Pimpri Chinchwad Education Trust's

PIMPRI CHINCHWAD COLLEGE OF ENGINEERING

SECTOR NO. 26, PRADHIKARAN, NIGDI, PUNE 411044

An Autonomous Institute Approved by AICTE and Affiliated to SPPU, Pune

DEPARTMENT OF INFORMATION TECHNOLOGY

Curriculum Structure and Syllabus

of

T.Y. B Tech Information Technology

(Course 2020)

Effective from Academic Year 2023-24
(Updated with Minor Changes)

VISION AND MISSION OF INSTITUTE

Institute Vision

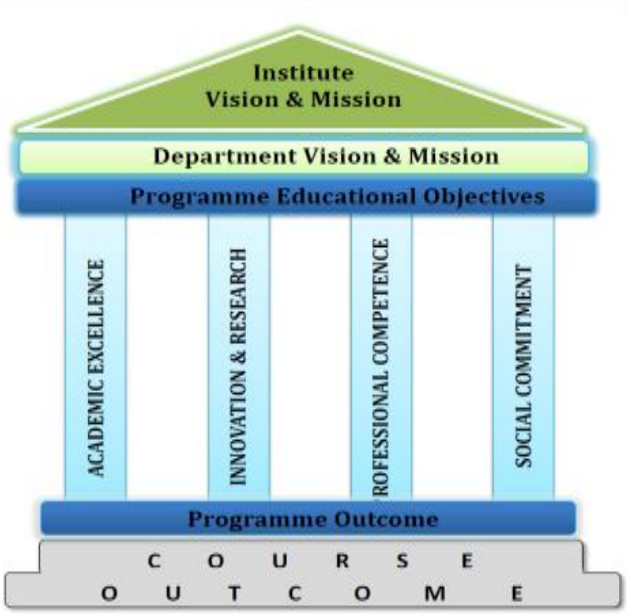
To be one of the top 100 Engineering Institutes of India in counting five years by offering exemplarily Ethical, Sustainable and Value Added Quality Education through a matching ecosystem for building successful careers.

Institute Mission

1. Serving the needs of society at large through establishment of a state-of-art Engineering Institutes.
2. Imparting right Attitude, Skills, Knowledge for self-sustenance through Quality Education.
3. Creating globally competent and Sensible Engineers, Researchers and Entrepreneurs with an ability to think and act independently in demanding situations.

Quality Policy

We at PCCOE are committed to impart Value Added Quality Education to satisfy the applicable requirements, needs and expectations of the Students and Stakeholders. We shall strive for academic excellence, professional competence and social commitment in fine blend with innovation and research. We shall achieve this by establishing and strengthening state-of-the-art Engineering and Management Institute through continual improvement in effective implementation of Quality Management System.



	Pimpri Chinchwad Education Trust's **Pimpri Chinchwad College of Engineering**	
Course Approval Summary		

A) Board of Study – Department of Applied Sciences and Humanities

Sr. No.	Name of the Course	Course Code	Page number	Signature and stamp of BoS
1	Statistical Data Analysis using R	BAS5607	47-48	
2	Principles of Management	BHM5113	53-54	
3	Professional Development Training - I	BHM5917	57-57	
4	Constitution of India	BHM9962	58-59	
5	Emotional Intelligence	BHM9963	122-123	
6	Entrepreneurship Development	BHM9964	124-125	
7	Research Article Writing	BHM9965	126-127	
8	Multivariate Data Analysis using R	BAS6608	99-100	
9	Financial Management	BHM6115	115-116	
10	Entrepreneurship Development	BHM6116	113-114	
11	Project Management	BHM6114	117-118	
12	Professional Development Training - II	BHM6918	120-121	

B) Board of study - Department of Information Technology

Sr. No.	Name of the Course	Course Code	Page number	Signature and stamp of BoS
1	Database Management System	BIT5401	13-14	
2	Database Laboratory	BIT5403	15-16	
3	Operating System	BIT5402	17-18	
4	Operating System Lab	BIT5404	19-20	
5	Distributed Computing	BIT 5501	21-22	
6	Distributed Computing Lab	BIT 5504	23-23	
7	Artificial Intelligence	BIT5502	24-25	
8	Artificial Intelligence Lab	BIT5505	26-27	
9	Computer Graphics and Image Processing	BIT5503	28-28	
10	Computer Graphics and Image Processing Lab	BIT5506	29-29	

11	Cyber Security	BIT5507	30-31	
12	Cyber Security Lab	BIT5510	32-32	
13	Foundations of Data Science	BIT5508	33-34	
14	Foundations of Data Science Lab	BIT5511	35-35	
15	Software Design Pattern	BIT5509	36-37	
16	Software Design Pattern Lab	BIT5512	38-38	
17	Java Programming	BIT5911	55-56	
18	Machine Learning	BIT6401	61-62	
19	Machine Learning Lab	BIT 6403	63-63	
20	Software Engineering and Project Management	BIT6402	64-65	
21	Software Engineering and Project Management Lab	BIT6404	66-67	
22	Cloud Computing	BIT6501	68-69	
23	Cloud Computing Lab	BIT6504	70-70	
24	Deep Learning	BIT6502	71-72	
25	Deep Learning Lab	BIT6505	73-73	
26	Computer Vision	BIT6503	74-74	
27	Computer Vision Lab	BIT6506	75-75	
28	Internet of Things	BIT6507	76-77	
29	Internet of Things Lab	BIT6510	78-79	
30	Big Data Analytics	BIT6508	80-81	
31	Big Data Analytics Lab	BIT6511	82-83	
32	Software Testing and Quality Assurance	BIT6509	84-85	
33	Software Testing and Quality Assurance Lab	BIT6512	86-86	
34	Advance Web Technology	BIT6911	119-119	

Board of study - Department of Civil Engineering

Sr. No.	Name of the Course	Course Code	Page number	Signature and stamp of BoS
1	Total Quality Management (TQM)	BCI5602A	39-40	
2	Intelligent Transport System (ITS)	BCI5602B	41-42	
3	Remote Sensing and GIS	BCI6603A	87-88	
4	Building Services and Maintenance	BCI6603B	89-90	
5	Smart Cities & Building Automations	BCI6604A	91-92	
6	Mechanical Electrical Plumbing (MEP) Systems	BCI6604B	93-94	

C) Board of study - Department of E &TC

Sr. No.	Name of the Course	Course Code	Page number	Signature and stamp of BoS
1	Smart City: An Electronic Perspective	BET5601	43-44	
2	Modeling and Simulation	BET5602	45-46	
3	Designing with Raspberry Pi	BET6601	95-96	
4	Basics of Automotive Electronics	BET6602	97-98	
5	Designing with Arduino platform	BET6603	105-106	
6	Communication Protocols for e-Vehicle	BET6604	107-108	

D) Board of study - Department of Mechanical Engineering

Sr. No.	Name of the Course	Course Code	Page number	Signature and stamp of BoS
1	Industry 4.0	BME5602A	49-50	
2	Safety, Health and Environment	BME5602B	51-52	
3	3D Printing and Modeling	BME6603A	101-102	
4	Material Informatics	BME6603B	103-104	
5	Model Based System Engineering	BME6604A	109-110	
6	Electronics Cooling	BME6604B	111-112	

Approved by Academic Council:

Chairman, Academic Council
Pimpri Chinchwad College of Engineering

Approved by Board of Governors:

Chairman Board of Governors:
Pimpri Chinchwad College of Engineering

INDEX

ABBREVIATIONS

Sr. No.	Type of course	Abbreviations
1	Basic Science Course	**BSC**
2	Engineering Core/Science Course	**ECC**
3	Humanities, Social Sciences and Management Course	**HSMC**
4	Professional Core Course	**PCC**
5	Professional Elective Course	**PEC**
6	Open Elective Course	**OEC**
7	Project	**PROJ**
8	Internship	**INTR**
9	Audit Course	**AC**
10	Mandatory Course	**MC**
11	Life Skills	**LS**
12	Proficiency Course	**PFC**
13	Professional Development Training	**PDT**
14	MOOC	**MO**
15	Internal Evaluation	**IE**
16	Mid Term Evaluation	**MTE**
17	End Term Evaluation	**ETE**
18	Term Work	**TW**
19	Oral	**OR**
20	Practical	**PR**

Curriculum Framework for B.Tech IT

Sr. No.	Type of course	Abbreviations
1	Basic Science Course	**BSC**
2	Engineering Core/Science Course	**ECC**
3	Humanities, Social Sciences and Management Course	**HSMC**
4	Professional Core Course	**PCC**
5	Professional Elective Course	**PEC**
6	Open Elective Course	**OEC**
7	Project	**PROJ**
8	Internship	**INTR**
9	Audit Course	**AC**
10	Mandatory Course	**MC**
11	Life Skills	**LS**
12	Proficiency Course	**PFC**

