study of Language, Applications of NLP, Evaluating Language Understanding Systems. Different levels of Language Analysis; Representations and Understanding. Organization of Natural language understanding Systems. Linguistic Background. An outline of English syntax.	30 Hours	CO1
2	**Knowledge Representation schemes in NLP:** Introduction to semantics and knowledge representation, Some applications, machine translation, database interface. Grammars and Parsing, Grammars and sentence Structure, Top- Down and Bottom-Up Parsers, Top-Down Chart Parsing. Transition Network Grammars. Feature Systems and Augmented Grammars; Basic Feature system for English, Morphological Analysis and the	30 Hours	CO2

	Lexicon, Parsing with Features. Augmented Transition Networks (ATN).		
3	**Grammar and Parsing Techniques in NLP:** Grammars for Natural Language, Auxiliary Verbs and Verb Phrases, Movement Phenomenon in Language. Handling questions in Context-Free Grammars. Human preferences in Parsing, Encoding uncertainty, Deterministic Parser. **Ambiguity Resolution and Probabilistic grammar:** Ambiguity Resolution in NLP, Statistical Methods, Probabilistic Language Processing, Estimating Probabilities. Part-of- Speech tagging. Obtaining Lexical Probabilities. Probabilistic Context-Free Grammars. Best First Parsing. Semantics and Logical Form. Word senses and Ambiguity. Encoding Ambiguity in Logical Form.	30 Hours	CO3, CO4

Suggested Readings

1. Akshar Bharti, Vineet Chaitanya and Rajeev Sangal, "NLP: A Paninian Perspective", Prentice Hall, New Delhi.
2. James Allen, "Natural Language Understanding", 2/e, Pearson Education, 2003.
3. L.M. Ivansca, S. C. Shapiro, "Natural Language Processing and Language Representation".
4. Daniel Jurafsky , James H. Martin , "Speech & language processing", Pearson publications.

Online Resources

1. https://onlinecourses.nptel.ac.in/noc19_cs56/preview

2. https://onlinecourses.nptel.ac.in/noc20_cs87/preview

Course Articulation Matrix														
PO-PSO	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**	**PSO1**	**PSO2**
CO1	**1**	**1**	**1**	**1**	**1**							**1**	**2**	**2**
CO2	**2**	**1**	**2**	**1**	**2**							**2**	**3**	**3**
CO3	**2**	**2**	**2**	**2**	**2**							**2**	**3**	**3**
CO4	**2**	**2**	**2**	**2**	**2**							**2**	**3**	**3**

Program	B. Tech CSE				
Year	IV	**Semester**	VIII		
Course Name	Augmented and Virtual Reality				
Code	NPEC43241				
Course Type	PEC	**L**	**T**	**P**	**Credit**
Pre-Requisite	Basics of A.I. and 3D Visualization.	3	0	0	3
Course Objectives	**1**. To provide students with a solid background of 3D compositing techniques. **2**. Applications in interactive interfaces augmented reality interfaces **3**. Provide students with a comprehensive knowledge in 3D vision. **4.** Develop skills in the design of interactive augmented reality games.				
Course Outcomes					
CO1	Understand interactive augmented reality applications.				
CO2	Analyze about some Software Technologies used in Visualization.				
CO3	Evaluate the 3D interaction techniques.				
CO4	Apply knowledge of the research literature in Augmented Reality.				

