BABU BANARASI DAS UNIVERSITY

School of Engineering
(School Code: 04)
Department of Computer Science and Engineering
(University Branch Code: 40)
Bachelor of Technology: Computer Science and Engineering (Internet of Things and Blockchain)
(in association with IBM)

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
Students need to select either GROUP 'A' or GROUP 'B'									
	NGP4101	General Proficiency				100		100	1
Total			3	1	0	140	60	200	5

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	NITBC4101	Data Visualization with Python	3	0	0	40	60	100	3
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	NITBC4151	Data Visualization with Python 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			15	2	8	360	540	900	21

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
ESC	NITBC4102	Java Fundamental	3	0	0	40	60	100	3
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
ESC	NITBC4152	Java Fundamental 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			14	3	8	360	540	900	21

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
Students need to select either GROUP 'A' or GROUP 'B'									
	NGP4201	General Proficiency				100		100	1
Total			3	1	0	140	60	200	5

GROUP 'A'

Course Category	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	NITBC4201	Data Visualization with Python	3	0	0	40	60	100	3
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	NITBC4251	Data Visualization with Python 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			15	2	8	360	540	900	21

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

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
ESC	NITBC4202	Java Fundamental	3	0	0	40	60	100	3
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
ESC	NITBC4252	Java Fundamental Lab	0	0	2	40	60	100	1
BSC	NBS4253	Engineering Chemistry Lab	0	0	2	40	60	100	1
ESC	NME4253	Engineering Graphics Lab	0	0	2	40	60	100	1
Total			14	3	8	360	540	900	21

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	NITBC4301	Internet of Things Application Development	2	1	0	40	60	100	3
PCC	NCS4302	Operating Systems	3	1	0	40	60	100	4
PCC	NCS4305	C Programming	3	1	0	40	60	**100**	**4**
PCC	NITBC4351	Internet of Things Lab	0	0	2	40	60	**100**	**1**
PCC	NCS4355	C Programming Lab	0	0	2	40	60	**100**	**1**
CQAC	NCC4351	NSS/YOGA*	0	0	2	100	-	100	1
	NGP4301	General Proficiency	-	-	-	100	-	**100**	**1**
Total			**16**	**4**	**6**	**520**	**480**	**1000**	**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	NCS4403	Data Structure Using 'C'	3	1	0	40	60	100	**4**
PCC	NCS4404	Big Data Analytics & Architecture	3	0	0	40	60	100	**3**
PCC	NITBC4401	Blockchain Essentials	3	0	0	40	60	100	**3**
PCC	NCS4451	Database Management Systems Lab	0	0	2	40	60	100	**1**
PCC	NITBC4451	Blockchain Essentials Lab	0	0	2	40	60	100	**1**
PCC	NCS4453	Data Structure Lab	0	0	2	40	60	100	**1**
CQAC	NVC4401	Indian Constitution*	1	0	0	40	60	100	**1**
	NGP4401	General Proficiency	-	-	-	100	-	100	**1**
* Compulsory Qualifying Audit Course									
Total			**17**	**3**	**6**	**500**	**600**	**1100**	**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	NCCML4501	Predictive Analytics	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	NITBC4501	Web Services	3	0	0	40	60	**100**	**3**
PCC	NCCML4551	Predictive Analytics Lab	0	0	2	40	60	**100**	**1**
PCC	NITBC4551	Web Services Lab	0	0	2	40	60	**100**	**1**
SPIC	NITBC4553	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			**16**	**2**	**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**
PCC	NITBC4601	Deployment of Cloud	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-I**	3	0	0	40	60	**100**	**3**
PCC	NITBC4651	Cloud Deployment Lab	0	0	2	40	60	**100**	**1**
PCC	NCS4652	Algorithms Lab	0	0	2	40	60	**100**	**1**
SPIC	NITBC4651	Seminar	0	0	2	100	0	**100**	**1**
SPIC	NITBC4653	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	NITBC4701	Privacy and Security in Internet of Things	3	1	0	40	60	**100**	**4**
PEC	-	**Professional Elective Course II**	3	0	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	NITBC4751	Privacy and Security in Internet of Things Lab	0	0	2	40	60	**100**	**1**
SPIC	NITBC4753	Major Project I	0	0	4	100	0	**100**	**2**
SPIC	NITBC4754	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	NITBC4801	Enterprise Design Thinking	**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	NITBC4853	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	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
NPEC44011	Blockchain and Distributed Ledger Technology
NPEC44012	Cloud-Native Application Development
NPEC44013	Pattern Recognition
NPEC44014	Web of Things

Course Code	Professional Elective Course II
NPEC44021	Network Security and Cryptography
NPEC44022	Wireless Communication Networks
NPEC44023	Security Governance and Law
NPEC44024	Cyber and Digital Forensics

Course Code	Professional Elective Course III
NPEC44031	Blockchain Architecture: Design and Use Cases
NPEC44032	Smart City Application Development
NPEC44033	Big Data Security
NPEC44034	Computer Vision

Course Code	Professional Elective Course IV
NPEC44041	Distributed Systems
NPEC44042	Cryptography and Information Security
NPEC44043	Data Science for Internet of Things
NPEC44044	Blockchain Technologies: Business Innovation and Applications

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(IOTBC)				
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(IOTBC)				
Year	I	**Semester**	I/II		
Course Name	Data Visualization with Python				
Code	NITBC4101/ NITBC4201				
Course Type	ESC	**L**	**T**	**P**	**Credit**
Pre-Requisite	Basic knowledge of Python Programming.	3	0	0	3
Course Objectives	**1.** Describe the basic concepts of data science such as Linear Algebra, Probability and Statistics, Matplotlib, Charts and Graphs. **2.** Understanding Data Analysis, Visualization of non-uniform data. **3.** Demonstrating Hypothesis and Gradient Descent, Data Clustering. **4.** To Study the basic concepts of the Python tool and Utilization.				
Course Outcomes					
CO1	Understand basic concepts of python, data visualization and data analysis.				
CO2	Analyze and plot the data visualization by using Matplotlib library.				
CO3	Analyze and plot the data visualization by using Matplotlib library				
CO4	Analyze and plot the data Visualization by using Seaborn Library.				

Module	Course Contents	Contact Hrs.	Mapped CO
1	**PYTHON AS TOOL:** Crash course of Python, Sample Scripts with Loops in python. **Data Visualization:** Understanding Data Visualization, history and Architecture of Matplotlib. **Data Analysis:** Understanding Data Analysis, exploring 1-D data, Exploring 2-D data, Bubble chart representation, Data Mingling Linear Algebra: What are vectors?, various operations of vectors, Understanding Matrices. **Statistics:** Single set of data, Concept of Central Tendencies, Dispersion. **Probability:** Probability concept, Normal Distribution, Central Limit Theorem.	30 Hours	CO1
2	**Visualization with Matplotlib library Basic plots:** Line Plots, Bar plot, Histograms, Scatter plot, pie chart, Area Plots, Pie Charts, Box Plots, Bubble Plots, Waffle Charts, Word Clouds **Pyplot in Matplotlib:** Line Plot, Histogram, Scatter, 3D Plot, Image, Contour, and Polar. **Matplotlib-Axes Class:** axes () function, add_axes () function, ax. Legend () function, ax. plot () function, sine and cosine functions. **Multiple Subplot:** Create multiple subplots, add title to subplots, set single main title for all subplots, turn off the axes for subplots Advance Data Visualization Visualizing the content of a 2D array, adding a color map legend to figure, Visualization non uniform 2D data, Visualizing contour lines, Polar charts, Plotting log charts for research.	30 Hours	CO2
3	**Creating Maps and Visualizing Geospatial Data:** Introduction to Folium, Maps with Markers, Choropleth Maps.	30 Hours	CO3, CO4

	Export Feature – Data Visualization: Generating a PNG picture, Generating PDF documents, Multiple graphs plotting and export, Inserting sub figure. **Hypothesis and Gradient Descent:** Understanding Hypothesis, Implementation of hypothesis in python, Gradient Descent, Implement of gradient Descent. **Visualization by using Seaborn Library:** **Relational plot:** Dist Plot, Line Plot, Lmplot. **Categorical plot:** Stripplot, Swarmplot,Barplot, Countplot, Boxplot, Violinplot, Stripplot. **Distribution plot:** Join plot, Distpot, Pairplot, Rugplot. **Regression plot:** Simple Linear plot with additional parameters (hue and markers), Setting size and color of the plot, Displaying multiple plots, Size and aspect ratio of plots. **Matrix plot:** Heatmaps, Cluster Maps. **Style and Color:** Set the background to be white, Set the background to be ticks, Set the background to be darkgrid, Set the background to be whitegrid. **Remove axes spine:** Despine Size and aspect: Non grid plot, Grid type plot Scale and Context: Poster, paper, notebook and talk.		

Suggested Readings

1. Matplotlib 3.0 Cookbook‖ by Srinivasa Rao Poladi
2. Data Visualization in Python‖ by David Landup

Online Resources

1. https://onlinecourses.nptel.ac.in/noc22_cs32/
2. https://onlinecourses.nptel.ac.in/noc21_cs45/

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

Program	B. Tech CSE(IOTBC)				
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(IOTBC)				
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(IOTBC)				
Year	I	**Semester**		I/II	
Course Name	Data Visualization with Python Lab				
Code	NITBC4151/NITBC4251				
Course Type	ESC	**L**	**T**	**P**	**Credit**
Pre-Requisite	Knowledge of Python	0	0	2	1
Course Objectives	**1.** To understand Use python libraries for data visualization. **2.** To apply and Conduct exploratory data analysis using Python. **3.** To evaluate Interpret results of exploratory data analysis. **4.** Students to learn the different data visualization techniques.				

Course Outcomes	
CO1	Implement data visualization techniques and plots using Python libraries, such as Matplotlib, Seaborn, and Folium to tell a stimulating story.
CO2	Implement the different types of charts and plots such as line, area, histograms, bar, pie, box, scatter, and bubble.
CO3	Implement advanced visualizations such as waffle charts, word clouds, regression plots, maps with markers, & choropleth maps.
CO4	Implementation of the scatter, line, bar, bubble, pie, and sunburst charts using the Dash framework and Plotly library.

S. No.	**List of Experiments**	
1	Scatter plot with color groupings on iris dataset.	**CO1**
2	Scatter plot with color groupings and size encoding for the third variable of country size.	
3	Line graph: Percentage of bachelor degree conferred to women in USA, by major (1970- 2012)	**CO2**
4	Read Total profit of all months and show it using a line plot.	**CO1, CO2**
5	Read all product sales data and show it using the stack plot.	**CO1,CO2**
6	**Some advance projects/labs** 1. Finance data analysis 2. Uber data analysis of NYC 3. Hotel booking 4. Covid-19 **5.** Amazon customer data analysis	**CO3,CO4**

Online Resources

1. https://python-iitk.vlabs.ac.in/

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

Program	B. Tech CSE(IOTBC)				
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(IOTBC)				
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	30 Hours	CO3

	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, 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 (IOTBC)				
Year	I	**Semester**	I/II		
Course Name	Java Fundamental				
Code	NITBC4102/ NITBC4202				
Course Type	ESC	**L**	**T**	**P**	**Credit**
Pre-Requisite	Basic Knowledge of C Programming Language.	3	0	0	3
Course Objectives	**1.** Introduction to Java programming and fundamentals of object-Oriented programming, including defining classes, Invoking methods, using Clang Libraries etc. **2.** Understanding the basic of polymorphism through use of super classes and interface. **3.** Understand to handle exception, implement check and unchecked exceptions. **4.** To develop interaction use interfaces using Java swing class.				
Course Outcomes					
CO1	Understand the basic concepts of OOPs.				
CO2	Understand the concepts of core java such as inheritance, polymorphism.				
CO3	Implement the enterprises application of java bean and JSP.				
CO4	Apply the knowledge of JSP and developed the enterprises application.				

Module	Course Contents	Contact Hrs.	Mapped CO
1	**INTRODUCTION** Introduction to object-oriented programming, Object concepts, Key principles of object-oriented programming. **INTRODUCTION JAVA PROGRAMMING LANGAUGE** Introduction to the Java programming language. Introduction to the Java development and Productivity tools. Object-oriented programming: Java syntax basics -Part 1, Java syntax basics -Part 2.	30 Hours	CO1
2	**CONCEPTS OF CORE JAVA** Writing simple Java code using the IDE, Building classes, Debug applications, Inheritance, Design patterns and refactoring, Interfaces, Collections, Generics, Threads and synchronization, Utility classes, Exceptions and exception handling, I/O and serialization. **INTRODUCTION TO ENTERPRISE APPLICATION DEVELOPMENT** JavaBeans, Introduction to Java EE Web Component, Overview of Servlets, Java EE Container Services Overview, Servlet API, Overview of JavaServer Pages, JavaServer Pages Specification and Syntax.	30 Hours	CO2 CO3
3	**ENTERPRISE APPLICATION DEVELOPMENT** Create and Edit HTML and JSPs, Debugging Web Applications, Web Archive Deployment Descriptor, Session State Storage Issues, Cookie API, HttpSession: Management of Application Data, URL Rewriting, Best Practices for Session Management, JSP Expression	30 Hours	CO4

	Language, JSP Custom Tags, JSP Tag Files. Create and Edit Servlets, Filters, and Listeners, XDoclet and Annotations, Connecting to a database, Web Application Security, Java EE Packaging and Deployment, Best Practices for Server, Side Application Development.		