Sr. No.	Type of course	No. of Courses	Total Credits	
			No	%
1	Basic Science Course	**8**	**23**	**14.3**
2	Engineering Core/Science Course	**14**	**22**	**13.7**
3	Humanities, Social Sciences and Management Course	**6**	**13**	**8.1**
4	Professional Core Course	**23**	**48**	**29.8**
5	Professional Elective Course	**10**	**18**	**11.2**
6	Open Elective Course	**6**	**18**	**11.2**
7	Project	**2**	**16**	**9.9**
8	Internship	**1**	**3**	**1.9**
9	Audit Course	**3**	**0**	**0.0**
10	Mandatory Course	**2**	**0**	**0.0**
11	Life Skills	**4**	**0**	**0.0**
12	Proficiency Course	**3**	**0**	**0.0**
	Total	**82**	**161**	**100.0**

COURSE DISTRIBUTION: SEMESTER WISE

Sr. No.	Type of course	No. of Courses/Semester								Total
		1	2	3	4	5	6	7	8	
1	Basic Science Course	3	3	2						**8**
2	Engineering Core/Science Course	5	6	2	1					**14**
3	Humanities, Social Sciences and Management Course	1	1	1	1	1	1			**6**
4	Professional Core Course			5	6	4	4	4		**23**
5	Professional Elective Course					4	4	2		**10**
6	Open Elective Course				1	1	2	2		**6**
7	Project	1							1	**2**
8	Internship								1	**1**
9	Audit Course				1	1	1			**3**
10	Mandatory Course					1	1			**2**
11	Life Skills	1	1	1	1					**4**
12	Proficiency Course				1	1	1			**3**
Total		**11**	**11**	**11**	**12**	**13**	**14**	**8**	**2**	**82**

CREDIT DISTRIBUTION: SEMESTER WISE

Sr. No.	Type of course	No. of Credits/Semester								Total
		1	2	3	4	5	6	7	8	
1	Basic Science Course	9	9	5						**23**
2	Engineering Core/Science Course	7	9	3	3					**22**
3	Humanities, Social Sciences and Management Course	2	2	3	2	2	2			**13**
4	Professional Core Course			12	12	8	8	8		**48**
5	Professional Elective Course					6	6	6		**18**
6	Open Elective Course				3	3	6	6		**18**
7	Project	2							14	**16**
8	Internship								3	**3**
9	Audit Course									**0**
10	Mandatory Course									**0**
11	Life Skills									**0**
12	Proficiency Course									**0**
Total		**20**	**20**	**23**	**20**	**19**	**22**	**20**	**17**	**161**

Curriculum Structure

TY B Tech

Information Technology

B. Tech (Information Technology) Curriculum Structure Semester V

Sem – V			Teaching Scheme					Evaluation Scheme						
Course Code	Category	Course Name	Lecture	Tutorial	Practical	Work Hour	Credit	CE	MTE	ETE	TW	PR	OR	Total
BIT5401	PCC	Database Management System	3	_	_	3	3	20	30	50	-	-	-	100
BIT5402	PCC	Operating System	3	_	_	3	3	20	30	50	-	-	-	100
BIT5501 to BIT5503	PEC	Elective-I	2	_	_	2	2	20	30	50	-	-	-	100
BIT5507 to BIT5509	PEC	Elective-II	2	_	_	2	2	20	30	50	-	-	-	100
	OEC	Open Elective-II	3	_	_	3	3	20	30	50	-	-	-	100
BIT5403	PCC	Database Lab		_	2	2	1				25	25	-	50
BIT5404	PCC	Operating System Lab	_	_	2	2	1				25	25	-	50
BIT5504 to BIT5506	PEC	Elective-I Lab	_	_	2	2	1				50	-	-	50
BIT5510 to BIT5512	PEC	Elective-II Lab	_	_	2	2	1				50	-	-	50
BHM5113	HSMC	HSMC-5	2	_	_	2	2	30		20				50
BIT5911	PFC	Java Programming	0	0	2	2	0	-	-	-	-	-	-	
BHM5917	MC	Professional Development Training-I	3	0	0	2	0	-	-	-	-	-	-	
BHM9962	AC	Audit Course-II	1	0	0	1	0	-	-	-	-	-	-	
Total			**16**	**0**	**13**	**28**	**19**	**130**	**150**	**270**	**150**	**50**	**0**	**750**

Abbr: Course Abbreviation; **L**- Lecture; **P**- Practical; **H**- Hours; **CR**- Credits; **IE1**– Internal Evaluation-1; **IE2**– Internal Evaluation-2; **ETE** – End Term Examination; **TW** – Term Work; **OR** – Oral Exam

Semester- V

List of Professional Electives –I

Course Code	Course Name	
BIT5501	Distributed Computing	Choose any one
BIT5502	Artificial Intelligence	
BIT5503	Computer Graphics and Image Processing	

List of Professional Electives -I LAB

Course Code	Course Name	
BIT5504	Distributed Computing Lab	Choose any one
BIT5505	Artificial Intelligence Lab	
BIT5506	Computer Graphics and Image Processing Lab	

List of Professional Electives -II

Course Code	Course Name	
BIT5507	Cyber Security	Choose any one
BIT5508	Foundations of Data Science	
BIT5509	Software Design Patterns	

List of Professional Electives -II LAB

Course Code	Course Name	
BIT5510	Cyber Security Lab	Choose any one
BIT5511	Foundations of Data Science Lab	
BIT5512	Software Design Patterns Lab	

List of Open Electives -II

Course Code	Course Name	Offering Department	
BCI5602.A	Total Quality Management	Civil	Choose Anyone
BCI5602B	Intelligent Transport System		
BET5601	Smart City: An Electronic Perspectives	E&TC	
BET5602	Modeling and Simulation with MATLAB		
BAS5607	Statistical Data Analysis Using R	A&SH	
BME5602A	Industry 4.0	Mechanical	
BME5602B	Safety, Health and Environment		

List of HSMC Courses

Course Code	Name of Course
BHM5113	Principles of Management

List of Proficiency Course

Course Code	Name of Course
BIT5911	Java Programming

List of Professional Development Training

Course Code	Name of Course
BHM5917	Professional Development Training-I

List of Audit Courses

Course Code	Name of Course
BHM9962	Constitution of India

B. Tech (Information Technology) Curriculum Structure Semester VI

Sem – VI			Teaching Scheme					Evaluation Scheme						
Course Code	Category	Course Name	Lecture	Tutorial	Practical	Work Hour	Credit	CE	MTE	ETE	TW	PR	OR	Total
BIT6401	PCC	Machine Learning	3	_	_	3	3	20	30	50	-	-	-	100
BIT6402	PCC	Software Engineering & Project Management	3	_	_	3	3	20	30	50	-	-	-	100
BIT6501 to BIT6503	PEC	Elective-III	2	_	_	2	2	20	30	50	-	-	-	100
BIT6507 to BIT6509	PEC	Elective-IV	2	_	_	2	2	20	30	50	-	-	-	100
	OEC	Open Elective-III	3	_	_	3	3	20	30	50	-	-	-	100
	OEC	Open Elective-IV	3	_	_	3	3	20	30	50	-	-	-	100
BIT6403	PCC	Software Engineering & Project Management	_	_	2	2	1				-	25	-	25
BIT6404	PCC	Machine Learning Lab	_	_	2	2	1				-	25	-	25
BIT6504 to BIT6506	PEC	Elective-III-Lab	_	_	2	2	1				25			25
BIT6510 to BIT6512	PEC	Elective-IV-Lab	_	_	2	2	1				25			25
BHM6114 to BHM6116	HSMC	HSMC-6	2	_	_	2	2	20		30				50
BIT6911	PFC	Advanced Web Technology	0	0	2	2	0							0
BHM6918	MC	Professional Development Training-II	3	0	0	2	0							0
BHM9963 to BHM9965	AC	Audit Course-III	1	0	0	1	0							0
Total			**19**	**0**	**12**	**32**	**22**	**140**	**180**	**330**	**50**	**50**	**0**	**750**

Abbr: Course Abbreviation; **L**- Lecture; **P**- Practical; **H**- Hours; **CR**- Credits; **IE1**– Internal Evaluation-1; **IE2**– Internal Evaluation-2; **ETE** – End Term Examination; **TW** – Term Work; **OR** – Oral Exam

Semester- VI

List of Professional Electives –III

Course Code	Course Name	
BIT6501	Cloud computing	Choose any one
BIT6502	Deep Learning	
BIT6503	Computer Vision	

List of Professional Electives -III LAB

Course Code	Course Name	
BIT6504	Cloud computing Lab	Choose any one
BIT6505	Deep Learning Lab	
BIT6506	Computer Vision Lab	

List of Professional Electives -IV

Course Code	Course Name	
BIT6507	Internet of Things	Choose any one
BIT6508	Big Data Analytics	
BIT6509	Software Testing & Quality Assurance	

List of Professional Electives -IV LAB

Course Code	Course Name	
BIT6510	Internet of Things Lab	Choose any one
BIT6511	Big Data Analytics Lab	
BIT6512	Software Testing & Quality Assurance Lab	

List of Open Electives -III

Course Code	Course Name	Offering Department	
BCI6603A	Remote Sensing and GIS	Civil	Choose Anyone
BCI6603B	Building Services and Maintenance		
BET6601	Designing with Raspberry Pi	E&TC	
BET6602	Basics of Automotive Electronics		
BAS6608	Multivariate data analysis using R	AS&H	
BME6603A	3D Printing and Modelling	Mech	
BME6603B	Material Informatics		

List of Open Electives -IV

Course Code	Course Name	Offering Department	
BCI6604A	Smart Cities & Building Automations	Civil	Choose Anyone
BCI6604B	Mechanical Electrical Plumbing (MEP) Systems		
BET6603	Designing with Arduino platform	E&E&TC	
BET6604	Communication Protocols for eVehicle		
BME6604A	Model Based System Engineering	Mech	
BME6604B	Electronics Cooling		

List of HSMC Courses

Course Code	Name of Course	
BHM6114	Project Management	Choose Anyone
BHM6115	Financial Management	
BHM6116	Entrepreneurship Development	

List of Proficiency Course

Course Code	Name of Course
BIT6911	Advanced Web Technology

List of Professional Development Training

Course Code	Name of Course
BHM6918	Professional Development Training-II

List of Audit Courses

Course Code	Name of Course	
BHM9963	Emotional Intelligence	Choose Anyone
BHM9964	Entrepreneurship Development	
BHM9965	Research Article Writing	

Course Syllabus

Semester-V

Program:	**B. Tech. I.T.**				Semester: **V**		
Course : **Database Management System**					Code : **BIT5401**		
Teaching Scheme				**Evaluation Scheme**			
Lecture	**Practical**	**Tutorial**	**Credit**	**IE**	**MTE**	**ETE**	**Total**
3	-	-	3	20	30	50	100

Prior Knowledge of

- Data structures.
- Discrete Structure

is essential.