Module	Course Contents	Contact Hrs.	Mapped CO
1	**VIRTUAL REALITY AND VIRTUAL ENVIRONMENT:** The historical development of VR: Scientific landmarks Computer Graphics, Real- time computer graphics, Flight simulation, Virtual environments, Requirements for VR, benefits of Virtual reality. Visual Displays Auditory Displays, Haptic Displays, And Choosing Output Devices for 3DUser Interfaces. Input device characteristics, Desktop input devices, Tracking Devices, 3D Mice, Special Purpose Input Devices, Direct Human Input, Home Brewed Input Devices, and Choosing Input Devices for 3D Interfaces.	30Hours	CO1
2	**SOFTWARE TECHNOLOGIES:** Database-World Space, World Coordinate, World Environment, Objects - Geometry, Position / Orientation, Hierarchy, Bounding Volume, Scripts and other attributes, VR Environment VR Database, Tessellated Data, LODs, Lights and Cameras, Scripts, Interaction - Simple, Feedback, Graphical User Interface, Control Panel, 2DControls, Hardware,Controls,Room/Stage/AreaDescriptions,WorldAuthoringandPlayback,VR toolkits.	30Hours	CO2
3	**3D INTERACTIONTECHNIQUES:** 3D Manipulation tasks, Manipulation Techniques and Input Devices, Interaction Techniques for 3D Manipulation, Deign Guidelines 3D Travel Tasks, Travel Techniques, Design Guidelines - Theoretical Foundations of Wayfinding, User Centered Wayfinding Support, Environment Centered Way finding Support, Evaluating Wayfinding Aids, Design Guidelines - System Control, Classification, Graphical Menus, Voice Commands, Gestrual Commands, Tools, Mutimodal System Control Techniques, Design Guidelines, Case Study: Mixing System Control Methods, Symbolic Input Tasks, symbolic Input Techniques, Design Guidelines.	30Hours	CO3, CO4

Suggested Readings

1. Alan B Craig, William R Shermanand Jeffrey D Will ,"Developing Virtual .
2. Gerard Joungh yun Kim,"Designing Virtual Systems: The Structured Approach",2005.
3. Bimberand Ramesh Raskar,"Spatial Augmented Reality :Merging Real and Virtual Worlds".
4. Burdea,Grigore Cand PhilippeCoiffet,"VirtualRealityTechnology"WileyInterscience,India.

Online Resources

1. https://archive.nptel.ac.in/courses/106/106/106106138

Course Articulation Matrix														
PO-PSO	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PO 6**	**PO7**	**PO8**	**PO9**	**PO1 0**	**PO11**	**PO1 2**	**PSO1**	**PSO2**
CO1	**1**	**2**	**2**		**2**							**1**	**2**	**2**
CO2	**1**	**3**	**2**	**1**								**1**	**2**	**2**
CO3	**2**	**1**		**1**	**2**							**1**	**2**	**2**
CO4	**2**	**2**	**1**		**1**							**1**	**2**	**2**

Program	B. Tech CSE				
Year	IV	**Semester**		VIII	
Course Name	Deep Learning				
Code	NPEC43242				
Course Type	PCC	**L**	**T**	**P**	**Credit**
Pre-Requisite	Knowledge of Machine Learning	3	0	0	3
Course Objectives	**1**. Provide basic concepts of deep learning and applications in various fields. **2.** This course emphasis is on analysing the fundamental issues to develop deep learning models and applied to solve complex engineering and social problems. **3**. Develop industry-oriented skills. **4.** Understand the data needs of deep learning.				
Course Outcomes					
CO1	To understand the basic concepts of deep learning.				
CO2	Applies basic principles of deep learning that are required to analyse large dataset and demonstrate the results in various formats.				
CO3	Analyse how to improve the learning quality of the model to make it more accurate.				
CO4	Evaluate current scope and limitations, and social impact of Deep learning				

Module	Course Contents	Contact Hrs.	Mapped CO
1	**INTRODUCTION:** Definition of machine learning- Linear models and Nonlinear Models, introduction to machine learning algorithms, biological neuron, perceptron, Neural Nets: shallow network, training a network: back propagation, gradient descent loss functions, and - Neural networks as universal function approximates	30 Hours	CO1
2	**DEEP NETWORKS:** History of Deep Learning- Deep Learning Platforms. A Probabilistic Theory of Deep Learning Back propagation and regularization, normalization, Deep Boltzmann Machine, Hidden Markov model, Deep Networks Vs. Shallow Networks- Convolutional Networks- Auto Encoder and Generative Adversarial Networks (GAN), Semi- supervised Learning	30 Hours	CO2
3	**OPTIMIZATION ALGORITHMS AND GENERALIZATION**: Concept of Optimization, Optimization in deep learning– First Order, Second Order Methods, Stochastic Methods, Population Based Methods, Spatial Transformer Networks- Recurrent networks, LSTM - Recurrent Neural Network Language Models- Word-Level RNNs & Deep Reinforcement Learning - Computational & Artificial Neuroscience. CASE STUDY: Image net- Image Classification	30 Hours	CO3