Suggested Readings

1. Java the Complete Reference" by Herbert Schildt.
2. Core Java An Integrated Approach‖ by Dr. R. Nageswara Rao.

Online Resources

1. https://onlinecourses.nptel.ac.in/noc22_cs47/preview

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

Program	B Tech CSE(IOTBC)				
Year	I	**Semester**	I/II		
Course Name	Basic 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 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(IOTBC)				
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**									
CO2	**3**	**2**	**3**	**2**	**2**									
CO3	**3**	**3**	**2**	**3**	**3**									
CO4	**3**	**2**	**3**	**2**	**2**									
CO5	**3**	**3**	**2**	**1**	**2**									

Program	B.Tech.: CSE(IOTBC)				
Year	I	**Semester**	I/II		
Course Name	Java Fundamental Lab				
Code	NITBC4152/NITBC4252				
Course Type	ESC	**L**	**T**	**P**	**Credit**
Pre-Requisite	Knowledge of C Programming language.	0	0	2	1
Course Objectives	**1.** List the editors used for creating java programs. **2.** Describe the Structure of java programs. **3.** Identify different keywords available in java programming language. **4.** Compare and use the various java keywords for writing java programs.				
Course Outcomes					
CO1	Understand the basic program of the java programming language using class.				
CO2	Analyze the constructor and interface in java programming language.				
CO3	Evaluate and discuss which query execution method and statement should be used to access database through Java programs.				
CO4	Apply knowledge of servlet to create server side programs.				

The following programs should be implemented preferably on 'UNIX/WINDOWS' platform using C.

S. No.	List of Experiments	Mapped CO
1	Write a program to create a class Student2 along with two method getData() ,printData() to get the value through argument and display the data in printData. Create the two objects s1, s2 to declare and access the values from class STtest.	CO1
2	WAP using parameterized constructor with two parameters id and name. While creating the objects obj1 and obj2 passed two arguments so that this constructor gets invoked after creation of obj1 and obj2.	CO2
3	Write a program in JAVA to demonstrate the method and constructor overloading.	CO2
4	Write a java program in which you will declare two interface sum and Add inherits these interface through class A1 and display their content.	CO2
5	Write a java program in which you will declare an abstract class Vehicle inherits this class from two classes car and truck using the method engine in both display ―car has good engine‖ and ―truck has bad engine‖.	CO1
6	Write a Java Program to finds addition of two matrices.	CO2
7	Write a program in java if number is less than 10 and greater than 50 it generate the exception out of range. Else it displays the square of number	CO1
8	Write a servlet to connect Java Web application to MySQLl/ DB2 Server	CO4
9	Create a Login form in Html and validated it on Server Side using Servlet.	CO3
10	Create a J.S.P Application to view all data of MySQL/ DB2 table on Web Page.	CO3

Project Statement

<u>Airline Reservation System in Java</u>

This Java project is used to book seats for airlines. There will be a database to store the number

of vacant seats, fight details, arrival and departure times, cities, and rates for each flight. As a beginner level project, you can exclude the option of payment processing. But, there should be one dummy model of payment processing and also to cancel the booking.

Online Air Ticket Reservation System in Java

To book tickets for an Airplane from your own place. There will be a local server to host the database of the system. All the details regarding the bus, schedules, arrival and departure time, available seats, the rate will be mentioned and the user has to book the ticket according to his requirements.

Inventory Management System in Java

This is also a core Java project for beginners can be implemented as a minor project to test and implement skills in Java.

This system will manage all the available stocks in a shop or any business organization. We can make purchases, sell and view the current stock. It keeps a track of manufacture, sale, purchase, orders, and delivery of the products by maintaining a database. You can search the product and it will show the status and details of the product on the screen.

Online Resources

1. https://java-iitd.vlabs.ac.in/List%20of%20experiments.html

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**	**1**	**2**
CO2	**2**	**2**		**3**								**1**	**2**	
CO3	**2**	**2**	**2**									**2**	**2**	**2**
CO4	**1**	**2**	**2**	**1**								**2**	**2**	**2**

Program	B. Tech CSE(IOTBC)				
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(IOTBC)				
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(IOTBC)				
Year	II	**Semester**	III		
Course Name	Internet of Things Application Development				
Code	NITBC4301				
Course Type	PCC	**L**	**T**	**P**	**Credit**
Pre-Requisite	Knowledge of computer.	2	1	0	3
Course Objectives	**1.** To introduce a complete Internet of Things (IoT) solution by using IBM Watson IoT Platform. **2.** To introduces basic concepts such as the service catalog, cloud applications, cloud services, and starter kits. **3.** To enable students to closer look at the building blocks of IoT architecture and at the capabilities that is provided by Watson IoT Platform. **4.** To introduce flow-based programming tool for wiring together hardware devices, APIs, and online services.				
Course Outcomes					
CO1	Understand the IBM Watson IoT Platform.				
CO2	Understand and apply IoT concepts over IBM Watson IoT Platform.				
CO3	Understand the IoT concepts over Node-red and analyzing the network.				
CO4	Apply the programming interface to connect IoT devices using Rest API for analysis and evaluation.				

Module	Course Contents	Contact Hrs.	Mapped CO
1	**Introduction to the Internet of Things and IBM Watson IoT Platform** IBM IoT point of view, IoT reference architecture, Watson IoT Platform overview, Connecting devices to Watson IoT Platform, Communication protocols **Introduction to IBM Cloud & IBM Watson IoT Platform** IBM Cloud overview, Databases on IBM Cloud, Managing users and resources on IBM Cloud, Managing applications and services on IBM Cloud, Getting started with Watson IoT Platform Watson IoT Platform features overview, Watson IoT Platform dashboard, Device management and security policies, Application management, Access Management, Advanced features in Watson IoT Platform, Watson IoT Platform recipes.	30 Hours	CO1
2	**Introduction to Node-RED and Network protocols** Introduction to flow-based programming, Node-RED overview, Node- RED flow editor, Node-RED Palette Manager, MQTT protocol overview, HTTP and MQTT protocol comparison **Enhancing Internet of Things solutions with REST APIs** Application programming interface overview, REST API overview, API versus SDK and API versus a library, JSON data format overview, Accessing Watson and Cloudant services with REST APIs, Enhancing an IoT solution with Watson AI.	30 Hours	CO2

3	**Introduction to analytics services on IBM Cloud** Analytics services on IBM Cloud overview, IBM Analytics Engine overview **Introduction to Watson Android SDK in Android** Introduction to Android development Explore the benefits of JSON and XML in Android applications. **Project** Simple application with the Watson Android SDK in Android Studio Developing full-stack mobile apps for Android Integrating IoT applications with IBM Watson Visual Recognition.	30 Hours	CO3, CO4

Suggested Readings

1. IoT Fundamentals: Networking Technologies, Protocols, and Use Cases for the Internet of Things by David Hanes, Gonzalo Salgueiro, Rob Barton Released June 2017 Publisher(s): Cisco Press ISBN: 9780134307091
2. Enterprise Internet of Things Handbook by Arvind Ravulavaru Released April 2018 Publisher(s): Packt Publishing ISBN: 9781788838399
3. Analytics for the Internet of Things (IoT) by Andrew Minteer Released July 2017 Publisher(s): Packt Publishing ISBN: 9781787120730

Further suggested Readings

1. Analytics: Data Science, Data Analysis and Predictive Analytics for Business‖ by Daniel Covington.
2. Artificial Intelligence for IoT: ―IBM Reference Architecture for High Performance Data and AI in Healthcare and Life Sciences‖ by Dino Quintero, Frank N. Lee.

Online Resources

1. https://onlinecourses.nptel.ac.in/noc21_cs17/preview
2. https://nptel.ac.in/courses/108108123

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	2
CO2	2		2											2
CO3	2	2		2	2									3
CO4	2	2	2	1									2	2

Program	B. Tech CSE(IOTBC)				
Year	II	Semester	III		
Course Name	Operating Systems				
Code	NCS4302				
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(IOTBC)				
Year	II	Semester	III		
Course Name	C Programming				
Code	NCS4305				
Course Type	PCC	**L**	**T**	**P**	**Credit**
Pre-Requisite	Fundamentals of computer	3	1	0	4
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** Programming Environment, Concept of algorithm, Strategy for designing Algorithms, Top-down development, Stepwise refinement, Flowchart, Programming Languages, Assembler, Compiler, Interpreter, Systematic Development of Programs, Program Writing and execution, Introduction to the design and implementation of correct efficient and maintainable programs, Structured Programming Concept, Number System and Conversion Methods, Introduction to C language, Identifiers, Keywords, Constants and Variables in C, Storage classes, Fundamental Data types in C, Integer	30 Hours	CO1

	types, short, long. Unsigned Character types, single and double precision floating point.		
2	**Storage Classes, Operators and Control Statements** Storage Classes in C: Automatic, register, static, extern, Operators and Expressions in C: Arithmetic, Relational, Logical, Assignment, Bitwise, Conditional, Increment and Decrement, Special Operators such as comma, sizeof etc. Type Conversion in C, Operator Precedence and Associativity, Mixed mode operations, Standard Input/output functions: printf(),scanf(), getch(), getchar(), getche() etc. Conditional and Control Statements: if statement, if-else statement, nested if- else statement, else if ladder, switch statements, restrictions on switch values, Use of break and default statement with switch. Looping or Iteration: Uses of while, for and do-while loops, nesting of loops, use of break and continue statements.	30 Hours	CO2
3	**Arrays, Structures and Functions** Array, notation and representation, using one dimensional, two dimensional and multi-dimensional arrays, Arrays of unknown and varying size, Searching and sorting in arrays. Strings: String declaration and initialization, String manipulation. Structures: Purpose and use of structures, declaring and assigning of structures, accessing structure elements, Array of structures, Arrays within structures. Union: Utility of unions, Union of structures. Function Declaration, function Definition, function call, Passing values between functions, Global and local variables and their scope, Call by value and call by reference	30 Hours	CO3
4	**Pointers, Preprocessors and File Handling** Pointers: Understanding Pointers, Declaration and initialization of pointer variables, Accessing the address of the variable, Pointer arithmetic, Pointers and arrays. Dynamic Memory Allocation, Stack, Linked list, Recursion, Pointers to functions, Declaration of a pointer to a function, Initialization of function pointers, Calling a function using a function pointer, Passing a function to another function, How to return a function pointer. Standard C library functions: Math functions, String handling functions, The C preprocessor: preprocessor directives, defining and calling macros, conditional compilation, passing values to the compiler. File Handling in C: Types of files, Defining, opening and closing of a file, Input/output operations on files, Multiple file handling in C.	30 Hours	CO4

Suggested Readings

1. Let Us C By Yashwant P. Kanetkar.
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
6. Problem Solving and Program Design in C, by Jeri R. Hanly, Elliot B. Koffman, Pearson Addison-Wesley, 2006

Online Resources

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

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

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**
CO 1	**1**	**2**	**1**		**2**								**1**	**2**
CO 2	**2**	**3**	**1**	**1**									**2**	**2**
CO 3	**1**	**3**	**2**	**2**	**2**								**1**	**2**
CO 4	**1**	**1**	**2**	**1**	**1**								**1**	**1**

Program	B.Tech.: CSE(IOTBC)				
Year	II	**Semester**	III		
Course Name	Internet of Things Lab				
Code	NITBC4351				
Course Type	PCC	**L**	**T**	**P**	**Credit**
Pre-Requisite	Knowledge of C programming and Python.	0	0	2	1
Course Objectives	**1.** Students Able to understand the application areas of IOT · **2.** Student Able to realize the revolution of Internet in Mobile Devices, Cloud & Sensor Networks · **3.** Able to understand building blocks of Internet of Things for Application. **4.** Students able to design & develop IOT Device.				
Course Outcomes					
CO1	Implementation the different interface program with Ardunio.				
CO2	Implementation the GSM module with Arduino.				
CO3	Implementation the various sensors with Arduino.				
CO4	Apply to upload/download sensor data on cloud and server.				