Course Objectives:

1. Understand the fundamental concepts of database management.
2. Understand the basic concepts of transaction processing and concurrency control
3. Describe various Database Architectures and Applications.
4. To learn and understand the role of Data warehousing and data mining in database management.

Course Outcomes:

After learning the course, the students will be able to:

1. **Draw** the database schema using ER and EER concepts.
2. **Apply a query to execute SQL and No SQL database commands**.
3. Explain transaction processing and concurrency control
4. **Describe various database architectures.**
5. Describe data warehousing and data mining concepts.
6. Make use of the emerging database technologies for real-time applications.

Detailed Syllabus

Unit	Description	Duration (Hrs)
1.	**Introduction To Database Concepts** Data Modeling: Data Models, Basic Concepts, Components of E-R and EER Model, Relational Model: Basic concepts, Attributes and Domains, Codd's Rules, Relational Integrity, Schema Diagram, Database Design, Normalization, Decomposition	**7**
2.	**Sql And Nosql Databases** SQL Data Types and Literals, DDL, DML, DCL, TCL, SQL Operators, Tables, Views, Indexes, Joins, Aggregate Functions, Nested Queries, Stored Procedures, Cursors, Triggers, Advanced SQL-Programming, NoSQL database system	**8**
3.	**Database Transactions** Properties of Transactions, Transaction Management, Commit Protocols, Concept of Schedule, Serializability, Concurrency Controls, Deadlocks, Recovery methods: Shadow-Paging and Log-Based Recovery, Checkpoints	**8**
4.	**Advance And Emerging Database Concept** Centralized and Client-Server Architectures, 2 Tier and 3 Tier Architecture, Architecture of Parallel Databases, Architecture of Distributed Databases	**7**

5.	**Data Warehousing And Data Mining** Distributed Database Design, Introduction of Data Warehousing Characteristics, Benefits, Limitation of Data Warehousing, Main Components of Data Warehouse, Conceptual Models, Data Mart, OLAP, Data Mining: Process, Knowledge Discovery, Goals and Tasks.	**8**
6.	**Emerging Database Technologies For Real-Time Applications** Temporal, spatial, deductive and Big databases-basic concepts, More recent applications-mobile databases, Multimedia databases	**7**
	Total	**45**

Text Books:

1. Silberschatz A., Korth H., Sudarshan S., "Database System Concepts"
2. S.K.Singh, “Database Systems: Concepts, Design and Application”
3. Connally T., Begg C., "Database Systems"

Reference Books:

1. Jiawei Han, Micheline Kamber, Jian Pei, “Data Mining: Concepts and Techniques”, Elsevier
2. Shio Kumar Singh, Database Systems Concepts Design and Applications, Pearson
3. Mario Piattini, Oscar Diaz “Advanced Database Technology and Design”- online book. J. Han, M. Kamber Data mining: concepts and techniques. Morgan Kaufmann.
4. Kristina Chodorow, Michael Dirolf, “MongoDB: The Definitive Guide”, O’Reilly Publications
5. Alex Holmes, “Hadoop in Practice”, DreamTech Press

Program:	**B. Tech. I.T.**				Semester: **V**		
Course : **Database Lab**					Code : **BIT5403**		
Teaching Scheme				**Evaluation Scheme**			
Lecture	**Practical**	**Tutorial**	**Credit**	**TW**	**PR**	**OR**	**Total**
-	2	-	1	25	25	-	50

Prior Knowledge of

- Discrete mathematics

is essential.

Course Objectives:

1. To learn database management system.
2. To know design standards for database system.
3. To learn the SQL commands and apply it to a database system.
4. To learn MongoDB standards commands.

Course Outcomes:

After learning the course, the students will be able to:

1. Install and configure client-server for MySQL, MongoDB, SQLite
2. Design the database schema using concepts of ER, EER diagrams and apply relational algebra
3. Create database using MySQL, MongoDB and perform CURD operations on it.
4. **Develop** a mini project using database concepts.

Detailed Syllabus

Unit	**Description**
	Group – A MySQL
1.	Install and configure client and server for MySQL and MongoDB (Show all commands and necessary steps for installation and configuration).
2.	Design any database with at least 3 entities and relationships between them. Draw suitable ER/EER diagram for the system.
3.	Create Table with primary key and foreign key constraints for assignment no 2 and apply DCL, DDL and DML commands.
4.	Write and execute suitable database triggers and Joins
5.	Execute DDL/DML statements which demonstrate the use of views, cursor.
	Group – B MongoDB
6.	Create a database with suitable example using MongoDB and implement Inserting and saving document (batch insert, insert validation) • Removing document ·Updating document (document replacement, using modifiers, upserts, updating multiple documents, returning updated documents)
7.	Execute at least 10 queries on database design in assignment no 4 using MongoDB that demonstrates following querying techniques: find and findOne (specific values) • Query criteria (Query conditionals, OR queries, $not, Conditional semantic, $ where queries) • Cursors (Limits, skips, sorts, advanced query options) · Database commands

	Group – C Mini Project
8.	Develop a mini project using the database identified in Assignment no. 2.

Reference Books:

1. Kristina Chodorow, MongoDB The definitive guide, O'Reilly Publications, ISBN:978-93-5110-269-4, 2nd Edition
2. Ivan Bayross, SQL, PL/SQL: The Programming Language of Oracle, BPB Publication

Program:	**B. Tech. I.T.**				Semester: **V**		
Course : **Operating System**					Code : **BIT5402**		
Teaching Scheme				**Evaluation Scheme**			
Lecture	**Practical**	**Tutorial**	**Credit**	**IE**	**MTE**	**ETE**	**Total**
3	-	-	3	20	30	50	100

Prior Knowledge of

- Computer Organization and Architecture.
- Fundamentals of Data Structures

is essential.

Course Objectives:

1. Understand the basic concept and functions of the operating system.
2. Understand the concept of Process and Thread management including scheduling, synchronization, and deadlocks.
3. Analyze the memory management techniques.
4. Understand I/O Management and File System.
5. Apply the Protection and Security to OS.

Course Outcomes:

After learning the course, the students will be able to:

1. **Explain** the role of the Operating System.
2. **Demonstrate the concepts of Process / Thread Scheduling**.
3. **Make use of Process Synchronization Techniques**.
4. **Make use of the memory management techniques**.
5. **Compare the various techniques of i/o management, disk scheduling and file system**.
6. **Discuss issues and solutions in OS Security.**

Detailed Syllabus

Unit	Description	Duration (Hrs)
1.	**Introduction** Operating System Objectives, The Evolution of Operating System, OS Design Considerations for Multiprocessor and Multicore OS, Architectures of Operating System: Monolithic, Microkernel, Exokernel, Introduction to Linux OS, Basic Shell Commands, Shell Scripting using BASH.	6
2.	**Process Management** **Process**: Process Concept, Process States, Process Control Block, Process Description **Threads**: Process and Threads, Basic types of threads, Multithreading, Thread Programming using thread library APIs **Process Scheduling**: Types of Scheduling, Scheduling Criteria, Scheduling Algorithms: First-Come First- Served, Shortest-Job-First, Priority, Round Robin, Case Study - Linux Scheduling	8

3.	**Process Synchronization** Principles of Concurrency, Critical - Section Problem, Mutual Exclusion: Requirements, Operating System support - Semaphore and Mutex, Classical Synchronization Problems: Reader-Writer Problem, Producer - Consumer Problem, Real Life Problems, Inter-Process Communication: Pipes and Shared Memory **Deadlock**: Principles of Deadlock, Deadlock Characterization: Necessary Conditions, Resource - Allocation Graph, Methods for Handling Deadlock: Deadlock Prevention, Deadlock Avoidance, Deadlock Detection and Recovery, Case Study: Dining Philosopher Problem	9
4.	**Memory Management** Memory Management Requirements, Memory Partitioning: Fixed Partitioning, Dynamic Partitioning, Buddy System, Paging, Segmentation, Virtual Memory: Demand Paging, Page Replacement, Thrashing, Case Study: Linux Operating System	8
5.	**Input / Output And File Management** I/O Management: I/O Devices, Organization of the I/O Function, I/O Buffering, Secondary Storage Management: Disk Structure, Disk Scheduling File Management: Overview-Files and File Systems, File structure. File Organization and Access, File Directories, File Sharing, Case Study: Linux File System, Android File System	8
6.	**Protection And Security** Goals of protection, Domain of protection, Access matrix, Implementation of access matrix, Revocation of access rights, Security problems, Authentication, Program threats, System threats, Threat monitoring	6
	Total	**45**