Suggested Readings

1. Cosma Rohilla Shalizi, Advanced Data Analysis from an Elementary Point of View, 2015
2. Deng & Yu, Deep Learning: Methods and Applications, Now Publishers, 2013.
3. Ian Goodfellow, Yoshua Bengio, Aaron Courville, Deep Learning, MIT Press, 2016.
4. Michael Nielsen, Neural Networks and Deep Learning, Determination Press, 2015.

Online Resources

1. https://nptel.ac.in/courses/106106184

2. https://nptel.ac.in/courses/106106201

Course Articulation Matrix														
PO-PSO	**PO 1**	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**	**PSO1**	**PSO2**
CO1	1	2	2	2	3							1	1	1
CO2	3	3	1	2	1							2	2	1
CO3	2	1	2	1	1								2	2
CO4	1	2	1	3	2							1	1	1

Program	B Tech CSE				
Year	IV	**Semester**	VIII		
Course Name	Data Compression				
Code	NPEC43243				
Course Type	PEC	**L**	**T**	**P**	**Credit**
Pre-Requisite	Multimedia	3	0	0	3
Course Objectives	**1.** To provide students with contemporary knowledge in Data Compression and Coding. **2.** To equip students with skills to analyze and evaluate different Data Compression and Coding methods. **3.** Student knows basic algorithms used in lossless and lossy compression. **4.** Student knows basic mathematical models used in lossless and lossy compression.				
Course Outcomes					
CO1	Apply fundamental ideas of the lossless data compression in multimedia.				
CO2	Implement and evaluate mathematical theory and algorithms.				
CO3	Analyze fundamental ideas of quantization and transform coding.				
CO4	Understand how lossless and lossy compression algorithms can be used for solving scientific and engineering problems.				

Module	Course Contents	Contact Hrs.	Mapped CO
1	**Introduction** Compression Techniques: Lossless and Lossy Compression, Measures of performance, Modeling and Coding; Mathematical Preliminaries for Lossless compression: A brief introduction to information theory; Models: Physical models, Probability models, Markov models, Composite source model; Coding: Uniquely decodable codes, Prefix codes.	30 Hours	CO1
2	**Huffman and Arithmetic Coding** Huffman coding algorithm: Minimum variance Huffman codes; Adaptive Huffman coding: Update procedure, Encoding procedure, Decoding procedure; Golomb codes, Rice codes, Tunstall codes Applications of Huffman coding: Lossless image compression, Text compression and Audio Compression Arithmetic Coding: Introduction, Coding a Sequence,	30 Hours	CO2

	Generating a Tag, Deciphering a Tag, Comparison of Huffman and Arithmetic Coding, Applications.		
3	**Dictionary Coding and Context Based Compression** Dictionary Techniques: Introduction, Static Dictionary: Diagram Coding; Adaptive Dictionary: The LZ77 Approach, The LZ78 Approach, Applications: File Compression-UNIX compress, Image Compression-Graphics Interchange Format (GIF) and Portable Network Graphics (PNG), Compression over modems-V.42 bits. Context Based Compression: Introduction, Prediction with Partial Match (ppm)-The basic algorithm, The ESCAPE SYMBOL, Length of context, The Exclusion Principle; The Burrows Wheeler Transform: Move-to-front coding, Dynamic Markov Compression. Lossless image compression: Introduction, CALIC, JPEG-LS, Multi-resolution Approaches, Facsimile Encoding.	30 Hours	CO3, CO4