S. No.	List of Experiments	Mapped CO
1	Interfacing of led with Arduino and write a code for led blinking. Interface 8 led‘s with Arduino and write a code to generate different patterns.	CO1
2	Interface seven segment with Arduino and write a code to run 0-9 counter on Display.	CO1
3	Interface 16*2 LCD with Arduino and write a code to print user‘s name in first row and run a counter from 0-99 in second row.	CO1
4	Interface DC geared motor and servo motor with Arduino. Write a program to run DC geared motor in clockwise direction for 3 seconds and then in Anticlockwise direction for 3 seconds. Write a program to sweep servo motor from 0-180 and 180-0 repeatedly.	CO1
5	Interfacing DHT11/22 with Arduino and write a code to Display temperature and humidity on Console turn on LED when temperature reading is above 30 degrees and turn it OFF otherwise	CO1
6	Interface Ultrasonic sensor with Arduino and write a code to display a distance on console or Serial Monitor.	CO3
7	Interface IR sensor or LDR with Arduino and write a code to turn on the buzzer alert when an obstacle is detected in the targeted area	CO3
8	Installation steps for Node-red and Description to its dashboard. Text to speech conversion and language translator app using Node-red	CO3
9	Bluetooth Interfacing with Arduino and write a code to turn on and off an led using android device and through voice commands.	CO3
10	Interfacing of GSM module with Arduino and Writing code to dial a number, attend a call or send an alert message using GSM and perform a task on particular message reception from user end.	CO2
11	Interfacing of servo motor, Soil Moisture sensor with arduino. And build a basic automatic irrigation system	CO3
12	Interfacing of Wifi Module(ESP8266) with Arduino and upload the count on thing speak(Open cloud platform)	CO4
13	**Project Statement**	CO3,

	✓ Using IBM Cloud Create a Watson Service to Implement Internet of Things (IoT) Application. Assume You working in a Organization - Pixel Crayons. There is requirement of building an IOT based product with the help of Cloud Platform. You are assigned to perform operation and how devices/sensors can be handled on cloud. Perform all the procedure that help client to implement in needful Areas. ✓ Create Watson IOT platform instance and perform the device registration process. ✓ Create an Application to generate random readings and upload the readings on Watson IOT platform and also store the readings on Database. ✓ Visualise the readings on graph. ✓ Plot the historical readings for visualizing the data extracted from cloudant. **Project Statement** • Cloudant database in IBM Cloud integration with a third-party application (Postman) 1. Install third party application postman on your system 2. Create database for student feedback system and document via creating an instance of Cloudant database. 3. Perform integration between IBM cloud and third-party application 4. Perform operations. 5. Make PDF document for performed tasks	CO4

Online Resources

https://syngient.in/iotify-virtual-lab/

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

Program	B.Tech. CSE(IOTBC)				
Year	II	**Semester**		III	
Course Name	C Programming Lab				
Code	NCS4355				
Course Type	PCC	**L**	**T**	**P**	**Credit**
Pre-Requisite	Basic knowledge of computer.	0	0	2	1
Course Objectives	**1.** To introduce students to the basic knowledge of programming fundamentals of C language. **2.** To impart writing skill of C programming to the students and solving problems. **3.** To impart the concepts like looping, array, functions, pointers, file, structure. **4.** Understand how to access and use library functions.				
Course Outcomes					
CO1	Understand and trace the execution of programs written in C language.				
CO2	Analyze the C code for a given algorithm..				
CO3	Evaluate Programs with pointers and arrays, perform pointer arithmetic, and use the pre-processor.				
CO4	Applying the basic concepts of pointer, file handling.				

S. No.	List of Experiments	Mapped CO
1	Creating and editing simple C program, debugging, compilation, execution.	CO1
2	C‘ programming on variables and expression assignment, simple arithmetic Loops, If-else, Case statements, break, continue, goto.	CO1
3	Implementing different operations on Single & Multidimensional arrays.	CO2
4	Implementing different String handling inbuilt and user defined functions.	CO2
5	Implementation of Functions, recursion, file handling in C‘.	CO2
6	Implementing different operations on Single & Multidimensional arrays.	CO3
7	Implement the Pointers, address operator, declaring pointers and operations on pointers in C’.	CO3
8	Implement the Address of an array, structures, pointer to structure, dynamic memory allocation in C’.	CO3
9	Implement the C’ program of 2‘s complement of a numbers.	CO4
10	Implement the Pointers, address operator, declaring pointers and operations on pointers in C’.	CO4

Online Resources

1. https://ps-iiith.vlabs.ac.in/

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

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	0	0	2	1
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(IOTBC)				
Year	II	**Semester**	IV		
Course Name	Database Management Systems				
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(IOTBC)				
Year	II	**Semester**	IV		
Course Name	Data Structure Using 'C'				
Code	NCS4403				
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(IOTBC)				
Year	II	**Semester**	IV		
Course Name	Big Data Analytics & Architecture				
Code	NCS4404				
Course Type	PCC	**L**	**T**	**P**	**Credit**
Pre-Requisite	Java, HADOOP frameworks, Clustering techniques, large data sets, PIG and HIVE	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 Pig. Introducing Hive: Getting started with Hive, Hive Services, Data types in Hive, Built-in functions in Hive, Hive DDL	30 Hours	CO3, CO4

Suggested Readings

1. Seema Acharya, Subhashini Chellappan, ―Big Data and Analytics, Wiley Publications, 2 nd Edition,2014DT Editorial Services, ―Big Data, Dream Tech Press, 2 ndEdition, 2015.
2. Tom White, ―Hadoop: The Definitive Guide, O'Reilly, 3 rd 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**	**PO9**	**PO10**	**PO11**	**PO12**	**PSO1**	**PSO2**
CO1	3	1		1				1				1	3	2
CO2	3	2		2				2				1	2	3
CO3	3	1	3	2	2			1				1	3	3
CO4	3		3	2	1			1					3	2

Program	B.Tech.: CSE(IOTBC)				
Year	II	**Semester**	IV		
Course Name	Blockchain Essentials				
Code	NITBC4401				
Course Type	PCC	**L**	**T**	**P**	**Credit**
Pre-Requisite	Knowledge of Networking and cryptography.	3	0	0	3
Course Objectives	**1.** Students study the foundational knowledge of blockchain. **2.** Basic concepts of blockchain required to understand the technology. **3.** To study about cryptocurrencies and their functions. **4.** To understand about Bitcoin and Ethereum and the role of Blockchain in various domains				
Course Outcomes					
CO1	Understand the basic concepts of blockchain and blockchain status.				
CO2	Understand the Linux foundation Hyperledger and blockchain.				
CO3	Evaluate the technical concepts of blockchain modelling and application.				
CO4	Understand the Hyperledger Fabric and IBM blockchain plateform.				

Module	Course Contents	Contact Hrs.	Mapped CO
1	**Blockchain prerequisites and Introduction to Blockchain** Introduction to HTML 5 and Javascript Programming, Concept of callback, promises and Async/Await, NodeJS- Server side Javascript, Docker essentials, Containers Orchestration, Implementations ,Creating and Deploying Docker containers. Introduction to Blockchain **Blockchain in detail and Blockchain Status** Understand the business context behind blockchain and the problems that blockchain aims to solve Distinguish between blockchain for business and other blockchain implementations, Enumerate the broad categories of blockchain solutions, Understand the state of the blockchain industry in 2019, in terms of technologies, topics and communities, See how today's blockchain implementations vary, Look at the indicators that point to blockchain's future.	30 Hours	CO1
2	**Linux Foundation Hyperledger and Blockchain Use-Cases** Understand the background behind the Linux Foundation Hyperledger project, Enumerate and compare the different Hyperledger projects, Introduce Hyperledger Fabric Learn about some successful blockchain projects, Evaluate good vs. bad blockchain ideas, Assess business value.	30 Hours	CO2
3	**Modelling Blockchain Applications and Blockchain Technical Concepts** Understand what happens after a blockchain solution has an initial design activity, Learn what modelling is and why it is necessary, Go through the different business concept types and see how they map to technical concepts, Revisit the computer science principles that are relevant to blockchain Without focusing on any particular technology, learn about key blockchain data structures and why they exist, Take a look at how agreement is achieved in a blockchain network.	30 Hours	CO3, CO4

	Hyperledger Fabric and IBM Blockchain platform Introduce Hyperledger Fabric from a technical point of view, including key concepts and components, Understand the things an application and smart contract developer needs to know when working with Hyperledger Fabric Learn the importance of the network in Hyperledger Fabric and how operators can create, manage and govern it. Introduce IBM Blockchain Platform, Take a look at the tools that IBM Blockchain Platform provides that makes it easier to develop blockchains, Learn how to get started with IBM Blockchain Platform.		

Suggested Readings

1. IBM Content/Books

Online Resources

2. https://onlinecourses.nptel.ac.in/noc22_cs44/preview

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

Program	B. Tech CSE(IOTBC)				
Year	II	Semester		IV	
Course Name	Database Management Systems 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(IOTBC)				
Year	II	**Semester**	IV		
Course Name	Blockchain Essentials Lab				
Code	NITBC4451				
Course Type	PCC	**L**	**T**	**P**	**Credit**
Pre-Requisite	Knowledge of Java Script and Cryptography.	0	0	2	1
Course Objectives	**1.** To acquire the basic knowledge and understandings of blockchain. **2.** To learn how blockchain systems work. **3.** Design, build, and deploy smart contracts and distributed applications. **4.** Integrate ideas from blockchain technology into their own projects.				
Course Outcomes					
CO1	Understand and implement the concepts of java scripts.				
CO2	Implementation of the function of java script with cryptography.				
CO3	Design and Evaluate the blockchain development environment using IBM blockchain platform extension.				
CO4	Implementation of the blockchain application.				

S. No.	List of Experiments
1	Implementation of java script concepts.
2	Implementation of call-back functions v/s promises v/s Async & Await.
3	Implementation of Node.js concepts.
4	Creating and deploying Docker containers.
5	Implementation of the Car Auction Blockchain App.
6	Analyze Commercial Paper Guide.
7	Understanding Cryptography Guide using java script and Node.js
8	Setting Up Blockchain Development Environment using IBM Blockchain platform extension.
9	Smart Contract and Client App development.
10	Blockchain Applications Guide – Connecting to an existing network.

Online Resources:

https://onlinecourses.nptel.ac.in/noc22_cs44/preview

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

Program	B.Tech CSE(IOTBC)				
Year	II	Semester		IV	
Course Name	Data Structure Lab				
Code	NCS4453				
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/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(IOTBC)				
Year	III	**Semester**	V		
Course Name	Predictive Analytics				
Code	NCCML4501				
Course Type	PCC	**L**	**T**	**P**	**Credit**
Pre-Requisite	Knowledge of basic linear algebra, calculus, probability and statistics..	3	1	0	4
Course Objectives	**1.** To provide an overview of an exciting field of Predictive Analytics. **2.** To introduce the tools required For Predictive Analytics. **3.** Explore data to look at data distributions and to identify data Problems, including missing values. **4.** To enable students to have skills that will help them to solve complex Real-world problems in decision support.				
Course Outcomes					
CO1	Understand the data mining and its application.				
CO2	Analyze the concepts of unit of analysis and its objective.				
CO3	Evaluate the predictive analytics with IBM Watson studio.				
CO4	To understand and apply IBM SPSS Modeler in Data Mining, what kinds of data can be mined, what kinds of patterns can be mined.				