Text Books:

1. William Stallings, Operating System: Internals and Design Principles, Prentice Hall, 8th Edition,2014, ISBN-10: 0133805913 • ISBN-13: 9780133805918
2. Abraham Silberschatz, Peter Baer Galvin and Greg Gagne, Operating System Concepts, John Wiley & Sons ,Inc., 9th Edition,2012, ISBN 978-1-118-06333-0
3. Arnold Robbins, Nelson H. F. Beebe, Classic Shell Scripting, O'Reilly Media, Inc., 2005, ISBN 9780596005955

Reference Books:

1. Tom Adelstein and Bill Lubanovic, Linux System Administration, O'Reilly Media, ISBN-10: 0596009526, ISBN-13: 978-0596009526.
2. Harvey M. Deitel, Operating Systems, Prentice Hall, ISBN-10: 0131828274, ISBN-13: 978-0131828278.
3. Thomas W. Doeppner, Operating System in depth: Design and Programming, WILEY, ISBN: 978- 0-471-68723-8.
4. Mendel Cooper, Advanced Shell Scripting, Linux Documentation Project.
5. Andrew S. Tanenbaum & Herbert Bos, Modern Operating System, Pearson, ISBN-13: 9780133592221, 4th Edition.

Program:	**B. Tech. I.T.**				Semester: **V**		
Course : **Operating System Lab**					Code : **BIT5404**		
Teaching Scheme				**Evaluation Scheme**			
Lecture	**Practical**	**Tutorial**	**Credit**	**TW**	**PR**	**OR**	**Total**
-	2	-	1	25	25	-	50

Prior knowledge of

- C Programming
- Fundamentals of Data Structures

are essential.

Course Objectives:

1. To introduce and learn Linux commands required for administration
2. To demonstrate the functioning of OS basic building blocks like processes, threads under the LINUX
3. To demonstrate the functioning of OS concepts in user space like concurrency control (process synchronization, mutual exclusion), CPU Scheduling, Memory Management and Disk Scheduling in LINUX.

Course Outcomes:

After learning the course, the students will be able to:

1. Apply the basic Linux commands.
2. **Use library functions to create processes and threads.**
3. **Implement Resource Management algorithms**.
4. **Implement inter-process communication**.

Suggested List of Assignments
(any 6)

1	Study of Basic Linux Commands: echo, ls, read, cat, touch, test, loops, arithmetic comparison, conditional loops, grep, sed find, diff, tac and Bash scripting
2	Implement the C program in which the main function accepts the integers to be sorted. Main function uses the FORK system call to create a new process called a child process. Parent process sorts the integers using a sorting algorithm and waits for the child process using WAIT system call to sort the integers using any sorting algorithm. Also demonstrate zombie and orphan states.
3	Implement the C program to simulate any 2 CPU Scheduling Algorithms (1 preemptive and 1 non- preemptive) with different arrival times.
4	Implement the C program for Producer Consumer problem using counting semaphores and mutex/binary semaphore.
5	Implement the C program for Reader-Writer problem with reader priority.
6	Implement the C program for Deadlock Avoidance Algorithm: Bankers Algorithm.
7	Implement the C program for Dinning Philosophers problem.
8	Implement the C program for any one Page Replacement Algorithm with minimum three frames as an input.
9	Implement the C program for any one Disk Scheduling Algorithm
10	Implement Full duplex communication between two independent processes. First process accepts sentences and writes on first pipe to be read by second process. Second process counts number of characters, number of words and number of lines in accepted sentences, and writes the contents on second pipe to be read by first process and displays on standard output.
11	**Study Assignment:** Implement a new system call in the kernel space, add this new system call in the Linux kernel by the compilation of this kernel (any kernel source, any architecture and any Linux kernel distribution) and demonstrate the use of this embedded system call using C program in user space.

12	**Study Assignment:** Case Study on process and threads creation, concurrency control and synchronization in various operating system

Text Books:

1. Das, Sumitabha, UNIX Concepts and Applications, TMH, ISBN-10: 0070635463, ISBN-13: 978-0070635463, 4th Edition.
2. William Stallings, Operating System: Internals and Design Principles, Prentice Hall, 8th Edition,2014, ISBN-10: 0133805913 • ISBN-13: 9780133805918
3. Abraham Silberschatz, Peter Baer Galvin and Greg Gagne, Operating System Concepts, John Wiley & Sons ,Inc., 9th Edition,2012, ISBN 978-1-118-06333-0

Reference Books:

1. Yashwant Kanetkar, UNIX Shell Programming, BPB Publication Maureen Spankle, "Problem Solving and Programming Concepts' ', 9th edition, Pearson.
2. Kay Robbins and Steve Robbins, UNIX Systems Programming, Prentice Hall, ISBN-13: 978-0134424071, ISBN-10: 0134424077, 2nd Edition

Program:	**B. Tech. I.T.**				Semester: **V**		
Course **: Distributed Computing**					**Code : BIT5501**		
Teaching Scheme				**Evaluation Scheme**			
Lecture	**Practical**	**Tutorial**	**Credit**	**IE**	**MTE**	**ETE**	**Total**
2	-	-	2	20	30	50	100

Prior Knowledge of

- Networking
- Algorithms

is essential

Objectives:

1. To present the principles underlying the function of distributed systems
2. To learn communication methodology in distributed systems
3. To acquaint with the Distributed File Systems
4. To expose students to current technology used to build architectures to enhance distributed computing infrastructures
5. Expose students to past and current research issues in the field of distributed systems

Outcomes:

After learning the course, the students should be able to:

1. Illustrate different types of distributed systems.
2. Make use of the concept of communication and election algorithms for designing distributed application.
3. Analyze the different types of distributed naming and File systems.
4. Explain different consistency models and protocols to make the system consistent and fault tolerant.

Detailed Syllabus

Unit	Description	Duration (Hrs)
1.	**Introduction** Defining distributed system, Characteristics, Middleware and Distributed System, Design goals- supporting resource sharing, making distribution transparent, open, scalable, pitfalls, Types of distributed systems – High performance distributed computing, Distributed Information Systems, Pervasive system, Architectural styles – Layered architectures, Object based architectures, Publish subscribe architectures, Middleware organization – Wrappers, Interceptors, Modifiable middleware, System architecture – Centralized, Decentralized, Hybrid, Example architecture – Network File System	6
2.	**Communication & Synchronization** Foundations – Layered protocols, Types of communication, Remote procedural call, Message oriented communication and applications, Multicast communication Clock synchronization – Physical clocks, Logical clocks, Lamport's logical clocks, Mutual exclusion- Overview, centralized, distributed, token-ring, decentralized algorithm, Election algorithms- bully, ring algorithm, Location systems- GPS, Logical positioning of nodes, Distributed event matching, Gossip-based contribution- Aggregation, A peer-sampling service, Gossip-based overlay construction	8

3.	**Naming and Distributed File Systems** Names, identifiers, and addresses, Flat naming, Structured naming, Attributed based naming, Introduction of distributed file system, File service architecture, Case study: Sun Network file system, Andrew File system	6
4.	**Replication, Consistency and Fault tolerance** Replication: Reasons for replication, Replication as scaling technique, Data-centric consistency models, Client-centric consistency models, Replica management, Example: Caching, and replication in the web Consistency: Introduction, Consistency Models and protocols Fault tolerance: Basic concepts, failure models, failure masking by redundancy, Process resilience Example: Paxos, Consensus in faulty systems with crash failures, limitations on realizing fault tolerant tolerance, failure detection, Reliable client server communication- point to point communication, RPC semantics in case of failures, Reliable group communication- Atomic multicast, Distributed commit, Recovery- Introduction, Check pointing, Message logging, Recovery oriented computing	10
	Total	**30**

Text Books:

1. Maarten van Steen, Andrew S. Tanenbaum, Distributed system, Third edition, version 3
2. George Coulouris, Jean Dollimore, Tim Kindberg, "Distributed Systems Concepts and Design", Fifth edition

Reference Books:

1. P.K.Sinha, "Distributed Operating System", Wiley IEEE Press
2. Singhal&Shivaratri, "Advanced Concept in Operating Systems", McGraw Hill
3. Vijay K.Garg Elements of Distributed Computing , Wiley

e-Books:

Martin Kleppmann, "Designing Data-Intensive Applications", Oreilly

MOOC/ Video Lectures available at:

1. Prof. Rajiv Misra, Distributed System, https://nptel.ac.in/courses/106/106/106106168/#
2. Prof. Rajiv Misra, Cloud computing and Distributed System, Prof. Rajiv Misra, Distributed System, https://nptel.ac.in/courses/106/104/106104182/

Program:	**B. Tech. I.T.**	Semester: **V**
Course : **Distributed Computing Lab**		Code :**BIT5504**

Teaching Scheme				**Evaluation Scheme**			
Lecture	**Practical**	**Tutorial**	**Credit**	**TW**	**PR**	**OR**	**Total**
-	2	-	1	50	-	-	50

Course Objectives:

1. To learn various algorithms for distributed systems
2. To learn various process communication trough socket programming
3. To learn various techniques, tools, applications in Distributed Systems

Course Outcomes:

After learning the course, the students will be able to:

1. Demonstrate the knowledge of the core concepts and techniques in Distributed Systems
2. Build distributed applications using the concept of communication.
3. Implement leader election algorithms for distributed applications.