Suggested Readings

1. David Salomon, “Data Compression”, Springer Publication, 4th Edition.
2. Khalid Sayood, “Introduction to Data Compression”, Morgan Kaufmann Series, 3rd Edition

Online Resources

1. https://onlinecourses.nptel.ac.in/noc22_ee49/preview

Course Articulation Matrix														
PO-PSO	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**	**PSO1**	**PSO2**
CO1	**2**	**2**	**3**	**1**	**1**							**1**	**2**	**2**
CO2	**3**	**2**	**2**	**2**	**1**							**1**	**2**	**2**
CO3	**1**	**2**	**3**	**2**	**2**							**1**	**2**	**2**
CO4	**2**	**2**	**1**	**1**	**1**							**1**	**2**	**2**

Program	B. Tech CSE				
Year	IV	**Semester**	VIII		
Course Name	Bioinformatics				
Code	NPEC43244				
Course Type	PEC	**L**	**T**	**P**	**Credit**
Pre-Requisite		3	0	0	3
Course Objectives	**1**. Understanding methods and software tools for understanding biological data. **2.** To analyze fundamentals of evolution, molecular biology, and molecular evolution. **3**. To understand DNA, RNA important molecules, protein data, etc. their structure, replication and transcription. **4.**To Evaluate the biological databases which help in analyzing biological data and their interpretation.				
Course Outcomes					
CO1	To understand the basic concept of Bioinformatics and its significance in Biological data analysis				
CO2	To Analyse properties of bio informatical databases, perform text- and sequence-based searches.				
CO3	To Apply the major steps in pair wise and multiple sequence alignment by dynamic programming.				
CO4	To Evaluate different types of Biological databases.				

Module	Course Contents	Contact Hrs.	Mapped CO
1	**Introduction** Bioinformatics objectives and overviews, Interdisciplinary nature of Bioinformatics, Data integration, Data analysis, Major Bioinformatics databases and tools. Metadata: Summary & reference systems, finding new type of data online. Molecular Biology and Bioinformatics: Systems approach in biology, Central dogma of molecular biology, problems in molecular approach and the bioinformatics approach, Overview of the bioinformatics applications	30 Hours	CO1
2	**The Information Molecules and Information Flow** Basic chemistry of nucleic acids, Structure of DNA, Structure of RNA, DNA Replication, -Transcription, -Translation, Genes-the functional elements in DNA, Analyzing DNA,DNA sequencing. Proteins: Amino acids, Protein structure, Secondary, Tertiary and Quaternary structure, Protein folding and function, Nucleic acid-Protein interaction; Perl: Perl Basics, Perl applications for bioinformatics- Boiler, Linux Operating System, Understanding and Using Biological Databases, Java clients, CORBA, Introduction to biostatics	30 Hours	CO2
3	**Nucleotide sequence data** Genome, Genomic sequencing, expressed sequence tags, gene expression, transcription factor binding sites and single nucleotide polymorphism. Computational representations of molecular biological data storage techniques: databases (flat, relational and object oriented), and controlled vocabularies,	30 Hours	CO3, CO4

	general data retrieval techniques: indices, Boolean search, fuzzy search and neighboring, application to biological data warehouses. **Biological data types and their special requirements** Sequences, macromolecular structures, chemical compounds, generic variability and its connection to clinical data, representation of patterns and relationships: alignments, regular expressions, hierarchies and graphical models.		

Suggested Readings

1. O'Reilly, " Developing Bio informatics computer skills", Indian Edition's Publication,2019
2. Rastogi, Mendiratta, Rastogi, "Bioinformatics concepts, skills & Applications", CBS Publishers,2020
3. "Bioinformatics", Addison Wesley,2021

Online Resources

1. https://nptel.ac.in/courses/102103044
2. https://nptel.ac.in/courses/102106065

Course Articulation Matrix														
PO-PSO	**PO1**	**PO2**	**PO 3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO 8**	**PO9**	**PO10**	**PO11**	**PO1 2**	**PSO1**	**PSO2**
CO1	**2**	**2**	**1**		**2**								**2**	**1**
CO2	**1**	**2**	**3**	**2**	**2**							**1**	**1**	**2**
CO3	**2**		**3**	**3**	**2**							**2**	**2**	**3**
CO4	**1**	**1**	**2**	**2**	**2**							**2**	**2**	**2**