Module	Course Contents	Contact Hrs.	Mapped CO
1	**ANALYTICS OVERVIEW** Definition of business Analytics with real time examples, How Predictive analytics: Transforming data into future insights, Analytics trends: Past, Present & Future, Towards a Predictive enterprise. **IBM SPSS MODELER & DATA MINING** What are Data Mining applications? Strategy for data mining: CRISP-DM, Identify nodes and streams, The framework of a Data – mining project, Brief the unit of analysis, Explain the type of dialog box.	30 Hours	CO1
2	**UNIT OF ANALYSIS**	30	CO2

	Concepts of Unit of analysis (Distinct, Aggregate, SetToFlag), Integrate data, CLEM Expression, Role of Relationship between two fields, Identifying the modelling objective.	Hours	
3	**PREDICTIVE ANALYTICS WITH IBM WATSON STUDIO** IBM Watson Studio, Watson studio Components, Data preparation, Watson Machine learning, Data Refinery, Watson Studio Neural Network Modeler, IBM Watson Studio jobs, Use case with AutoAI.	30 Hours	CO3
4	**PROJECT** Predicting using IBM SPSS Modeler & IBM Watson with real Case studies	30 Hours	CO4

Suggested Readings

1. IBM Courseware.
2. Predictive Analytics Mesmerizing & fascinating by ERIC SIEGEL.

Online Resources

1. https://nptel.ac.in/courses/110104086
2. https://archive.nptel.ac.in/courses/111/106/111106164/

Course Articulation Matrix

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

Program	B. Tech CSE(IOTBC)				
Year	III	**Semester**	V		
Course Name	Computer Networks				
Code	NCS4503				
Course Type	PCC	**L**	**T**	**P**	**Credit**
Pre-Requisite		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; examples of a simple transport protocol. **Session layer:** Design issues; remote procedure call; examples **Presentation layer:** Design issues; data compression and	30 Hours	CO3 CO4

	encryption; network security and privacy. **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(IOTBC)					
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(IOTBC)				
Year	III	**Semester**	V		
Course Name	Web Services				
Code	NITBC4501				
Course Type	PCC	**L**	**T**	**P**	**Credit**
Pre-Requisite	Basic Knowledge of HTML, CSS, AJAX, Programming Language.	3	0	0	3
Course Objectives	**1.** To explain the importance of Web Services and Use of XML JAXB and using SOAP and REST Web Services. **2.** To learn the importance of Spring Boot and JAVA in Web Services. **3.** Be able to use POSTMAN accessing dummy URLs as well as self-created URLs. **4.** Able to Secure Web Service using Transport layer and Application Level Security.				
Course Outcomes					
CO1	Understand the basic introduction of SOAP and web services.				
CO2	Analyze the different services of JAVA API.				
CO3	To evaluate the application of REST Web Services in university environment by Using JAX-RS and JAX-WS API‘s in java.				
CO4	Apply of UDDI and WSDL for web development project.				

Module	Course Contents	Contact Hrs.	Mapped CO
1	**WEB SERVICES INTRODUCTION** Introduction to XMl What is Web Services? Why Web Services? Web Services Fundamentals Services Oriented Architecture; HTTP and XML and SOAP WSDL; UDDI; REST; SOAP vs REST JAXB Overview; JAXB Binding Process; **INTRODUCTION TO SOAP** SOAP Overview; SOAP Message Exchange Model; Data Encoding, Installing and Configuring Apache SOAP; Server and Client Program; Deployment Descriptor, Describing Web Services with Example; Anatomy of a services; Defining Data types and structures with XML Schemas; Describing Web Services Interface and Implementation; Understanding Message patterns.	30 Hours	CO1
2	**JAVA API FOR RESTFUL SERVICES** Introduction to JAVA API; REST and HTTP; Resource URI; Collection URIs; Method Idempotence; What is JAX-RS, Introduction to UDDI; UDDI Registry; Technical Architecture; Using UDDI with WSDL. **Dispatching Request to Methods** Creating a Resource; Returing XML Responses; Installing REST API Client; Building Services Stubs; Accessing Path Params; Returning JSON Response; Implementing POST Update and Delete Methods; Pagination and Filtering. **REST API USING JAVA CLIENT JAX-RS** The Param Annotation; Sending Status codes and location	30 Hours	CO2,CO 3

	Headers; Handling Exception; Using Web-Application Exception; Content Negotiation and Content Negotiation using HTTP Headers; Content Negotiation using URIs Patterns JAX-RS Client; Creating JAVA Client using JAX-RS; Sending GET/POST Request using JAVA Client		
3	**WRITING SOAP SERVICES** Initialize a Spring Web Service Application with Spring Boot; Overview of creating SOAP Web Service using Contract First Approach; Define Request and Response XML Structure; Define XSD for Request and Response; Introduction to JAXB and configuration What are Secure Web Services?; Transport Level Security and Application Level Security. Future of Web Development; Future of SOAP WSDL and UDDI **Project** Create and execute a SOAP project using WSDL. Following should be done on the project : 1. Creating SOAP project- adding WSDL during creation or after it is created. 2. Request and Response verification.	30 Hours	CO4

Suggested Readings

1. IBM Courseware
2. IBM Knowledge Center
3. RESTful Web Services by Leonard Richardson O'Reilly Media

Further suggested Readings

1. Core Java,
2. Collection Framework IBM Knowledge Center.

Online Resources

1. NPTEL VIDEO COURSES

Course Articulation Matrix

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

Program	B. Tech.: CSE(IOTBC)				
Year	III	**Semester**	V		
Course Name	Predictive Analytics Lab				
Code	NCCML4551				
Course Type	PCC	**L**	**T**	**P**	**Credit**
Pre-Requisite	Knowledge of Data mining	0	0	2	1
Course Objectives	**1.** Developing Predictive model and improving business outcomes. **2.** Exploring new data sources. **3.** Implementing predictive models. **4.** Evaluating model performance.				
Course Outcomes					
CO1	Implementation social media data using appropriate data/web mining techniques.				
CO2	Demonstrate Structured Data Extraction.				
CO3	Design a system to harvest information available on the web to build recommender systems.				
CO4	Implement the different components of a web page that can be used for mining.				

S. No.	List of Experiments	Mapped CO
1	Create a data-mining project to predict churn in telecommunications.	CO2
2	Demonstrate the Integration of telecommunications data Using IBM SPSS Modeler.	CO3
3	Demonstrate the Derive and reclassify fields for the tele-communications data.	CO1
4	Predict churn in telecommunications and cluster customers into segments.	CO2
5	Demonstrate linear regression analysis by predicting a target (amount of waste produced) as a function of several related inputs (amount of acreage put to different uses).	CO4
6	Predicting real use case using SVM Model.	CO3
7	Predicting real use case using Cox Regression.	CO3
8	Implementation of Model Bagging Using Neural Net.	CO4
9	Forecasting national broadband provider who wants to produce forecasts of user subscriptions in order to predict bandwidth usage.	CO3
10	Implementation of Error or Fraud Detection in Claims.	CO2
11	Predicting Credit Risk using Logistic Regression.	CO4

Online Resources

1. https://www.iiitmk.ac.in/DAVirtalLab/

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

Program	B.Tech CSE(IOTBC)				
Year	III	**Semester**	V		
Course Name	Web Services Lab				
Code	NITBC4551				
Course Type	PCC	**L**	**T**	**P**	**Credit**
Pre-Requisite	Knowledge of Web tech	0	0	2	1
Course Objectives	**1.** Illustrates the representation of data in XML format and Parses the data using various Java Parsers. **2.** Develops programs to interact with the Data Base using Java Servlets **3.** Determines the appropriate web technology and builds web applications **4.** Develops suitable server-side applications using PHP				
Course Outcomes					
CO1	Implement the HTML, CSS, JavaScript, XML, PHP and develop JavaScript programs.				
CO2	Implement XML program to display student information using CSS.				
CO3	Develop PHP program to keep track of the number of visitors visiting the web page, Digital Clock, simple calculator, matrix addition, multiplication, transpose				
CO4	Develop the PHP programs to sort the student records stored in database using selection sort, string manipulations				

S. No.	List of Experiments	Mapped CO
1	XML implementation to demonstrate internal DTD (Document Type Declaration).	CO2
2	XML implementation to demonstrate External DTD (Document Type Declaration).	CO2
3	XML implementation to demonstrate XSD(XML Schema Definition)	CO2
4	Utilizing document builder factory API to read XML Files.	CO1
5	Using Servlet creates application form in which you have got all information.	CO3
6	Using XML create one form in XML and retrieve information from java file using Eclipse IDE.	CO2
7	Installing Eclipse IDE and set Environment.	CO3
8	Executing Servlets on Eclipse with Tomcat Integration.	CO4
9	Accessing response of web component from desktop application.	CO4

Online Resources

1. https://html-iitd.vlabs.ac.in/basics-of-html/exp/introduction-to-html/references.html

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	2	2										1	1	1
CO 2	2	2		1								1	2	2
CO 3	1	2	2					2				1	2	2
CO	2	1				1						1	2	2

4														

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(IOTBC)				
Year	III	**Semester**	VI		
Course Name	Deployment of Cloud				
Code	NITBC4601				
Course Type	PCC	**L**	**T**	**P**	**Credit**
Pre-Requisite	Knowledge of database.	3	0	0	3
Course Objectives	**1.** To understand Cloud concepts, introduction to IBM cloud Compare the advantages and disadvantages of various cloud computing platforms. **2.** To learn introductory concepts of trade-offs between deploying applications in the cloud and over the local infrastructure. **3.** This course will provide an overview regarding the performance, scalability, and availability of the underlying cloud technologies and software. **4.** Learners will be able to understand how to work on the containerization concept using Docker as a Tool and will work on Kubernetes.				
Course Outcomes					
CO1	To understand and overview of the Cloud and its architecture.				
CO2	To understand the Devops on IBM cloud.				
CO3	Evaluate and implementation of the cloud computing projects.				
CO4	Applying and analyzing data services on IBM cloud.				

Module	Course Contents	Contact Hrs.	Mapped CO
1	**Cloud Computing Overview:** Origins of Cloud computing– Cloud components - Essential characteristics – On- demand self-service, Broad network access, Location independent resource pooling, Rapid elasticity , Measured service, Comparing cloud providers with traditional IT service providers, Roots of cloud computing. Advantages of Cloud computing. **Cloud Architecture- Layers and Models** Layers in cloud architecture, Software as a Service (SaaS),	30 Hours	CO1

	features of SaaS and benefits, Platform as a Service (PaaS), features of PaaS and benefits, Infrastructure as a Service (IaaS), features of IaaS and benefits, Service providers, challenges and risks in cloud adoption. Cloud deployment model: Public clouds – Private clouds – Community clouds - Hybrid clouds. **IBM Cloud Exposure:** IBM Cloud resources, Cloud Foundry concepts. Toolchain.		
2	**DevOps on IBM Cloud:** What is DevOps? Capabilities of IBM Cloud Continuous Delivery, Architecture of REST, IBM Watson services, Databases types and capabilities, APIs interaction with Cloudant database. **REST API's with Data Services on IBM Cloud** The architecture of REST, Best practices for using REST in your application, Advantages of using JSON format, IBM Watson services and Watson services REST APIs. Databases types and capabilities, Main data services on IBM Cloud and benefits of IBM Cloudant, APIs to interact with Cloudant database.	30 Hours	CO2,CO 4
3	**Containerization with Cloud** Introduction to Containers, Dockers and Docker Hub, Container Registry with IBM Cloud, Container orchestration (Kubernetes), key capabilities of Kubernetes, Kubernetes building blocks: Pods, Deployment and Service, Kubernetes cluster. **Project** Research Activities on Cloud Computing with projects and research letters.	30 Hours	CO3

Suggested Readings

1. Gautam Shroff, ―Enterprise Cloud Computing Technology Architecture Applications‖, Cambridge University Press;2014.
2. Anubhav Hanjura , ―Cloud Application Development‖,Packt Publishing Ltd, 2014.Peter Linz, "An Introduction to Formal Language and Automata", Narosa Publishing

Further suggested Readings

1. Toby Velte, Anthony Velte, Robert Elsenpeter, ―Cloud Computing, A Practical Approach‖ McGraw-Hill Osborne Media; 2015.
2. Dimitris N. Chorafas, ―Cloud Computing Strategies‖ CRC Press; 2016

Online Resources

1. https://archive.nptel.ac.in/courses/106/105/106105223/

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

Program	B. Tech CSE(IOTBC)				
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(IOTBC)				
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(IOTBC)				
Year	III	**Semester**	VI		
Course Name	Cloud Deployment Lab				
Code	NITBC4651				
Course Type	PCC	**L**	**T**	**P**	**Credit**
Pre-Requisite	Basic knowledge of Programming.	0	0	2	1
Course Objectives	**1.** To study the various paradigm of cloud computing and computing techniques. **2.** To study the concepts of key technologies, strength and limitation of cloud computing and possible application. **3.** To understand the architecture and infrastructure of cloud computing including SaaS, PaaS,Iaas, public cloud, private cloud and hybrid cloud. **4.** To study Interpretation of various data, scalability and cloud services to acquire efficient database for cloud storage.				
Course Outcomes					
CO1	Implement the configuration IBM cloud account and service models of cloud computing.				
CO2	Analyze and implement the different cloud application.				
CO3	Implementation of the different type the nodeJs application.				
CO4	Implement the program using the Docker container, watson services and kubernetes.				