Detailed Syllabus

Expt.	**Description**
1.	Inter-process communication using socket programming: implementing multithreaded echo server.
2.	Implementation of RPC Mechanism
3.	Simulation of election algorithms (Ring and Bus Topology)
4.	Clock synchronization: a) NTP b) Lamports clock
5.	Study and configuration of Distributed File System: NFS
6.	Study and installation of CUDA/Google FS/Hadoop DFS

Text Books:

1. Maarten van Steen, Andrew S. Tanenbaum, Distributed system, Third edition, version 3
2. George Coulouris, Jean Dollimore, Tim Kindberg, “Distributed Systems Concepts and Design”, Fifth edition

Reference Books:

1. P.K.Sinha, “Distributed Operating System”, Wiley IEEE Press
2. Singhal&Shivaratri, "Advanced Concept in Operating Systems", McGraw Hill
3. Vijay K.Garg Elements of Distributed Computing , Wiley

Program:	**B. Tech. I.T.**				Semester: **V**		
Course : **Artificial Intelligence**					Code : **BIT5502**		
Teaching Scheme				**Evaluation Scheme**			
Lecture	**Practical**	**Tutorial**	**Credit**	**IE**	**MTE**	**ETE**	**Total**
2	-	-	2	20	30	50	100

Prior knowledge of
Fundamentals of Data Structures is essential.

Course Objectives:

1. To describe the concept of Artificial Intelligence (AI) in the form of various Intellectual tasks.
2. To describe problem solving using various peculiar search strategies for AI
3. To know multi-agent environment in competitive environment
4. To acquaint with the fundamentals of knowledge and reasoning

Course Outcomes:

After learning the course, the students will be able to:

1. **Discuss the fundamentals of Artificial Intelligence and Intelligent agents**
2. **Identify various search algorithms in problem solving**
3. **Apply heuristic and game search algorithms in problem solving**
4. **Apply knowledge representation and reasoning for real life application**

Detailed Syllabus

Unit	Description	Duration (Hrs)
1.	**Introduction AI** What is AI, History, AI problems, Classification of AI systems, AI Application (E-Commerce, & Medicine). Statistical Analysis: Relationship between attributes: Covariance, Correlation Coefficient, Chi Square. Intelligent Agent: Concept of Rationality, nature of environment, structure of agents.	6
2.	**Overview to Problem Solving** Problem solving by Search- forward and backward, Problem space - State space, Blind Search - Types, Performance measurement. Problem-solving Agents, Type and Example problems.	8
3.	**Heuristic Search** Heuristic search Types, Hill Climbing, Best first search, mean and end analysis, Constraint Satisfaction, A* and AO* Algorithm. Game Theory, Optimal Decisions in Games, Game playing minimax algorithm, Alpha-Beta Pruning.	8
4.	**Knowledge Representation and Reasoning** Logical systems, Knowledge based systems, Propositional Logic Constraints, Predicate Logic, First Order Logic, Inference in First Order Logic, Ontological Representations and applications. Foundation of reasoning and sample application, Reasoning with defaults, Reasoning about knowledge.	8
	Total	**30**

Text Books:

1. Russell, S. and Norvig, P. 2015. Artificial Intelligence - A Modern Approach, 3rd edition, Prentice Hall
2. Elaine Rich and Kerin Knight, Artificial Intelligence, 3rd Edition, McGraw Hill.

Reference Books:

1. George F Luger, Artificial Intelligence: Structures and Strategies for Complex Problem Solving, Pearson Edu., 4th Edition.
2. Poole, D. and Mackworth, A. 2010. Artificial Intelligence: Foundations of Computational Agents, Cambridge University Press.
3. Padhy, N.P. 2009. Artificial Intelligence and Intelligent Systems, Oxford University Press.
4. Eugene, Charniak, Drew McDermott, Introduction to artificial intelligence, Addison Wesley.

MOOC Courses:

1. NPTEL Artificial Intelligence : Search Methods For Problem solving https://onlinecourses.nptel.ac.in/noc22_cs67/preview

Program:	**B. Tech. I.T.**				Semester: **V**		
Course : **Artificial Intelligence Lab**					Code : **BIT5505**		
Teaching Scheme				**Evaluation Scheme**			
Lecture	**Practical**	**Tutorial**	**Credit**	**TW**	**PR**	**OR**	**Total**
-	2	-	1	50	-	-	50

Prior Knowledge of

- C/ C++/ Java/ Python Programming.
- Fundamentals of Data Structures.

are essential

Course Objectives:

1. To apply the concepts of artificial intelligence
2. To learn and apply various search strategies for AI
3. To formalize and use constraints in search problems

Course Outcomes:

After learning the course, the students will be able to:

1. **Apply informed /uninformed search algorithm.**
2. **Apply heuristic and greedy approaches in problem solving.**
3. **Develop** a game using AI algorithms

List of Assignments

All assignments are compulsory

Sr. No.	**Description**
1.	Use an undirected graph and develop a recursive algorithm for searching all the vertices of a graph or tree data structure (a) Implement depth first search algorithm (b) Implement breadth first search algorithm
2.	Implement A star algorithm for game search problems.
3.	Implement greedy search algorithm for any two of the following application: I. Selection Sort II. Minimum Spanning Tree III. Single-Source Shortest Path Problem IV. Job Scheduling Problem V. Prim's Minimal Spanning Tree Algorithm VI. Kruskal's Minimum Spanning Tree Algorithm VII. Dijkstra's Minimal Spanning Tree Algorithm
4.	Implementation of games (any one): 8 puzzle, Tic-Tac-Toe, tower of Hanoi, water jug problems

Text Books:

1. Russell, S. and Norvig, P. 2015. Artificial Intelligence - A Modern Approach, 3rd edition, Prentice Hall
2. Elaine Rich and Kerin Knight, Artificial Intelligence, 3rd Edition, McGraw Hill.

Reference Books:

1. George F Luger, Artificial Intelligence: Structures and Strategies for Complex Problem Solving, Pearson Edu., 4th Edition.
2. Poole, D. and Mackworth, A. 2010. Artificial Intelligence: Foundations of Computational Agents, Cambridge University Press.
3. Eugene, Charniak, Drew Mcdermott, Introduction to artificial intelligence, AddisonWesley.
4. Padhy, N.P. 2009. Artificial Intelligence and Intelligent Systems, Oxford UniversityPress.

MOOC Courses:

1. NPTEL Artificial Intelligence : Search Methods For Problem solving https://onlinecourses.nptel.ac.in/noc22_cs67/preview

Program:	**B. Tech I.T.**				Semester : **V**		
Course **: Computer Graphics and Image Processing**					Code : **BIT5503**		
Teaching Scheme				**Evaluation Scheme**			
Lecture	**Practical**	**Tutorial**	**Credit**	**IE**	**MTE**	**ETE**	**Total**
2	-	-	2	20	30	50	100

Prior Knowledge of

- Mathematics fundamentals, data structures.

is essential.

Course Objectives:

1. To learn Computer graphics fundamental knowledge
2. To know how to use image processing techniques
3. To make aware of image transformation techniques

Course Outcomes:

After learning the course, the students will be able to:

1. **Use line and circle drawing algorithms.**
2. **Apply transformation functions and polygon filling algorithms to objects.**
3. **Explain fundamentals of digital image processing.**
4. **Apply transformation and segmentation techniques to images.**

Detailed Syllabus

Unit	**Description**	**Duration (Hrs)**
1.	Basics of Computer graphics and Algorithms:- Video Display devices- Refresh Cathode Ray Tubes, Random Scan Displays and systems, Line drawing algorithms- DDA, Bresenham's algorithm. Circle drawing algorithms- Midpoint Circle generation algorithm, Bresenham's algorithm.	**7**
2.	Filled Area Primitives and transformations: Filled Area Primitives- Scan line polygon filling, Boundary filling and flood filling, Two dimensional transformations, Composite transformations, Matrix representations and homogeneous coordinates.	**7**
3.	Fundamentals of Digital Image Processing: Image as 2D data. Image representation in Gray scale, Binary and Colour images. Fundamental steps in image processing, Sampling and quantization. Spatial and Gray Level Resolution. Basic relationship between pixels.	**8**
4.	Image Transformation and Segmentation : Log transformations, Power-Law transformations, Basics of spatial filtering - Smoothing spatial filterLinear and nonlinear filters, and Sharpening spatial filters-Gradient and Laplacian. Image Segmentation : Thresholding - Basics of Intensity thresholding and Global Thresholding, Region based Approach - Region Growing, Region Splitting and Merging. Edge Detection - Edge Operators- Sobel and Prewitt.	**8**
	Total	**30**

Text Books:

1. Donald Hearn and M. Pauline Baker, Computer Graphics, PHI, 2e, 1996
2. Rafael C. Gonzalez and Richard E. Woods, Digital Image Processing. Pearson, 4e, 2017.