Program	**B.Tech**				
Year	**IV**	**Semester**		**VIII**	
Course Name	**Disaster Management**				
Code	**OE33101**				
Course Type	Theory	**L**	**T**	**P**	**Credit**
Pre-Requisite	Environmental Studies, Chemistry	**4**	**0**	**0**	**4**
Course Objectives	**1.** Study about basic concept of environmental chemistry. **2.** Learn about the various parameters of water and wastewater. **3.** How to examine microbial contamination of water. **4.** Study about the different – phases of microbial growth.				
Course Outcomes					
CO1	**1.** Introduction to the basic principles of environmental chemistry.				
CO2	**2.** Detailed knowledge of different parameter of water and wastewater.				
CO3	**3.** To know the thermodynamics microbial system.				
CO4	**4.** Know the aerobic and anaerobic process involved in the water and Wastewater.				

Module	Course Contents	Contact Hrs.	Mapped CO
1	**Introduction** Concept of Environmental Hazards, Environmental stress & Environmental Disasters. Types of Environmental hazards & Disasters: Natural hazards and Disasters, Volcanic Hazards/ Disasters, - Causes and distribution of Volcanoes, - Hazardous effects of volcanic eruptions, - Environmental impacts of volcanic eruptions, Earthquake Hazards/ disasters, - Causes of Earthquakes, - Distribution of earthquakes, - Flood control measures (Human adjustment, perception & mitigation), Droughts: - Impacts of droughts, - Drought hazards in India, - Drought control measures.	30 hrs.	CO1
2	**Mechanics & forms of Soil Erosion** Factors & causes of Soil Erosion, Conservation measures of Soil Erosion, Chemical hazards/ disasters-- Release of toxic chemicals, nuclear explosion, Sedimentation processes, - Global Sedimentation problems, Regional Sedimentation problems, Sedimentation & Environmental problems, Corrective measures of 23 Erosion & Sedimentation, Biological hazards / disasters, Population Explosion	30 hrs.	CO2
3	**Stages** Pre- disaster stage (preparedness)- Preparing hazard zonation maps, Predictability/ forecasting & warning, Preparing disaster preparedness plan, Land use zoning, Pre-disaster stage (mitigation) Disaster resistant house construction, Population reduction in vulnerable areas, Awareness . Emergency Stage:- Rescue training for search & operation at national & regional level, Immediate relief, and Assessment surveys. Post Disaster	30 hrs.	CO3

	stage, Rehabilitation- Political Administrative Aspect		
4	**Relief Measures** Provision of Immediate relief measures to disaster affected people, Prediction of Hazards & Disasters, Measures of adjustment to natural hazards Mitigation discuss the work of following Institution, Meteorological observatory, Seismological observatory, Hydrology Laboratory, Industrial Safety inspectorate, Institution of urban & regional planners, Chambers of Architects, Engineering Council, National Standards Committee, Integrated Planning Contingency management Preparedness Education on disasters, Community involvement, The adjustment of Human Population to Natural hazards & disasters	30 hrs.	CO4

Suggested Readings

1. Singh. Savinder, "Environmental Geography", Prayag Pustak Bhawan.
2. Sharma V.K., "(Ed) Disaster Management", IIPA Publication New Delhi.