S. No.	List of Experiments	Mapped CO
1.	Configuring IBM Cloud account and create an application using Cloud Foundry Service on IBM Cloud.	CO1
2.	Mention all commands use in IBM cli to push an application from local system to IBM cloud environment.	CO2
3.	Configuring Cloudant and managing the datasets on IBM Cloud.	CO1
4.	Configuring secure a web-application with single sign-on (APP ID) on IBM cloud.	CO1
5.	Create Rest API using NodeJs; Apply rest method to perform CRUD operations on resources at Server.	CO3
6.	Developing NodeJs application for displaying weather information using IBM Cloud DevOps service and deploying through delivery pipeline and manifest file configuration.	CO3
7.	Create Watson services (text to speech /speech to text).	CO4
8.	Build Chatbot applications for more than one sector like: Hospital, Industry, Banking etc, using Artificial Intelligence (AI) services.	CO2
9.	Create Docker container for deploying on containerized platform.	CO4
10.	Implementation of container orchestration using Kubernetes.	CO4

Online Resources

https://onlinecourses.nptel.ac.in/noc22_cs20/

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

Program	B. Tech CSE(IOTBC)				
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(IOTBC)				
Year	IV	**Semester**		VII	
Course Name	Privacy and Security in Internet of Things				
Code	NITBC4701				
Course Type	PCC	**L**	**T**	**P**	**Credit**
Pre-Requisite	Security mechanism	3	1	0	4
Course Objectives	**1.** To understand Cloud concepts, introduction to IBM cloud, ISO 27017-Privacy & Security, PCI DSS Controls, Flips Levels. **2.** To learn introductory concepts of Cloud Data Life Cycle (CSUSAD). **3.** This course will provide an overview regarding Management plan implementation & Cloud Forensics for IOT **4.** Learners will be able to understand how to work on containerization concept using Dockers as a Tool and will work on Kubernetes				
Course Outcomes					
CO1	Understand the vision of Cloud and its security.				
CO2	Applying and analyzing architecture with data management over cloud platforms.				
CO3	To evaluate the application of cloud security with its phases.				
CO4	To understand the implementation of Forensic Science.				

Module	**Course Contents**	**Contact Hrs.**	**Mapped CO**
1	**Introduction to Security in IOT model** IOT Security Model, Privacy Cloud Broker Services, Introduction to IBM Cloud, Network Perimeter, What is Encryption, Cloud Foundry, Cryptographic Erasure, ISO 27017-Cloud Security 11114, NIST DP 800-53, PCI DSS Controls, FIPS Levels. **Enterprise IOT management** Management plan implementation, What is Forensic Science, Evidence Management, OECD Privacy Principles, eDiscovery, GDPR‘s Key Points, Gap Analysis, ISO 27001: 2013 Domains, Risk Terminology, The CSA STAR components, Supply Chain Risk	30 Hours	CO1

2	**Cloud Data Life Cycle (CSUSAD) & DLP(data Loss Prevention** Key data function: Access Process and Store, Data functions mapping to the data life cycle, Controls, Data dispersion in cloud storage, Erasure Coding, Threat to storage types, Database encryption, Gateway encryption, Key storage in cloud. **Containerization** Data De-identification/ anonymization, Tokenization, DLP (data Loss Prevention), Data Discovery, DRM(digital rights management), Crypto-shredding, Chain of Custody, Software-Defined Networking(SDN), Data centre design standards, ENISA, Data protection risk, Risk assessment/Analysis, Automation of Controls, iSCSI.	30 Hours	CO2
3	**Audit Mechanism & Application Security** Key regulations for CSP facilities ,IAM ,VPC, Understanding of Cloud environment, BCDR planning factors, Business impact analysis (BIA), Design phase, API types, Phases and Methodologies, Cross-site scripting, Security misconfiguration , Threat Modelling, Software Supply-chain (API) management, ISO/IEC 27034-1	30 Hours	CO3
4	**IAM on Cloud** Federated Identity management, SAML, WS federation, OAuth2.0, OpenID Connect, Reduced Sign-on (RSO), Database activity Monitor, Application Virtualization, Cloud Secure Development Life Cycle, Open Web Application Security Project (OWASP), VLANs, Distributed Resource Scheduling(DRS), Patch Management, Performance Monitoring, Intrusion Detection System **Project** Research Activities on Cloud Security with projects and research letters.	30 Hours	CO4

Suggested Readings

1. Ronald L. Krutz and Russell Dean Vines, Cloud Security: A Comprehensive Guide to Secure Cloud Computing
2. John R. Vacca, Cloud Computing Security.
3. Building the Infrastructure for Cloud Security: A Solutions View Book by Enrique Castro-Leon and Raghuram Yeluri
4. Cybersecurity for Executives in the Age of Cloud Book by Teri Radiche

Online Resources

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

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

Program	B.Tech.: CSE(IOTBC)				
Year	IV	**Semester**	VII		
Course Name	Privacy and Security in IoT Lab				
Code	NITBC4751				
Course Type	PCC	**L**	**T**	**P**	**Credit**
Pre-Requisite	Knowledge of computer, cyber Security and cryptography.	0	0	2	1
Course Objectives	**1.** Able to understand the recover Data of IOT **2.** Analyze the techniques of data encryption/decryption. **3.** Students able to understand data recovery using different electronic devices. **4.** Demonstrate the methodology for protect the data against the theft.				
Course Outcomes					
CO1	Implementation of the data encryption/decryption techniques.				
CO2	Demonstrate of the data protection, data shredding and backup using cloning partition/file history.				
CO3	Perform the concepts of data recovery using different resources like USB, HDD and SSD.				
CO4	Perform the concepts of system restoration and spywares.				

S. No.	**List of Experiments**	**Mapped CO**
1.	Demonstrating use of Steganography - the art of sending secret message Using Data Encryption and Decryption techniques.	CO1
2.	Protect your data from being Social Engineered.	CO2
3.	Practical to demonstrate the concept of Data Shredding.	CO2
4.	Practical to recover Data from USB, HDD, SSD.	CO3
5.	Practical to Create Backups using Cloning Partition.	CO2
6.	Demonstration of Creating Backups using File History.	CO2
7.	Demonstration of methodology to Protect against Identity Theft.	CO2
8.	Practical to illustrate the concept of System Restoration–Restoration of data after virus impact.	CO4
9. Generate	Demonstration of Spywares and Key loggers.	CO4

Online Resources

1. Virtual Lab required

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	2	2											1	

CO 2	2	2		1								1	1	2
CO 3	2	2	2									1	2	
CO 4	3	1	1									1	2	2

Program	B. Tech CSE(IOTBC)				
Year	IV	**Semester**	VIII		
Course Name	Enterprise Design Thinking				
Code	NITBC4801				
Course Type	PCC	**L**	**T**	**P**	**Credit**
Pre-Requisite		3	0	0	3
Course Objectives	**1.** To provide an overview of an exciting field of design thinking and business processes. **2.** To introduce the tools required for design thinking like IBM Blue works live, IBM Mural. **3.** To immerse students into the world of innovation as a systematic process of tackling relevant business and/or social problems. **4.** To provide a social and thinking space for the recognition of innovation challenges and the design of creative solutions.				
Course Outcomes					
CO1	Understand and critically apply the concepts and methods of business processes.				
CO2	Analyze the Modeling process of the Enterprise design thinking.				
CO3	Understand the 7 key habits of effective thinkers design in the Enterprise design thinking.				
CO4	Apply IBM Blueworks live and process designer tool concepts.				

Module	Course Contents	Contact Hrs.	Mapped CO
1	**INTRODUCTION TO BUSINESS PROCESS MANAGEMENT &AS-IS BUSINESS PROCESS** Define business process management (BPM), List and describe the phases in the BPM lifecycle procedure, Define process modeling., Describe how to use IBM Business Process Manager to accomplish process modeling goals, Explain how to create and modify process applications in the Process Center, Create a process application, Explain case management, Describe the purpose and function of Blue works Live, List and describe the core notation elements that are used in IBM Process Designer, Create a business process definition (BPD) from the process and nested process tasks and responsible, Explain how to create and modify process models with the Designer view of the IBM Process Designer.	30 Hours	CO1
2	**PLAYBACK 0: MODELING PROCESS** List and describe gateways as they are used in IBM Process Designer, List and describe intermediate event types that are used in IBM Process Designer, Model a business process escalation path with an attached timer intermediate event, Describe the Playback 0 validation goals and requirements, Validate that a process model meets Playback 0 goals and Requirements, Describe IBM Business Process Manager product components, Identify the integrations with other IBM products. **ENTERPRISE DESIGN THINKING – HISTORY, OVERVIEW** Understand what came before Design Thinking, Identify	30 Hours	CO2

	who did what to bring it about, Learn how it built upon previous approaches, Get an overview of the whole approach to design thinking, Understand the principles, loop, and keys, Determine what is most important.		
3	**ENTERPRISE DESIGN THINKING –7 KEY HABITS, THE LOOP, USER RESEARCH** Learn 7 key habits of effective thinkers design, Avoid common anti-patterns, Optimize for success with these habits, Understand the importance of iteration, Learn how to observe, reflect, & make, Get ready to drill down & do tomorrow, Understand the importance of user research, Appreciate empathy through listening, Learn key methods of user research. **ENTERPRISE DESIGN THINKING – MAKE, USER FEEDBACK:-** Understand how Make fits into the Loop ,Learn how to leverage Observe information, Learn Ideation, Storyboarding, & Prototyping, Understand user feedback and the Loop, Learn the different types of user feedback, Learn how to carry out getting feedback. **PROJECT** Creating discovery map, process model in blueworks live. Adding and viewing process details in blueworks live Enterprise design thinking - user research, reflect, ideation, storyboarding, crafting hills, prototyping in mural.	30 Hours	CO3, CO4

Suggested Readings

1. IBM SKILLS ACADEMY

Online Resources

1. https://www.theknowledgeacademy.com/in/offers/design-thinking-certification-training-courses/

Course Articulation Matrix														
PO-PSO	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**	**PSO1**	**PSO2**
CO1	2	2										1	3	
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**	**1**
CO2		**1**	**2**	**3**									**1**	
CO3	**2**		**2**	**2**	**1**							**1**	**1**	**2**
CO4	**1**		**2**	**1**	**1**							**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(IOTBC)				
Year	III	**Semester**	VI		
Course Name	Blockchain and Distributed Ledger Technology				
Code	NPEC44011				
Course Type	PEC	**L**	**T**	**P**	**Credit**
Pre-Requisite	-	3	0	0	3
Course Objectives	**1.** Blockchain technology and the key concepts like cryptography and cryptocurrency concepts **2.** Gain a deep insight into Bitcoin, its network and how Bitcoin transactions are validated by miners **3.** Interpret the prospects of Blockchain and assess how Blockchain can improve your business standards **4.** Design, build, and deploy smart contracts and distributed applications,				
Course Outcomes					
CO1	Understand how blockchain solutions are transforming the industry landscape.				
CO2	Develop a deeper understanding of blockchain technical topics such as consensus, cryptography, privacy and security.				
CO3	Explain design principles of Bitcoin and Ethereum.				
CO4	Understand the Cryptocurrency and research activities on blockchain network.				

Module	Course Contents	Contact Hrs.	Mapped CO
1	**Basic** 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. **Blockchain** Introduction, Advantage over conventional distributed database, Blockchain Network, Mining Mechanism, Distributed Consensus, Merkle Patricia Tree, Gas Limit, Transactions and Fee, Anonymity, Reward, Chain Policy, Life of Blockchain application, Soft & Hard Fork, Private and Public blockchain.	30 Hours	CO1
2	**Distributed Consensus** Nakamoto consensus, Proof of Work, Proof of Stake, Proof of Burn, Difficulty Level, Sybil Attack, Energy utilization and alternate. **Cryptocurrency** History, Distributed Ledger, Bitcoin protocols - Mining strategy and rewards, Ethereum - Construction, DAO, Smart Contract, GHOST, Vulnerability, Attacks, Sidechain, Namecoin.	30 Hours	CO2, CO3
3	**Cryptocurrency 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 Blockchain.	30 Hours	CO4

	PROJECT Research Activities on Blockchain network.		

Suggested Readings

1. IBM Courseware
2. Implementing Blockchain solutions using Hyperledger

Online Resources

1. NPTEL :: Computer Science and Engineering - NOC:Blockchain and its Applications

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	2	2			2							2	3	2
CO 2	2	2		2	3							2	2	2
CO 3	2	2	3	2								2	3	2
CO 4	2	2	2	3	2							2	3	2

Program	B. Tech CSE(IOTBC)				
Year	III	**Semester**	VI		
Course Name	Cloud-Native Application Development				
Code	NPEC44012				
Course Type	PEC	**L**	**T**	**P**	**Credit**
Pre-Requisite	Knowledge of Hybrid Cloud	3	0	0	3
Course Objectives	**1.** Describe the characteristics of cloud-native applications. **2.** Understand hybrid cloud concepts and benefits. **3.** Explain application modernization with hybrid cloud. **4.** Explain the concepts and use of container technology and containerized applications.				
Course Outcomes					
CO1	Understand the vision of Cloud native application development from a global context.				
CO2	Applying and analyzing RedHat OpenShift architecture and APIs with application development.				
CO3	To evaluate the application of DevOps with Redhat Open Shift architecture in industrial Automation.				
CO4	Creating projects and research activities based on application development with Redhat OpenShift.				