Reference Books:

1. Rafael C. Gonzalez, Digital Image Processing, 3rd edition.
2. M. Sonka, V. Hlavac, and R. Boyle, Image Processing, Analysis, and Machine Vision, Thomson India Edition, 4e, 2017

Program:	**B. Tech I.T.**			Semester : **V**			
Course : Computer Graphics and Image Processing Lab				Code : **BIT5506**			
Teaching Scheme				**Evaluation Scheme**			
Lecture	**Practical**	**Tutorial**	**Credit**	**TW**	**PR**	**OR**	**Total**
-	2	-	1	50	-	-	50

Prior Knowledge of

- Mathematics fundamentals, data structures.

is essential.

Course Objectives:

1. To learn computer graphics fundamental algorithms.
2. To get acquainted with image processing techniques.

Course Outcomes:

After learning the course, the students will be able to:

1. **Implement line and Circle drawing algorithms.**
2. **Apply transformation and color filling algorithms to graphical objects**
3. **Compare image point processing techniques for image enhancement**
4. **Apply segmentation techniques to images**

Detailed Syllabus

Unit	Description
1.	Write a program in C++ to draw line using DDA and a circle using Bresenham's algorithm.
2.	Write a program in C++ to perform scaling of a line.
3.	Write a program in C++ to implement flood filling algorithm.
4.	Instructor can design any 2 assignment based on the fundamental understanding of image processing techniques like image transformation and segmentation.

Reference Books:

1. Rafael C. Gonzalez, Digital Image Processing, 3rd edition.
2. NPTEL Course Material Computer Vision : https://onlinecourses.nptel.ac.in/noc19
3. D. Hearn, M. Baker, "Computer Graphics – C Version", 2nd Edition, Pearson Education, 2002, ISBN81 – 7808 – 794 – 4

Program:	**B. Tech. I.T.**	Semester: **V**
Course :	**Cyber Security**	Code: **BIT5507**

Teaching Scheme				**Evaluation Scheme**			
Lecture	**Practical**	**Tutorial**	**Credit**	**IE**	**MTE**	**ETE**	**Total**
2	-	-	2	20	30	50	**100**

Prior Knowledge of

1. Data Communication and Computer Networks
2. Cryptography

are essential.

Objectives:

1. To learn fundamental concepts of cyber security
2. To learn about different types of threats and cyber-crimes.
3. To understand the basics of cyber forensics, network forensics, Email forensics, web forensics, and crypto currency forensics.
4. To analyze how particular social engineering attacks take advantage of specific features of the Internet and of human nature.

Outcomes:

After learning the course, the students should be able to:

1. **To interpret the fundamentals and need of cyber security**
2. **To classify the types of cyber threats and cyber crimes.**
3. **To apply cyber forensic techniques to identify criminal activities.**
4. **To classify the social engineering methods used in committing the cybercrimes.**

Detailed Syllabus

Unit	**Description**	**Duration (Hrs)**
1.	**Introduction to Cyber Security** Introduction: Introduction to Cyber Security, Need, Importance and challenges in Cyber Security, Cyberspace, Cyber threats, Cyber-warfare, CIA Triad, Cyber Terrorism, Cyber Security of Critical Infrastructure, Cyber security - Organizational Implications	**8**
2	**Cyber Crimes and Hacking** Overview of Cyber-Attacks and Vulnerabilities, Types of Threats – Malware, spyware, Sniffing, Gaining Access, Escalating Privileges, Executing Applications, Hiding Files, Covering Tracks, Worms, Trojans, Viruses, Backdoors. Types of Cyber Crime - cyber stalking, forgery, software piracy, cyber terrorism, phishing, computer vandalism, computer hacking, creating and distributing viruses over the internet, spamming, cross-site scripting, online auction fraud, cyber-squatting, logic bombs, web jacking, internet time thefts, DoS attack, salami attack, data diddling, email spoofing. Types of Hacker Hacking and Cracking, Hacking: Ethical issues, Ethical Hacking.	**8**

3	**Cyber Forensics** Introduction to Cyber Forensics: What are cyber forensics, cyber forensics investigation process, digital evidence, challenges in cyber forensics; Web Attack Forensics: Intrusion forensics, database forensics, preventive forensics; Anti- forensics practices, Anti-forensics detection techniques, Network forensics analysis tools; Malware Forensics: Malware types, Malware Analysis, Tools for analysis; Email Forensics: e-mail Protocols, e-mail crimes, email forensics; Bitcoin Forensics: crypto currency, crimes related to bitcoin;	**7**
4	**Social Engineering** Introduction of social engineering and cyber security, social engineering conceptual evolution, defining social engineering-categories, Phases, attack spiral model, Attack Vendors-social approach, socio-technical approach. Advanced social engineering attacks, Phishing attacks, Insider attacks, Identity Theft, Preventing Insider Threats, Social Engineering Targets, and Defense Strategies. Case Study: Phishing and Identity Theft Online Scams	**7**
	Total	**30**

Text Books:

1. Cyber Security: Understanding Cyber Crimes, Computer Forensics and Legal Perspectives, Nina Godbole and Sunil Belapure, Wiley INDIA. ISBN 978-81-265-2179-1
2. 2. Practical Cyber Forensics an Incident-Based Approach to Forensic Investigations, Niranjan Reddy, Apress, ISBN-13: 978-1-4842-4459-3

Reference Books:

1. William Stallings, Computer Security: Principles and Practices, Pearson 6th Ed, ISBN: 978-0- 13- 335469-0
2. Bernard Menezes, Network Security and Cryptography, Cengage Learning, ISBN-978-81-315-1349- 1
3. Dr. V.K. Pachghare, Cryptography and Information security, PHI, Second edition, ISBN-978- 81- 203-5082-3

Program: **B. Tech I.T.**					Semester : **V**		
Course : **Cyber Security Lab**					Code :**BIT5510**		
Teaching Scheme				**Evaluation Scheme**			
Lecture	**Practical**	**Tutorial**	**Credit**	**TW**	**OR**	**PR**	**Total**
-	2	-	1	50	-	-	50

Prerequisites:
Data Communication, Computer Networks

Course Objectives:

1. To learn fundamental concepts of cyber security
2. To identify and find the vulnerabilities of web based applications and to protect those applications from attacks
3. To learn how vulnerability assessment can be carried out by means of automatic tools

Outcomes:
After learning the course, the students should be able to:

1. **Configure and demonstrate the firewall used to provide network security**
2. **Analyze various security threats and vulnerabilities in any web browser / Website.**
3. **Demonstrate the data transfer in client server communication using any network scanner tool.(Wireshark)**

Detailed Syllabus

Unit	Description
1	Study of the features of firewall in providing network security and to set Firewall Security in windows.
2	Study of the features of firewall in providing network security and to set Firewall Security in windows.
3	Steps to ensure Security of any one web browser (Mozilla Firefox/Google Chrome)
4	Study of different types of vulnerabilities for hacking a websites / Web Applications.
5	Analysis the Security Vulnerabilities of E-commerce services
6	Analysis the security vulnerabilities of E-Mail Application.
7	Installation of Wire shark, tcp dump and observe data transferred in client server communication

Text Books:

1. Cyber Security: Understanding Cyber Crimes, Computer Forensics and Legal Perspectives, Nina Godbole and Sunil Belapure, Wiley INDIA. ISBN 978-81-265-2179-1
2. 2. Practical Cyber Forensics an Incident-Based Approach to Forensic Investigations, Niranjan Reddy, Apress, ISBN-13: 978-1-4842-4459-3

Reference Books:

1. William Stallings, Computer Security: Principles and Practices, Pearson 6th Ed, ISBN: 978-0- 13- 335469-0
2. Bernard Menezes, Network Security and Cryptography, Cengage Learning, ISBN-978-81- 315-1349- 1
3. Dr. V.K. Pachghare, Cryptography and Information security, PHI, Second edition, ISBN- 978- 81- 203-5082-3

Program:	**B. Tech I.T.**			Semester : **V**			
Course : **Foundations of Data Science**				Code : **BIT5508**			
Teaching Scheme				**Evaluation Scheme**			
Lecture	**Practical**	**Tutorial**	**Credit**	**IE**	**MTE**	**ETE**	**Total**
2	-	-	2	20	30	50	100

Prior knowledge of

- Linear Algebra

is essesntial.

Course Objectives:

1. To learn the basics and process of data science
2. To study mathematical foundation for data science
3. To study data pre-processing techniques
4. To study data science in business

Course Outcomes:

After learning the course, the students will be able to:

1. Interpret the process of data science.
2. Apply statistics and probability methods to solve real-life problems.
3. Make use of pre-processing techniques for real-life data
4. Examine data science in business applications.