Online Resources

1. https://nptel.ac.in/courses/124107010

2. https://www.youtube.com/watch?v=Eh8dAmiJ-fo

Course Articulation Matrix														
PO-PSO	**PO1**	**PO 2**	**PO3**	**PO4**	**PO 5**	**PO6**	**PO7**	**PO 8**	**PO9**	**PO10**	**PO11**	**PO12**	**PSO 1**	**PSO2**
CO1	**3**	**2**		**2**		**2**	**2**					**2**		
CO2	**3**	**2**		**2**		**2**	**2**					**2**		
CO3	**3**	**2**		**2**		**2**	**2**					**2**		
CO4	**3**	**2**		**2**		**2**	**2**					**2**		

Program	B.Tech				
Year	IV	**Semester**	VII		
Course Name	NON-CONVENTIONAL ENERGY RESOURCES				
Code	OE43302				
Course Type	OE	**L**	**T**	**P**	**Credit**
Pre-Requisite	Knowledge of Engineering	3	1	0	4
Course Objectives	1. To develop a strong foundation in the field of Non-Conventional energy resources. 2. The subject gives the knowledge about different forms of Non-Conventional energy.				
Course Outcomes					
CO1	To understand about Non-Conventional energy resources.				
CO2	Evaluate solar energy, make use of it, and understand the principals involved in gathering solar energy and converting it into electricity.				
CO3	Study the components, kinds, and performance of the wind energy conversion system to gain an understanding of the topics involved.				
CO4	To understand about examples of ocean energy and describe the practical ways to use it.				

Module	Course Contents	Contact Hrs.	Mapped CO
I	**Introduction:** Indian and global energy sources, Energy exploited, Energy planning, Introduction to various sources of energy, Solar thermal, Photovoltaic, Water power, wind energy, Biomass, Ocean thermal, Tidal and wave energy, Geothermal energy. Solar radiations: Extra-terrestrial radiation, Spectral distribution, Solar constant, Solar radiations on earth, Measurement of solar radiations, Solar radiation geometry, flux on a plane surface, latitude, declination angle, surface azimuth angle, hour angle, Zenith angle, solar altitude angle expression for angle between incident beam and the normal to a plane surface (no derivation), Local apparent time, Apparent motion of sun, Day length.	30 Hours	CO1
II	**Solar energy:** Solar thermal power and its conversion, Solar collectors, Flat plat, Concentric collectors, Cylindrical collectors, Thermal analysis of solar collectors. Solar energy storage, Different systems, solar pond. Applications, Water heating, Space heating & cooling, Solar distillation, solar pumping, solar cooking, Greenhouses, Solar power plants. **Biogas:** Photosynthesis, Bio gas production Aerobic and anaerobic bio-conversion process, Raw materials, Properties of bio gas, Transportation of bio gas, bio gas plant technology & status, Community biogas plants, Problems involved in bio gas production, Bio gas applications, Biomass conversion techniques, Energy plantation, Fuel	30 Hours	CO2

	properties.		
III	**Wind energy:** Properties of wind, Availability of wind energy in India, wind Velocity, win machine fundamentals, Types of wind machines and their characteristics, Horizontal and Vertical axis wind mills, Elementary design principles, Coefficient of performance of a wind mill rotor, Aerodynamic considerations in wind mill design, Selection of a wind mill, Economic issues, Recent development. **Electrochemical effects and fuel cells:** Revisable cells, Ideal fuel cells, other types of fuel cells, Efficiency of cells, Thermions systems. **Tidal power:** Tides and waves as sources of energy, Fundamentals of tidal power, Use of tidal energy Limitations of tidal energy conversion systems. **Hydrogen Energy:** Properties of hydrogen in respect of its use as source of renewable energy, Sources of hydrogen, Production of hydrogen, Storage and transportation, Problems with hydrogen as fuel.	30 Hours	CO3
IV	**Thermoelectric systems:** Kelvin relations, power generation, Properties of thermoelectric materials, Fusion Plasma generators. **Geothermal energy:** Hot springs, Steam ejection, Principal of working, types of geothermal station with schematic representation, Site selection for geothermal power plants. Advanced concepts Problems associated with geothermal conversion. **Ocean energy:** Principal of ocean thermal energy conversion, Power plants based on ocean energy, problems associated with ocean thermal energy conversion systems.	30 Hours	CO4

Suggested Readings

1. 'Renewable energy sources and conversion technology' by Bansal Keemann, Meliss," Tata McGraw Hill.
2. 'Non-Conventional energy Sources' by Rai G.D, Khanna Publishers.
3. 'Non-conventional Energy' by Ashok V. Desai, New Age International Publishers Ltd.