Module	Course Contents	Contact Hrs.	Mapped CO
1	**Introduction to Hybrid Clouds** Definition of Cloud native applications, Understand concepts of hybrid cloud and its connectivity, Understand application modernization with hybrid cloud, Concept of security architecture in hybrid cloud, Definition of Multi-Cloud **Foundations of Cloud Native Application Development** Understand twelve-factor app methodology, Linux containers, Introduction to Microservices architecture and its integration Architecture of IBM Kubernetes Service, Virtual machines and Containers isolation, Rapid security patching by using container image layering, DevOps	30 Hours	CO1
2	**Architecture overview of IBM Kubernetes Service (IKS)** Technical architecture of Kubernetes Container Platform, Pods, Role of master nodes, and worker nodes, Role of scheduler, Services and Routes with working, Persistent storage and list its benefits with Kubernetes, external routing into Kubernetes applications and the router‘s role, Internal routing within Kubernetes, Workflow of a pod deployment in Kubernetes **Introduction to Red Hat OpenShift on IBM Cloud** Introduction Red Hat OpenShift on IBM Cloud architecture, Key features of Red Hat OpenShift, Understand namespaces, users, and resource quota limits, application creation and auto scalling processes.	30 Hours	CO2
3	**Configuring applications on Red Hat OpenShift** Understand application configuration concepts, Role of volumes in cloud native application development, Concept of persistent volumes, What are environment variables, Concept of secrets, what are ConfigMap, Articulate downward API, **DevOps for Red Hat Open**	30 Hours	CO3, CO4

	Shift applications on IBM Cloud Challenges of application integration, Features of continuous integration (CI) and its best practices, Understand workflows, their benefits, and their tools, Introduction to DevOps Practices, Continues Delivery, Understand deployment pipeline process, Explain DevSecOps and why it is important, Understand tool chains on IBM Cloud		

Suggested Readings

1. Deploying to OpenShift: A Guide for Busy Developers Book by Graham Dumpleton
2. Cloud Native Patterns: Designing Change-tolerant Book by Cornelia Davis
3. Programming Kubernetes: Developing Cloud-Native Applications Book by Michael Hausenblas and Stefan Schimanski (Software engineer)

Online Resources

1. https://onlinecourses.nptel.ac.in/noc23_cs42/preview

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	2	2			2							1		
CO 2	2	2			3							1	2	2
CO 3	2	2	3									2	2	1
CO 4	2	2	2		2							2	2	2

Program	B. Tech CSE(IOTBC)				
Year	III	**Semester**	VI		
Course Name	Pattern Recognition				
Code	NPEC44013				
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(IOTBC)				
Year	III	**Semester**		VI	
Course Name	Web of Things				
Code	NPEC44014				
Course Type	PEC	**L**	**T**	**P**	**Credit**
Pre-Requisite	Knowledge of Embedded system	3	0	0	3
Course Objectives	**1.** To assess the vision and introduction of IoT. **2.** To Understand IoT Market perspective. **3.** To Implement Data and Knowledge Management and use of Devices in IoT Technology. **4.** To Understand State of the Art - IoT Architecture.				
Course Outcomes					
CO1	Understand the basic concepts and vision of IoT.				
CO2	Analyze the reference architecture in IoT.				
CO3	Understand different network wireless technology in IoT.				
CO4	Understand of the various type protocols and its security in IoT.				

Module	Course Contents	Contact Hrs.	Mapped CO
1	**Overview** An Architectural Overview– Building an architecture, Main design principles and needed capabilities, An IoT architecture outline, standards considerations. M2M and IoT Technology Fundamentals- Devices and gateways, Local and wide area networking, Data management, Business processes in IoT, Everything as a Service (XaaS), M2M and IoT Analytics, Knowledge Management.	30 Hours	CO1
2	**Reference Architecture** IoT Architecture-State of the Art – Introduction, State of the art, Reference Model and architecture, IoT reference Model - IoT Reference Architecture Introduction, Functional View, Information View, Deployment and Operational View, Other Relevant architectural views. Real-World Design Constraints- Introduction, Technical Design constraints-	30 Hours	CO2

	hardware is popular again, Data representation and visualization, Interaction and remote control.		
3	**Iot Data Link Layer & Network Layer Protocols** PHY/MAC Layer(3GPP MTC, IEEE 802.11, IEEE 802.15), Wireless HART, Z-Wave, Bluetooth Low Energy, Zigbee Smart Energy,DASH7-NetworkLayer-IPv4,IPv6,6LoWPAN, 6TiSCH,ND, DHCP, ICMP, RPL, CORPL, CARP. **Transport Layer , Session Layer And Service Layer Protocols & Security** Transport Layer (TCP, MPTCP, UDP, DCCP, SCTP)-(TLS, DTLS) – Session Layer- HTTP, CoAP, XMPP, AMQP, MQTT, Service Layer - oneM2M, ETSI M2M, OMA, BBF – Security in IoT Protocols – MAC 802.15.4 , 6LoWPAN, RPL, Application Layer.	30 Hours	CO3, CO4

Suggested Readings

1. Samuel Greengard , ―The Internet of Things‖ .
2. Klaus Schwab, ―The Fourth Industrial Revolution‖.
3. Cuno Pfister, ―Getting started with Internet of Things‖.
4. Peter Waher, ―Learning Internet of Things‖.

Online Resources

1. **https://archive.nptel.ac.in/courses/106/105/106105166/**

Course Articulation Matrix

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

Program	B. Tech CSE(IOTBC)				
Year	IV	**Semester**	VII		
Course Name	Network Security and Cryptography				
Code	NPEC43821				
Course Type	PCC	**L**	**T**	**P**	**Credit**
Pre-Requisite	Security Services and Mechanism	3	0	0	3
Course Objectives	**1.** Have a fundamental understanding of the objectives of cryptography and network security **2.** Getting familiar with the cryptographic techniques that provide information and network security. **3.** To know the different types of algorithms of exchanging information in a secret way. **4.** To know the possible threats which can break the secure communication.				
Course Outcomes					
CO1	Understanding cryptography and network security concepts and applications.				
CO2	Apply security principals to system design and Real time Scenarios.				
CO3	To evaluate the application of security with Digital signature.				
CO4	Analysis of network traffic and security threats.				

Module	Course Contents	Contact Hrs.	Mapped CO
1	**Introduction to Cryptography and Symmetric Ciphers** Security Attacks: Security Services and mechanism; Classical encryption techniques: Substitution ciphers and Transposition ciphers, Steganography, Cryptanalysis; Modern Block Ciphers: Stream and Block Cipher, Block Cipher Principles, Block Cipher Modes of Operations; Shannon‘s theory of Confusion and Diffusion; Fiestal structure; Data encryption standard(DES); Strength of DES; Idea of differential cryptanalysis; Triple DES; Symmetric Key Distribution; Finite Fields: Introduction to groups, rings and fields, Modular Arithmetic, Euclidean Algorithm, Finite Fields of the form GF(p).	30 Hours	CO1
2	**Basics of Number Theory and Publickey Cryptography** Introduction to Number Theory: Prime and Relative Prime Numbers, Fermat‘s and Euler‘s theorem, Testing for Primality, Chinese Remainder theorem, Discrete Logarithms; Public Key Cryptography: Principles of Public-Key Cryptography, RSA Algorithm, Security of RSA; Key Management: Deffie-Hellman Key Exchange.	30 Hours	CO2
3	**Hash Functions and Digital Signatures** Message Authentication; Hash Functions; Secure Hash Functions; Security of Hash functions and MACs; Digital Signatures; Digital Signature Standards (DSS); Proof of digital signature algorithm; Advanced Encryption Standard (AES) encryption and decryption. **Network and System Security** Authentication Applications: Kerberos, X.509 Certificates; Electronic Mail Security: Pretty Good Privacy, S/MIME; IP	30 Hours	CO3,CO 4

	Security: IP Security Architecture, Authentication Header, Encapsulating security payloads, Combining Security Associations; Web Security: Secure Socket Layer and Transport Layer Security, Secure Electronic transaction; Intruder; Viruses; Firewalls.		

Suggested Readings

1. William Stallings, ‑Cryptography and Network Security: Principals and Practice‖, Pearson Education.
2. Behrouz A. Frouzan: ‑Cryptography and Network Security‖, Tata McGraw- Hill
3. Bruce Schiener, ‑Applied Cryptography‖. John Wiley & Sons

Online Resources

1. http://swayam.gov.in/
2. https://nptel.ac.in/

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

Program	B. Tech CSE(IOTBC)				
Year	IV	**Semester**	VII		
Course Name	Wireless Communication Networks				
Code	NPEC44022				
Course Type	PEC	**L**	**T**	**P**	**Credit**
Pre-Requisite	Basic knowledge of wireless network.	3	0	0	3
Course Objectives	**1.** Understand basic sensor network concepts **2.** Knowledge about physical layer, network layer, and transport layer, their **3.** To understand internals of main protocols such as FTP, SMTP, TCP, UDP, IP **4.** To analyze simple protocols and can independently study literature concerning computer networks.				
Course Outcomes					
CO1	Understand the Wireless Sensor network and issues.				
CO2	Understand and building the skills of deployment mechanisms.				
CO3	Evaluate the challenges in building wireless sensor networks and solutions using MAC layer.				
CO4	Understand and Recognize the technological trends of wireless sensor networks.				

Module	Course Contents	Contact Hrs.	Mapped CO
1	**FUNDAMENTALS OF SENSOR NETWORKS** Introduction to computer and wireless sensor networks and Overview of the syllabus. Motivation for a network of Wireless Sensor nodes- Sensing and sensors-challenges and constraints - node architecture-sensing subsystem, processor subsystem communication interfaces- prototypes, Application of Wireless sensors- Introduction of Tiny OS Programming and TOSSIM Simulator	30 Hours	CO1
2	**COMMUNICATION CHARACTERISTICS DEPLOYMENT MECHANISMS** Wireless Transmission Technology and systems-Radio Technology Primer-Available Wireless Technologies - Hardware- Telosb, Micaz motes- Time Synchronization Clock and the Synchronization Problem - Basics of time synchronization-Time synchronization protocols - Localization- Ranging Techniques- Range based Localization-Range Free Localization- Event driven Localization	30 Hours	CO2
3	**MAC LAYER** Overview-Wireless Mac Protocols-Characteristics of MAC protocols in Sensor networks – Contention free MAC Protocols- characteristics- Traffic Adaptive Medium Access-Y- MAC, Low energy Adaptive Clustering - Contention based MAC Protocols Power Aware Multi-Access with signaling, Sensor MAC-Timeout MAC-Data gathering MAC- Case study –Implementation and Analysis of MAC player protocol in TinyOS. **ROUTING IN WIRELESS SENSOR NETWORKS** Design Issues in WSN routing- Data Dissemination and Gathering- Routing Challenges in WSN - Flooding-Flat	30 Hours	CO3, CO4

	Based Routing – SAR, Directed Diffusion, Hierarchical Routing- LEACH, PEGASIS- Query Based Routing- Negotiation Based Routing- Geographical Based Routing- Transport layer- Transport protocol Design issues Performance of Transport Control Protocols. Case study- Implementation and analysis of Routing protocol or transport layer protocol in Tiny OS		

Suggested Readings

1. William Stallings –Wireless Communications & Networks, 2/edition‖ Pearson edition 2009. 2nd Edition, John Wiley, 2006.
2. Vijay K. Garg, ―Wireless Communications and Networks‖, Morgan Kaufmann Publishers an Imprint of Elsevier, USA 2009 (Indian reprint).

Online Resources

1. **https://archive.nptel.ac.in/courses/117/102/117102062/**

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	2	2			2							1		2
CO 2	2				2							2	2	2
CO 3	2	2	1									2	2	2
CO 4	2	2	2		2							2	2	2

Program	B.Tech,: CSE(IOTBC)				
Year	IV	**Semester**	VII		
Course Name	Security Governance and Law				
Code	NPEC44023				
Course Type	PEC	**L**	**T**	**P**	**Credit**
Pre-Requisite	Knowledge of Security mechanism.	3	0	0	3
Course Objectives	**1.** Recognize and differentiate information security policies and strategies to guide the development of standards and procedures, in alignment with organizational goals and objectives. **2.** Identify and analyze risk management processes and procedures to ensure compliance with applicable security, privacy laws and regulations **3.** Identify incident response processes for detecting and responding to security risks **4.** Determine the proper steps to implement comprehensive business continuity, disaster recovery, and incident response plans.				
Course Outcomes					
CO1	Understand the concept of cyber security law and types.				
CO2	Analyze the misuses of electronics and international security for cyber fraud.				
CO3	To evaluate the application of IT Act 2000 & IT Amendment Act 2008.				
CO4	Copyright Infringe Remedies of Infringement Multimedia, Copyright issues Software Piracy.				