Detailed Syllabus

Unit	Description	Duration (Hrs)
1.	**Introduction to Data Science** Defining data science and big data, Recognizing the different types of data, Machine Learning Definition and Relation with Data Science, Data Science Process: Data collection; Data preparation; Training a model on the data; Evaluation of the model performance; Data visualization techniques and inferences.	7
2.	**Mathematical foundation for Data Science** Statistics: Describing a Single Set of Data, Correlation, Simpson's Paradox, Some Other Co relational Caveats, Correlation and Causation Probability: Dependence and Independence, Conditional Probability, Bayes's Theorem, Random Variables, Continuous Distributions, The Normal Distribution, The Central Limit Theorem.	8
3.	**Data Pre-Processing** Understanding the Data, Dealing with Missing Values, Data Formatting, Data Normalization, Data Binning, Importing and Exporting data in Python, Turning categorical variables into quantitative variables in Python, Accessing Databases with Python.	8
4.	**Data Science in Business** How Data Science is Saving lives?, How Should Companies Get Started in Data Science?, Applications of Data Science, How Can Someone Become a Data Scientist?, Recruiting for Data Science, Careers in Data Science.	7
	Total	**30**

Text Books:

1. Data Mining: Concepts and Techniques, 3rd Edition. Jiawei Han, Micheline Kamber, Jian Pei.
2. Data Science from Scratch: Joel Grus, O'Reilly Media Inc., ISBN: 9781491901427

Reference Books:

1. Coursera Course on "What is Data Science?" offered by IBM. Available at https://www.coursera.org/learn/what-is-datascience?specialization=ibm-data-science
2. Getting Started with Business Analytics: Insightful Decision-Making, David Roi Hardoon, Galit Shmueli, CRC Press

Program:	B. Tech. I.T.			Semester: V			
Course : **Foundations of Data Science Lab**				Code : **BIT5511**			
Teaching Scheme				**Evaluation Scheme**			
Lecture	**Practical**	**Tutorial**	**Credit**	**TW**	**PR**	**OR**	**Total**
-	2	-	1	50	-	-	50

Prior knowledge of

- Linear Algebra, Basic programming skills

is essential.

Course Objectives:

1. To study mathematical foundation for data science
2. To study data pre-processing techniques
3. To study data science in business

Course Outcomes:

After learning the course, the students will be able to:

1. **Examine the data science processes to the real-life applications.**
2. **Choose** pre-processing techniques to data and Visualize the data using python libraries.
3. **Compile** report on data science business application.

Suggested list of Assignments

Expt.	Description
1.	READING AND WRITING DIFFERENT TYPES OF DATASETS: Reading different types of data sets such as .txt, .csv, .xml from Web and disk and writing in file in specific disk location. Get familiar with dataset.
2.	DESCRIPTIVE STATISTICS: Write a python script to find basic descriptive statistics using summary, quartile function, etc on iris datasets.
3.	CORRELATION AND COVARIANCE: a. Find the correlation matrix on the iris dataset. b. Plot the correlation plot on the dataset and visualize giving an overview of relationships among data on iris dataset.
4.	Implement normal distribution in python and visualize it for Mean =100, Standard_deviation = 4, dataset_size = 100000.
5.	DATA PREPROCESSING: Perform the following operations using Python on the Air quality data sets a. Data cleaning b. Data transformation
6.	DATA PREPROCESSING: Perform the following operations using Python on the heart diseases data sets a. Data cleaning b. Error-correcting
7.	Prepare a report on any one Data Science Business Application.

Text Books:

1. Data Science from Scratch: Joel Grus, O'Reilly Media Inc., ISBN: 9781491901427
2. Python for Data Analysis by Wes McKinney published by O' Reilly media, ISBN : 978-1-449-31979-3. 4. Python

Reference Books:

1. Coursera Course on "What is Data Science?" offered by IBM. Available at https://www.coursera.org/professional-certificates/ibm-data-science
2. Getting Started with Business Analytics: Insightful Decision-Making, David Roi Hardoon, GalitShmueli, CRC Press
3. Data Science Handbook by Jake VanderPlas https://tanthiamhuat.files.wordpress.com/2018/04/pythondatasciencehandbook.pdf
4. Online References for data set http://archive.ics.uci.edu/ml/ https://www.kaggle.com

Program: **B. Tech. I.T.**				Semester: **V**			
Course : **Software Design Patterns**				Code : **BIT5509**			
Teaching Scheme				**Evaluation Scheme**			
Lecture	**Practical**	**Tutorial**	**Credit**	**IE**	**MTE**	**ETE**	**Total**
2	-	-	2	20	30	50	100

Prior knowledge of

- Object Oriented Programming with java

is essential

Course Objectives:

1. To identify the importance of design Pattern.
2. To classify different design patterns and their intents.
3. To design Software solutions using appropriate design patterns.
4. To build the programming skills for implementation of design pattern.

Course Outcomes:

After learning the course, the students will be able to:

1. Identify appropriate solutions to recurring programming problems with help of design patterns.
2. Develop design solutions using creational patterns.
3. Apply structural patterns to solve design problems. .
4. Construct design solutions by using behavioral patterns.

Detailed Syllabus

Unit	Description	Duration
1	**Introduction to Design Pattern** Introduction: What is a design Pattern? Design patterns in smalltalk MVC, Describing Design patterns, the catalog of design patterns, organizing the catalog, How design patterns solve design problems, how to select a design pattern, how to use a design pattern.	**8**
2	**Study of Creational Patterns** Creational patterns:object creational, abstract factory, builder, factory method, prototype, singleton.	**8**
3	**Study of Structural Patterns** Structural patterns: object structural, adapter, bridge, composite, decorator, façade, flyweight, proxy.	**7**
4	**Study of Behavioral Patterns** Behavioral patterns: Object Behavioral, chain of responsibility, command, interpreter, iterator, mediator, memento, observer, state, strategy, template method, and visitor.	**7**
	Total	**30**

Text Books:

1. Erich Gamma, Richard Helm, Ralph Johnson, John Vlissides, Design Patterns: Elements of Reusable Object Oriented Software, ISBN-10: 0-201-63361-2, ISBN-13: 078-5342633610, Pearson 1st edition.
2. Allan Shalloway, James Trott, Design Patterns Explained- A New Perspective on Object Oriented Design, Addison Wesley 2nd Edition, ISBN-10: 0321247140, ISBN-13: 978-0321247148

Reference Books:

1. Eric Freeman and Elisabeth Freeman, Head First Design Patterns, O"Reilly 1st Edition,

ISBN-10: 8173664668, ISBN-13: 978-8173664663
2. Stephen Stelting and Olav Maassen , Applied Java Patterns, Prentice Hall 1st Edition, ISBN-10: 0130935387, ISBN-13: 978-0130935380

Program:	**B. Tech I.T.**			Semester: **V**			
Course : **Software Design Pattern Lab**				Code : **BIT5512**			
Teaching Scheme				**Evaluation Scheme**			
Lecture	**Practical**	**Tutorial**	**Credit**	**TW**	**PR**	**OR**	**Total**
-	2	-	1	50	-	-	50

Prior knowledge of

- Object Oriented Modeling Design
- Object Oriented Programming using java.

are essential.

Course Objectives:

1. To design Software solutions using appropriate design patterns.
2. To build the programming skills for implementation of design patterns.

Course Outcomes:

After learning the course, the students will be able to:

1. Identify usage of different design patterns.
2. **Apply creational patterns to solve the design problems**
3. Apply structural patterns to solve design problems.
4. **Solve the design problems using behavioral patterns.**

Suggested List of Assignments

Unit	Description
1.	Students shall submit at-least four template patterns drawn in (any) modeling language.
2.	Draw and implement different types of structural patterns (minimum3).
3.	Design and implement pattern templates for behavioral patterns (minimum 2)
4.	Create architectural patterns for various applications (minimum 1)
5.	Implement abstract factory pattern for at least one case scenario.
6.	Draw and implement adapter design pattern for multimedia applications.

Text Books:

1. Erich Gamma, Richard Helm, Ralph Johnson, John Vlissides, Design Patterns: Elements of Reusable Object Oriented Software, ISBN-10: 0-201-63361-2, ISBN-13: 078-5342633610, Pearson 1st edition.
2. Allan Shalloway, James Trott, Design Patterns Explained- A New Perspective on Object Oriented Design, Addison Wesley 2nd Edition, ISBN-10: 0321247140, ISBN-13: 978-0321247148 Teaching Scheme:

Reference Books:

1. Eric Freeman and Elisabeth Freeman, Head First Design Patterns, O"Reilly 1st Edition, ISBN-10: 8173664668, ISBN-13: 978-8173664663
2. · Stephen Stelting and Olav Maassen , Applied Java Patterns, Prentice Hall 1st Edition, ISBN-10: 0130935387, ISBN-13: 978-0130935380

Program:	B. Tech. (Civil Engineering)			Semester:	V		
Course:	Total Quality Management (OEC-2)			Code:	BCI5602A		
Teaching Scheme				Evaluation Scheme			
Lecture	Practical	Tutorial	Credit	IE	MTE	ETE	Total
3	-	-	3	20	30	50	100

Prior Knowledge of

- Quality and need of Quality in any work

is essential.