Online Resources

1. NPTEL (SWAYAM)
   https://archive.nptel.ac.in/courses/121/106/121106014/

2. IEEE Papers

A. Ashwin Kumar, "A study on renewable energy resources in India," *2010 International Conference on Environmental Engineering and Applications*, Singapore, 2010, pp. 49-53, doi: 10.1109/ICEEA.2010.5596088.

Course Articulation Matrix														
PO-PSO	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**	**PSO1**	**PSO2**
CO1	**3**	**3**	**2**	**3**	**2**	**3**							**2**	**2**
CO2	**3**	**3**	**2**	**3**	**3**	**3**							**1**	**2**
CO3	**2**	**2**	**3**	**2**	**3**	**2**							**2**	**1**
CO4	**3**	**2**	**3**	**2**	**3**	**2**							**2**	**1**

Program	B. Tech				
Year	IV	**Semester**	VIII		
Course Name	Quality Management				
Code	OE43501				
Course Type	OE	**L**	**T**	**P**	**Credit**
Pre-Requisite	Intermediate School Education	3	1	0	4
Course Objectives	1. To have knowledge of Quality concept & Quality Management. 2. To be aware about the importance Quality Management. 3. To have knowledge about Control charts. 4. To have knowledge of ISO 9000 series.				
Course Outcomes					
CO1	Know the importance of Quality Management Tools and their applications.				
CO2	Increase the productivity and efficiency of organization with the help of Quality Management Tools.				
CO3	Can develop new types Quality Management Techniques.				
CO4	Apply Taguchi method & JIT method for various applications.				

Module	Course Contents	Contact Hrs.	Mapped CO
1	**Quality Concepts:** Evolution of Quality control, Concept change, TQM Modern concept, Quality concept in design, Review off design, Evolution of prototype. **Control on Purchased Product:** Procurement of various products, Evaluation of supplies, Capacity verification, Development of sources, Procurement procedure. **Manufacturing Quality:** Methods and Techniques for manufacture, Inspection and control of product, Quality in sales and services, Guarantee, analysis of claims.	30 Hours	CO1
2	**Quality Management:** Organization structure and design, Quality function, Decentralization, Designing and fitting organization for different types products, Economics of quality value and contribution, Quality cost, Optimizing quality cost. **Human Factor in Quality:** Attitude of top management, Co-operation, of groups, Operators attitude, responsibility, Causes of operator's error and corrective methods.	30 Hours	CO2
3	**Control Charts:** Theory of control charts, Measurement range, Construction and analysis of R charts, Process capability study, Use of control charts. **Attributes of Control Charts:** Defects, Construction and analysis off-chart, Improvement by control chart, Variable sample size, Construction and analysis of C-chart.	30 Hours	CO3
4	**Defects Diagnosis and Prevention:** Defect study, Identification and analysis of defects,	30 Hours	CO4

	Corrective measure, Factors affecting reliability, MTTF, Calculation of reliability, Building reliability in the product, Evaluation of reliability, Interpretation of test results, Reliability control, Maintainability, Zero defects, quality circle. **IS0-9000anditsconceptofQualityManagement:** ISO9000series, Taguchi method, JIT in some details		

Suggested Readings

1. Concurrent Engineering Kusiak John Wiley.

2. Concurrent Engineering Menon Chapman & hall.

3. Quality Control & Reliability Analysis – Bijendra Singh, Khanna Publications

Online Resources

1. https://archive.nptel.ac.in/courses/110/104/110104080/

2. https://nptel.ac.in/courses/110104085

Course Articulation Matrix

PO-PSO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	3	1		2	2				1		2	2			
CO2	2	2	1	3	2				2	1	2	2			
CO3	2	3	1	1	3						1	2			
CO4	3	3	3	3	3				1		1	2			