Module	Course Contents	Contact Hrs.	Mapped CO
1	**Overview Security Types and Laws** Designing Trusted Operating Systems, Security Policies Methods of security, Trusted operating system design, Database Security, Multilevel databases, Proposals for Multilevel security, Administrating Security, Security planning, Risk analysis, Organization and security Policies, Legal, Privacy and Ethical Issues in Computer Security, International Cyber crimes	30 Hours	CO1
2	**Cyber Fraud and Electronic Misuse** Characteristics Cyber Fraud Offence, fraud related Offenses, Encryption in Crime and Terrorism- Law Enforcement Options, Data protection for system designers, Evaluation criteria and security testing **International standards** Analysis and Logging, Recovery and data backs, Security policy development, Security Models: Frameworks, Standards, Security Certification ISO 17799/ ISO 27001, System Security Engineering Capacity Maturity Model, Laws and Legal Framework for Information Security, Recovery and risk analysis, Operating system and application specific auditing	30 Hours	CO2,CO 3
3	**IT Act 2000 & IT Amendment Act 2008**: Introduction, Digital Signature, Secure Electronic records and secure digital signatures, Digital Signature Certificates, Offences covered under IT Act 2000, Major Amendments in IT Act,	30 Hours	CO4

	Understanding Copy Right in Information Technology: Understanding the technology of Software software-copyright vs Patent debate Authorship **Copy right and Legal Issues** Software Copyright Jurisdiction Issues, Copyright Infringe Remedies of Infringement Multimedia, Copyright issues Software Piracy, Patents understanding and Data Privacy laws: GDPR. **PROJECT** Research Activities on Security Governance with projects and research letters. (POC on dataset)		

Suggested Readings

1. Information Security Governance: A Practical Development and Implementation Approach (Wiley Series in Systems Engineering and Management Book 92) by Krag Brot Phillip. A. Laplante, ‒Real-Time Systems Design and Analysis‖, second edition, PHI, 2005.
2. Information Security Governance Simplified: From the Boardroom to the Keyboard by Todd Fitzgerald
3. Handbook of Governance and Security Edited by James Sperling, Professor of Political Science, University of Akron, US Publication Date: 2014 ISBN: 978 1 78195 316 7 Extent: 752.

Online Resources

1. **https://nptel.ac.in/courses/106106129**

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	2	2			2							1		1
CO 2	2	2			1							1		
CO 3	2	2	1									1	1	1
CO 4	2	2	2		2							1	1	2

Program	B.Tech: CSE IOT(BC)				
Year	IV	Semester		VII	
Course Name	Cyber and Digital Forensics				
Code	NPEC44024				
Course Type	PEC	L	T	P	Credit
Pre-Requisite	Basic knowledge of Cyber Security	3	0	0	3
Course Objectives	**1.** Learn the security issues network layer and transport layer. **2.** Be exposed to security issues of the application layer. **3.** Learn computer forensics, tools and to analyse and validate forensics data. **4.** Will gain the knowledge to implement various security attacks.				
Course Outcomes					
CO1	Understand to the get the ideas in various ways to trace an attacker.				
CO2	Analyse and validate forensics data to satisfy.				
CO3	Evaluate the security in different layers.				
CO4	Apply the security tools to provide the security in Cyber.				

Module	Course Contents	Contact Hrs.	Mapped CO
1	**Introduction to IT laws & Cyber Crimes** – Internet, Hacking, Cracking, Viruses, Virus Attacks, Pornography, Software Piracy, Intellectual property, Legal System of Information Technology, Social Engineering, Mail Bombs, Bug Exploits, and Cyber Security. **Legal and Ethical Principles :** Introduction to Forensics – The Investigative Process – Code of Ethics, Ethics of Investigations, Evidence Management – Collection, Transport, Storage, access control, disposition	30 Hours	CO1
2	**Forensic Science:** Principles and Methods – Scientific approach to Forensics, Identification and Classification of Evidence, Location of Evidence, Recovering Data, Media File Forensic Steps, Forensic Analysis – Planning, Case Notes and Reports, Quality Control	30 Hours	CO2
3	**Digital Forensics:** Hardware Forensics – Hidden File and Anti- forensics - Network Forensics – Virtual Systems - Mobile Forensics Digital Watermarking Protocols: A Buyer-Seller Watermarking Protocol, an Efficient and Anonymous Buyer- Seller Watermarking Protocol, Extensions of Watermarking Protocols, Protocols for Secure Computation **Application Forensics, Tools and Report Writing** – Application Forensics, Email and Social Media Investigations, Cloud Forensics, Current Digital Forensic Tools, Report Writing for Investigations	30 Hours	CO3, CO4

Suggested Readings

1. Bill Nelson, Christopher Steuart, Amelia Philips, –Computer Forensics and Investigations‖, Delmar Cengage Learning; 5th edition January 2015
2. Chuck Eastom, –Certified Cyber Forensics Professional Certification:, McGraw Hill, July

2017
3. Nilakshi Jain, Dhananjay Kalbande, ―Digital Forensic : The fascinating world of Digital Evidences‖ Wiley India Pvt Ltd 2017.
4. John R.Vacca, ―Computer Forensics: Computer Crime Scene Investigation‖, Laxmi Publications, 2015.
5. MarjieT.Britz, ―Computer Forensics and Cyber Crime‖: An Introduction‖, 3rd Edition, Prentice Hall, 2013.
6. Clint P Garrison ―Digital Forensics for Network, Internet, and Cloud Computing A forensic evidence guide for moving targets and data , Syngress Publishing, Inc. 2010

Online Resources

1. https://onlinecourses.swayam2.ac.in/cec20_lb06/preview
2. https://onlinecourses.swayam2.ac.in/cec21_ge10/preview

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	1	2	1	1									1	
CO2	2		2	2	2							2	1	
CO3	1	2		2	2							1	2	1
CO4	2		2	2	2								2	2

Program	B Tech CSE(IOTBC)				
Year	IV	**Semester**	VII		
Course Name	Blockchain Architecture: Design and Use Cases				
Code	NPEC44031				
Course Type	PEC	**L**	**T**	**P**	**Credit**
Pre-Requisite	Basics knowledge of the Networking.	3	0	0	3
Course Objectives	**1.** Blockchain technology and the key concepts like cryptography and cryptocurrency concepts **2.** Gain a deep insight into Bitcoin, its network and how Bitcoin transactions are validated by miners **3.** Interpret the prospects of Blockchain and assess how Blockchain can improve your business standards **4.** Deploy your private Blockchain on the web where you can visually see your chains & send transactions between nodes.				
Course Outcomes					
CO1	Understand how blockchain solutions are transforming the industry landscape.				
CO2	Analyse a deeper understanding of blockchain technical topics such as consensus, cryptography, privacy and security.				
CO3	Evaluate hands-on expertise using popular blockchain open source technology, including Hyperledger Fabric.				
CO4	Apply on design and develop for a permissioned Blockchain.				

Module	Course Contents	Contact Hrs.	Mapped CO
1	**Blockchain prerequisites and Introduction to Blockchain** Introduction to Blockchain – I (Basics, History, Architecture, Conceptualization), Basic Crypto Primitives, Bitcoin Basics Distributed Consensus. **Blockchain in detail and Blockchain Status** Consensus in Bitcoin – I (The Basics, PoW and Beyond, The Miners) Permissioned Blockchain (Basics, Consensus), Permissioned Blockchain(RAFT Consensus, Byzantine General Problem, Practical Byzantine Fault Tolerance), Blockchain for Enterprise - Overview Blockchain Components and Concepts	30Hours	CO1
2	**Linux Foundation Hyperledger Project** Hyperledger Fabric – Transaction Flow, Hyperledger Fabric Details Fabric, Membership and Identity Management, Hyperledger Fabric Network Setup, Fabric Demo on IBM Blockchain Cloud Fabric Demo, deploy from scratch. Hyperledger Composer–Application Development, Hyperledger Composer – Network Administration, **Blockchain Use Cases** Blockchain in Financial Service(Payments and Secure Trading, Compliance and Mortgage, Financial Trade), Revolutionizing Global Trade, Blockchain in Supply Chain, Blockchain in Other Industries Blockchain in Government (Advantages, Use Cases, Digital Identity) Blockchain in Government(Hyperledger Indy, Tax Payments andLand Registry Records).	30Hours	CO2,CO 3

3	**Blockchain Security** Blockchain Security (Overview, Membership and Access control in Fabric, Privacy in Fabric),Blockchain Security(Fabric SideDB) Research Aspects(Consensus Scalability, Bitcoin-NG, Collective Signing, Byzcoin),Research Aspects(Algorand, Cross Fault Tolerance, Secured Multi-Party Computation), Blockchain for Science (Blockchain for Big Data, Blockchain and AI) **Project** Research Activities on Blockchain network	30Hours	CO4

Suggested Readings

1. IBM Courseware

Further suggested Readings

1. Implementing Blockchain solutions using Hyperledger

Online Resources

1. https://onlinecourses.nptel.ac.in/noc19_cs63/preview
2. https://archive.nptel.ac.in/courses/106/105/106105184/

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	2	1	2		1								1	3
CO 2	2	1		1									2	2
CO 3			1	1	2							2	3	3
CO 4	1		2	1	2							2	2	2

Program	B. Tech CSE(IOTBC)				
Year	IV	**Semester**	VII		
Course Name	Smart City Application Development				
Code	NPEC44032				
Course Type	PEC	**L**	**T**	**P**	**Credit**
Pre-Requisite	Knowledge of Security mechanism	3	0	0	3
Course Objectives	**1.** To provide an overview of Smart city and use of IoT and blockchain. **2.** To introduce the tools required to build and study the services like IoT and Blockchain. **3.** To teach the fundamental techniques and principles in achieving the concepts of smart applications for smart cities. **4.** To enable students to have skills that will help them to solve complex challenges for developing smart cities application using IoT and Blockchain.				
Course Outcomes					
CO1	Understand the vision of Smart city development, its solutions and technologies.				
CO2	To understand and apply IoT and Block chain in the development of smart cities applications.				
CO3	Applying and analyzing architecture and IoT and Blockchain with use of Google Cloud IoT and Hyperledger Fabrix.				
CO4	To evaluate the application of IoT and Blockchain based application of smart cities.				

Module	Course Contents	Contact Hrs.	Mapped CO
1	**Smart City Solutions and Technologies:** Eras of Smart Cities, Idea & components of smart city, smart technologies, services and application of smart city Role of IOT and Block chain in Smart City. Use Cases of some smart cities.	30 Hours	CO1
2	**Foundation IOT and Blockchain:** Understanding IoT fundamentals, IoT Architecture and its Protocols, Wireless Ad-hoc networks, Embedded System Design, Various Platforms for IoT (Google cloud IoT, Cisco IoT cloud connect, IRI Voracity)	30 Hours	CO3
3	**Major Applications of Smart City** Smart applications such as, intelligent transportation, Fourth Industrial Revolution, smart banking, Smart utility meters, Smart Energy and Mobility, Blockchain introduction, Examples of Blockchain types, Opportunities of blockchain, challenges and barriers of blockchain technology, The smartness of blockchain for cities, Decentralized Ledger System, Major Blockchain Platforms (Hyperledger Fabrix, Hyperledger Sawtooth), Risks in the implementation of blockchain in a Smart City.	30 Hours	CO2, CO4

Suggested Readings

1. Rashmi, “Iot and Smart Cities Your Smart City Planning Guide”, BPB Publications.
2. Aurélien Géron, “Blockchain & The Smart Cities”, Notion Press.Enterprise
3. Blockchain Applications in IoT Security‖ by IGI Global; 1st edition..
4. Blockchain Technology: Concepts and Applications‖ by Kumar Saurabh (Author), Ashutosh Saxena (Author).

Online Resources

1. **https://nptel.ac.in/courses/105105160**

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	2	2	2		2							1	3	3
CO 2	2	2			3							1	2	2
CO 3	2	2	3									2	3	2
CO 4	2	2	2		2							2	3	2

Program	B. Tech CSE(IOTBC)				
Year	IV	**Semester**	VII		
Course Name	Big Data Security				
Code	NPEC44033				
Course Type	PEC	**L**	**T**	**P**	**Credit**
Pre-Requisite	Knowledge of SQL, Data Warehousing, and Database Knowledge.	3	0	0	3
Course Objectives	**1.** Understand the Big Data Security module and introduce the concepts of Big Data. **2.** Understand & define security control –core disciplines. **3.** Analyze and monitor the data usage. **4.** Apply the data protection laws for secure the data.				
Course Outcomes					
CO1	To understand Big Data, Big Data use cases and Capabilities, Big Data Architecture Security goals, controls.				
CO2	Analyze and classifying sensitive data, Remediation plans, Security Perimeters Encryption of data.				
CO3	To Understand the Kerberos, Identity management, Activity Monitoring, Apache Knox overview.				
CO4	Understand the Guardium overview, working with Data in motion, implementing Masking, Data life cycle management, Access Management, Case studies & hands on.				

Module	Course Contents	Contact Hrs.	Mapped CO
1	**Introduction to Big Data** Explain what Big Data is? Reviewing concept of Big data capabilities, use cases & Architecture Explain Threats Introduction to Security Disciplines.	30 Hours	CO1
2	**Securing & Protecting Data** Understand how to identify data for down streaming processes, Understand how to integrate, process , generate data, Understand Security perimeter for security Management, Know how Access management and Auditing works.	30 Hours	CO2
3	**Monitor ,Enforce and Audit** Understand Guardium data activity Monitoring, Benefits of Big Infosphere Guardium, Understand Architecture of Guardium , Hands-on experience with all of them. **Data Protection Laws for Big data** Explain GDPR Laws, Explain ILG(Lifecycle Governance), ISO 27000 Series HIPAA	30 Hours	CO3,CO 4

Suggested Readings

1. IBM COURSEWARE.

Online Resources

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

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

Program	B. Tech CSE(IOTBC)				
Year	IV	**Semester**	VII		
Course Name	Computer Vision				
Code	NPEC44034				
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	30 Hours	CO2
3	Deep Learning: Supervised learning, Unsupervised learning, Deep neural networks, Convolutional neural networks, More complex models Recognition: Instance recognition, Image classification, Object detection, Semantic segmentation, Pose estimation, Video understanding, Vision and language Feature detection and matching: Edges and contours, Contour tracking, Lines and vanishing points, Segmentation Motion estimation: Translational alignment, Parametric motion, Optical flow, Layered motion Computational photography, High dynamic range imaging, Super-resolution, denoising, and blur removal,	30 Hours	CO3, CO4

	Image matting and compositing, Video matting, Texture analysis and synthesis		

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(IOTBC)				
Year	IV	Semester		VIII	
Course Name	Distributed Systems				
Code	NPEC44041				
Course Type	PEC	L	T	P	Credit
Pre-Requisite	Operating System	3	0	0	3
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. **Failure Recovery:** Backward and Forward recovery, Recovery in	30 Hours	CO3, CO4

	Concurrent systems: Checkpoints; Recovery in Distributed Database Systems; Fault Tolerance: Issues in Fault Tolerance, Voting Protocols.		

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(IOTBC)				
Year	IV	Semester		VIII	
Course Name	Cryptography and Information Security				
Code	NPEC44042				
Course Type	PEC	L	T	P	Credit
Pre-Requisite	Basic knowledge of Operating System	3	0	0	3
Course Objectives	**1.** To understand basics of Cryptography and Network Security **2.** To be able to secure a message over insecure channel by various means. **3.** To learn about how to maintain the Confidentiality, Integrity and Availability. **4.** To understand various protocols for network security to protect against the threats in the networks.				
Course Outcomes					
CO1	Understand the DES/AES standard.				
CO2	Analyze the different public key cryptography and authentication.				
CO3	Evaluate various authentication algorithms such like digital signature.				
CO4	Understand the IP security system and key management concepts.				

Module	**Course Contents**	**Contact Hrs.**	**Mapped CO**
1	**Introduction to Cryptography and Block Ciphers** Introduction to security attacks - services and mechanism - introduction to cryptography - Conventional Encryption: Conventional encryption model - classical encryption techniques - substitution ciphers and transposition ciphers – cryptanalysis – steganography - stream and block ciphers - Modern Block Ciphers: Block ciphers principals - Shannon‘s theory of confusion and diffusion - fiestal structure - data encryption standard(DES) - strength of DES - differential and linear crypt analysis of DES - block cipher modes of operations - triple DES – AES **Confidentiality and Modular Arithmetic** Confidentiality using conventional encryption - traffic confidentiality- key distribution - random number generation - Introduction to graph - ring and field - prime and relative prime numbers - modular arithmetic - Fermat‘s and Euler‘s theorem - primality testing - Euclid‘s Algorithm - Chinese Remainder theorem – discrete algorithms.	30 Hours	CO1
2	**Public key cryptography and Authentication requirements** Principles of public key crypto systems - RSA algorithm - security of RSA - key management – Diffle - Hellman key exchange algorithm - introductory idea of Elliptic curve cryptography – Elgamal encryption - Message Authentication and Hash Function: Authentication requirements - authentication functions - message authentication code - hash functions - birthday attacks – security of hash functions and MACS.	30 Hours	CO2
3	**Integrity checks and Authentication algorithms** MD5 message digest algorithm - Secure hash algorithm	30 Hours	CO3, CO4

	(SHA) Digital Signatures: Digital Signatures - authentication protocols - digital signature standards (DSS) - proof of digital signature algorithm - Authentication Applications: Kerberos and X.509 - directory authentication service - electronic mail security-pretty good privacy (PGP) - S/MIME. **IP Security and Key Management** IP Security and Key Management, IP Security: Architecture - Authentication header - Encapsulating security payloads - combining security associations - key management. **Web and System Security** Web Security: Secure socket layer and transport layer security - secure electronic transaction (SET) - System Security: Intruders - Viruses and related threads - firewall design principals – trusted systems.		

Suggested Readings

1. IBM Courseware

Online Resources

1. **https://archive.nptel.ac.in/courses/106/105/106105162/**

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	2		2	3							2	2		1
CO2		2	3		2						2			2
CO3			1	2									2	1
CO4	2		2		2						2		2	2

Program	B. Tech CSE(IOTBC)				
Year	IV	Semester		VIII	
Course Name	Data Science for Internet of Things				
Code	NPEC44043				
Course Type	PEC	L	T	P	Credit
Pre-Requisite	Basic knowledge of Internet	3	0	0	3
Course Objectives	**1.** Basic understanding of Networking Protocols and IOT data messaging protocols. **2.** Exploring IOT Data for Analytics and Visualization. **3.** Learn various techniques and parameters for Data Quality Check **4.** Understand basics of Machine learning and Use cases for deep learning with IoT data				
Course Outcomes					
CO1	Understand IOT communication protocols used for device data transmission.				
CO2	Analyse IOT device data collection to perform analytics and visualize data for better understanding of volumes of Data.				
CO3	Evaluate the Machine learning and Deep Learning concepts on Data.				
CO4	Apply cloud resources to manage complete data lifecycle.				

Module	Course Contents	Contact Hrs.	Mapped CO
1	**Introduction to IOT and Data Science:** Introduction to IoT, applications, IoT architectures, introduction to analytics, IoT analytics challenges, History and evolution of Data Science, Factors contributing to growth of Data, Domains involved in Field of Data Science, Critical roles involved in Data Science projects. **Communication Protocols and IOT Data Analysis**IoT devices, Networking basics, IoT networking connectivity protocols, IoT networking data messaging protocols, Analyzing data to infer protocol and device characteristics.	30 Hours	CO1
2	**IoT Analytics for the Cloud:** Introduction to elastic analytics, Decouple key components, Cloud security and analytics, Designing data processing for analytics, Applying big data technology to storage Basics, Cloud Computing and Industry 4.0. **Exploring IoT Data:** Exploring and visualizing data, Techniques to understand data quality, Basic time series analysis, Statistical analysis.	30 Hours	CO2
3	**Data Science for IoT Analytics:** Introduction to Machine Learning, Feature engineering with IoT data, Validation methods, Understanding the bias–variance trade-off, Use cases for deep learning with IoT data. **Business issues in Industry 4.0:** Linked Analytical Datasets, Managing data lakes, data retention strategy Understand concepts such as object storage, data refinery machine learning, visual recognition and model building.	30 Hours	CO3, CO4

Suggested Readings

1. Minteer, Andrew, Analytics for the Internet of Things (IoT), Packt Publishing Ltd.
2. Kai Hwang, Min Chen, Big-Data Analytics for Cloud, IoT and Cognitive Computing, Wiley Hwaiyu Geng, Internet of Things and Data Analytics Handbook, Wiley.
3. John Soldatos, Building Blocks for IoT Analytics Internet-of-Things Analytics, River Publishers Gerardus Blokdyk, IoT Analytics A Complete Guide, 5starcooks

Online Resources

1. https://nptel.ac.in/courses/106106179
2. https://onlinecourses.nptel.ac.in/noc19_cs65/preview

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	2	2	1								2		2	1
CO2	2		2	2							2	2	2	
CO3	2	3		2	2							1	3	2
CO4	2	2	2	3	2						2		2	2

Program	B.Tech: CSE (IOTBC)				
Year	IV	Semester		VIII	
Course Name	Blockchain Technologies: Business Innovation and Applications				
Code	NPEC44044				
Course Type	PEC	L	T	P	Credit
Pre-Requisite	Basic knowledge of Networking	3	0	0	3
Course Objectives	**1.** Block chain technology and the key concepts like cryptography and crypto currency concepts. **2.** Gain a deep insight into Bitcoin, its network and how Bitcoin transactions are validated by miners. **3**. Interpret the prospects of Blockchain and assess your business standards. **4**. Explanation of how blockchain, reduces the cost of networking.				
Course Outcomes					
CO1	Understand how blockchain solutions are transforming the industry landscape.				
CO2	Analyse a deeper understanding of blockchain technical topics such as consensus, cryptography, privacy and security.				
CO3	Evaluate better knowledge of blockchain technology's potential, allowing them to determine which business challenges it can address.				
CO4	Apply blockchain-based method for addressing a business problem in their sector.				

Module	Course Contents	Contact Hrs.	Mapped CO
1	**Introduction to Blockchain:** Articulate the challenges of predicting technological evolution and its impact on the economy Identify common misconceptions about blockchain technology Compare the emergence of blockchain technology to that of other general-purpose technologies. Evaluate a business application of blockchain through the lens of a strategic framework. Discern the role of entrepreneurial strategy in a time of technological uncertainty **Bitcoin and The Curse of The Double-Spending Problem** Explain the double-spending problem and how it is addressed by Bitcoin Interpret Bitcoin as a medium of exchange, store of value, and unit of account. Review the technical details of the Bitcoin protocol Compare the algorithms used to establish consensus in a blockchain to ensure its integrity Determine from a Bitcoin transaction how the PoW algorithm works. Investigate alternative cryptocurrencies and how they might address the challenges presented by bitcoin Evaluate current issues with scaling the Bitcoin blockchain and how they can be addressed. Investigate the role of mining in bootstrapping Bitcoin's Infrastructure.	30 Hours	CO1
2	**Costless Verification: Blockchain Technology and The Last Mile Problem:** Demonstrate the cost of verifying the attributes of a	30 Hours	CO2

	transaction Identify situations where settlement and reconciliation are expensive today Determine how to build data integrity with costless verification Compare applications of cheaper settlement and reconciliation across different industries Investigate (online and offline) complements to blockchain technology that may help to solve the last mile problem Recommend feasible solutions to the last mile problem.		
3	**Bootstrapping Network Effects Through Blockchain Technology And Cryptoeconomics:** Deduce how the nature of intermediation may change as a result of blockchain technology Articulate the economic consequences of a reduction in the cost of networking. Analyze the risks associated with smart contracts Discern the role of tokens in incentivizing the growth, operations, and security of a platform. Investigate the conditions under which relational contracts can be automated. Recommend a reward system for an incumbent adding a token to its ecosystem. Assess the ability of case examples to capitalize on the reduction in the cost of networking **Using Tokens to Design New Types of Digital Platforms-** Investigate the value that tokens may bring to a business's ecosystem. Analyze examples of tokens and decide which industry verticals are most promising. Distinguish the role of tokens in funding blockchain innovations and platforms. Evaluate various tokens, ranking them in terms of capital raised and trading performance. Deduce how challenges around securities regulation can affect the successful tokenization of an ecosystem.	30 Hours	CO3

Suggested Readings

1. IBM Courseware Kai Hwang, Min Chen, Big-Data Analytics for Cloud, IoT and Cognitive Computing, Wiley Hwaiyu Geng, Internet of Things and Data
2. Implementing Blockchain solutions using Hyperledger

Online Resources

1. https://onlinecourses.nptel.ac.in/noc22_cs44/preview
2. https://www.digimat.in/nptel/courses/video/106104220/L01.html

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	2		2	2							1		3	2
CO2	2	2	2		3						2	1	3	1
CO3	2	2		2	2							1	2	2
CO4	2	3	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		