Program	**B. Tech**				
Year	**IV**	**Semester**		**VIII**	
Course Name	**Concepts of Climate Smart Agriculture**				
Code	OE43102				
Course Type	Theory	**L**	**T**	**P**	**Credit**
Pre-Requisite	Environmental Studies, Disaster Management	**3**	**1**	**0**	**4**
Course Objectives	1. To give knowledge about meteorology, atmosphere, and climate smart agriculture. 2. To give knowledge about soil formation and its physicochemical properties. 3. To know about climate change and its possible impacts. 4. To know about climate challenges and water management.				
Course Outcomes					
CO1	1. To know about meteorology, atmosphere, and climate smart agriculture.				
CO2	2. To understand soil formation and its physicochemical properties.				
CO3	3. To know climate change and its possible impacts.				
CO4	4. To know challenges due to climate change and water management.				

Module	Course Contents	Contact Hrs.	Mapped CO
1	**Climate relations** Meteorology and atmosphere, structure and composition of atmosphere, atmospheric inputs (acid rain, dust), water-soil-plant relations, pollution in the environment and its effects on human, plant and soil, climate smart agriculture and greenhouse gases.	30 hrs.	CO1
2	**Soil formation and its physicochemical properties** Soil forming rocks and minerals, their classification and composition, important soil physical properties; and their importance; soil particle distribution; soil organic matter – its composition and decomposition, effect on soil fertility; soil reaction – acid, saline and sodic soils. Soil nutrients, Influence of physicochemical properties of soil on plant health. Effects of macro and micro nutrients on plant growth.	30 hrs.	CO2
3	**Climate change and its possible impacts** Historical examples of crop failure, reasons, and its social consequences, need and strategy of development of climate smart crop, successful examples of climate smart crops, effects of climate on crops, crop growth and development in relation to environmental stress -water and temperature stress, nutrient stress and resistance mechanism.	30 hrs.	CO3
4	**Challenges due to climate change and water management** Challenges arising out of climate change and case studies (e.g., cultivating Durum wheat in Ethiopia and its mitigation). Advances of crop water management for climate smart crop production, examples of case studies. Rain water harvesting, organic farming, and use of high-quality varieties of crops.	30 hrs.	CO4

Suggested Readings

1. Manohar, K.R. and Iga Thinathane. C. Green House Technology and Management, B.S.Publications, Hyderabad.
2. Benkeblia Noureddine (Ed) (2020) Climate Change and Crop Production: Foundations for Agroecosystem Resilience; CRC Press
3. Hebbar, KB, Naresh Kumar, S. and Chowdappa, P. (2017). Impact of Climate Change on Plantation Crops (Eds). P 260. Astrel International –Daya Publishing House, New Delhi, India, ISBN: 9789351248330.
4. Brady, N. E., The Nature and Properties of Soils, MacMillan Publishing Co., INC., 1984.
5. Bohn, H. L., McNeal, B. L., O'Connor, G. A., Soil Chemistry, John Wiley and Sons, New York, 1979.
6. M.M. Rai, Principles of Soil Science, 4th ed., Macmillan India Limited, Delhi, 2002.
7. Henry D. Foth and Boyd G. Ellis, Soil Fertility, 2nd edition, Lewis Publishers, New York, 1997.

Online Resources

1. L. Molley, The Chemical Nature of Soils. In: Soils, Ontario Forestry Association, 2011, Available: http://www.ontarioenvirothon.on.ca/files/soil/soil_Chapter4.pdf
2. U.M. Sainju, R. Dris and B. Singh, Mineral Nutrition of Tomato, 2003, Available: www.aseanfood.info/Articles/11019991.pdf.
3. Making climate-smart agriculture work for the poor (www.worldagroforestry.org/publication/making-climate-smart-agriculture-work-poor
4.

Course Articulation Matrix														
PO-PSO	**PO 1**	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**	**PSO1**	**PSO2**
CO1	3	2	2	2		2	2					2		
CO2	3	2	2	2		2	2					2		
CO3	3	2	2	2		2	2					2		
CO4	3	2	2	2		2	2					2		