Course Objectives: After Completing this course, student will have adequate background :

1. To understand the importance of Quality
2. To understand the need of Total Quality Management & it's tools.
3. To understand role of ISO in quality management

Course Outcomes:

After learning the course, the students should be able to:

1. Articulate quality and quality ideas as presented by many gurus and philosophers after learning.
2. Apply different quality control tools.
3. Apply ISO concepts and the cost of quality to quality assurance.
4. Apply various methods of TQM.

Detailed Syllabus

Unit	Description	Duration (Hrs)
1	**Unit I: Quality in Construction** a) Quality – Various definitions and interpretation. Importance of quality on a project in the context of global challenges, Factors affecting quality, Reasons for poor quality & measures to overcome, Contribution of various Quality Gurus(Juran, Deming, Crossby, Ishikawa). b) Evolution of TQM- QC, TQC, QA, QMS, TQM.	**07**
2	**Unit II: TQM & Six Sigma** a) TQM – Necessity, advantages , Quality Function Deployment(QFD). b) Six sigma – Importance, levels.	**08**
3	**Unit III: Cost of Quality and ISO** a) Categories of cost of Quality. b) Study of ISO 9001 principles., Quality manual – Importance, contents, documentation, Corrective and Preventive actions, Conformity and NC reports	**08**
4	**Unit IV: Techniques in TQM Implementation** a) Benchmarking in TQM, Kaizen in TQM, b) '5-S' techniques, Zero Defects.	**08**
5	**Unit V: Applications of Quality Control tools through Case study** a) Quality Circle Concept and applications through Quality Circle Formation b) Implementation of 7 QC tools through case study	**07**
6	**Unit VI: Failure Mode Effect Analysis** a) FMEA problems b) Decision Tree problems	**07**
	Total	**45**

Text Books:

1. Total Quality Management-- Dr. GunmalaSuri and Dr. Puja Chhabra Sharma—Biztantra.
2. Quality Control and Total Quality Management by P.L.Jain- Tata McGraw Hill Publ.
3. Total Quality Management - Dr. S.Rajaram and Dr. M. Sivakumar—Biztantra.
4. Total Engineering Quality Management – Sunil Sharma – Macmillan India Ltd.

Program:	B. Tech. (Civil Engineering)			Semester:	V		
Course:	Intelligent Transport System (OEC-2)			Code:	BCI5602B		
Teaching Scheme				Evaluation Scheme			
Lecture	Practical	Tutorial	Credit	IE	MTE	ETE	Total
3	-	-	3	20	30	50	100

Prior Knowledge:

- Fundamentals of Transportation and Traffic engineering
- Transportation Planning and Designing

Course Objectives: After Completing this course, student will have adequate background :

1. To identify all the aspects related to intelligent transportation system and its application
2. To use the fundamental concepts of transportation system management.
3. To nurture their necessary skills to develop their career in transportation industry

Course Outcomes: After learning the course, the students will be able to:

1. Describe the fundamentals and principles of Intelligent transport system and its background
2. Demonstrate the knowledge of telecommunication practices in Intelligent transport system
3. Distinguish the physical architecture and hardware composition in the implementation of Intelligent transport system
4. Implement the Intelligent transport system concepts in various transportation domains
5. Explain the user needs and services in the context of implementing effective strategies
6. Identify and evaluate the practical constraints in the implementation of the technology and the grass root level.

Detailed Syllabus

Unit	Description	Duration (Hours)
1	**Introduction:** Introduction to Intelligent Transportation Systems (ITS) – Definition of ITS and Identification of ITS Objectives, Historical Background, Benefits of ITS - ITS Data collection techniques – Detectors, Automatic Vehicle Location (AVL), Automatic Vehicle Identification (AVI), Geographic Information Systems (GIS), video data collection	07
2	**Telecommunications in Intelligent Transport System:** Telecommunications in ITS – Importance of telecommunications in the ITS system, Information Management, Traffic Management Centres (TMC). Vehicle – Roadside communication – Vehicle Positioning System	08
3	**IIntelligent Transport System architecture and Hardware:** Architecture – ITS Architecture Framework – Hardware Sensors – Vehicle Detection – Techniques – Dynamic Message Sign – GPRS – GPS – Toll Collection	08
4	**Intelligent Transport System Functional Area:** Advanced Traffic Management Systems (ATMS), Advanced Traveler Information Systems (ATIS), Commercial Vehicle Operations (CVO), Advanced Vehicle Control Systems (AVCS), Advanced Public Transportation Systems (APTS), Advanced Rural Transportation	07

	Systems (ARTS).	
5	**Intelligent Transport System User Needs and Services:** Travel and Traffic management, Public Transportation Management, Electronic Payment, Commercial Vehicle Operations, Emergency Management, Advanced Vehicle safety systems, Information Management.	**08**
6	**Case Studies:** Automated Highway Systems - Vehicles in Platoons – Integration of Automated Highway Systems. ITS Programs in the World – Overview of ITS implementations in developed countries, ITS in developing countries	**07**
	Total	**45**

Text Books:

1. Ghosh, S., Lee, T.S.,"Intelligent Transportation Systems: New Principles and Architectures", CRC Press, 2000.
2. Mashrur A. Chowdhury, and Adel Sadek, "Fundamentals of Intelligent Transportation Systems Planning", Artech House, Inc., 2003.

Reference Books:

1. Intelligent Transport Systems, Intelligent Transportation Primer, Washington, US, 2001.
2. Henry F.Korth, and Abraham Siberschatz, Data Base System Concepts, McGraw Hill, 1992.
3. Turban E.,"Decision Support and Export Systems Management Support Systems", Maxwell Macmillan, 1998.
4. Sitausu S. Mittra, "Decision Support Systems – Tools and Techniques", John Wiley, New York, 1986.
5. Cycle W.Halsapple and Andrew B.Winston, "Decision Support Systems – Theory and Application", Springer Verlog, New York, 1987.

Standard Codes:

1. ITS Hand Book 2000: Recommendations for World Road Association (PIARC) by Kan Paul Chen, John Miles.
2. Automotive Industry Standard by MoRTH, 2017 https://morth.nic.in/sites/default/files/Finalized_Draft_AIS_140_regarding_Intelligent_Transportation_Systems_.pdf

E-Resources:

1. **https://nptel.ac.in/courses/105105204**
2. **https://archive.nptel.ac.in/courses/105/101/105101008/**
3. **https://www.civil.iitb.ac.in/tvm/nptel/591_ITS_1/web/web.html**
4. **https://ocw.mit.edu/courses/1-212j-an-introduction-to-intelligent-transportation-systems-spring-2005/pages/lecture-notes/**

Program:	**B. Tech. (E&TC)**			Semester: **V**			
Course : **Smart City: An Electronic Perspective**				Code : **BET5601**			
Teaching Scheme				**Evaluation Scheme**			
Lecture	**Practical**	**Tutorial**	**Credit**	**IE**	**MTE**	**ETE**	**Total**
3	-	-	3	20	30	50	100

Prior Knowledge of

- Basic Electronics
- Basics of electronic communications, is essential.

is essential.

Course Objectives:

1. To explore the need and basics of smart city and fundamental concepts of IoT.
2. To comprehend the roles of sensors and protocols in the IoT
3. To explain different IoT frameworks and networking protocols.

Course Outcomes:

After learning the course, the students will be able to:

1. Understand the conceptual basis of a smart city.
2. Analyze physical and logical designs for IoT systems with communication protocols.
3. Analyze the different wireless communication protocols used in sensor networks
4. Compare the features, addressing, packet fragmentation, operation, and security of the different wireless protocols.
5. Describe distributed intelligence and central planning in a smart city.
6. Interpret the role of ICTs in the development of smart cities using IoT applications.

Detailed Syllabus

Unit	Description	Duration (Hrs)
1.	**Necessity of SMART CITY:** The Smart City Philosophy, Development of Asian Cities, Megacities of India: Current Challenges, The India Story of Smart Cities, Conceptual Basis of a Smart City, Global Smart City Programs, Recommendations for Smart City Framework	**7**
2.	**Fundamentals of IOT:** History of IoT, Introduction,definition and characteristics of IoT, architecture of IoT, Physical & logical design of IoT, Enabling technologies in IoT, Identifiers in IoT, M2M communication verses IoT.	**8**
3.	**Sensor Networks:** Definition, types of sensors & actuators, examples & working, RFID Principles and components, Wi-Fi, Bluetooth, etc. wireless sensor network: History, sensor node, networking nodes, WSN versus IoT.	**7**
4.	**Wireless Protocols for Smart Cities:** IPv6overLow-Power Wireless Personal Area Network: Features, Addressing, Packet fragmentation, Operation, Security. ZigBee: Architecture Objectives, Wireless Networking Basics, Wireless Networking Assumptions, Bluetooth Low Energy, IoT data protocols: MQTT Protocol. COAP Protocol, AMQ Protocol.	**8**

5.	**Distributed Intelligence and Central Planning:** On the Interplay between Humans and Smart Devices, Intelligence-artificial Intelligence (Machine Intelligence), Information Dynamics, Synergetic, Information Dynamic and Algometry in Smart Cities.	**7**
6.	**Applications of IoT in smart city: The Role of ICTs,** Applications in smart city & their distinctive advantages -smart environment, smart street light and smart water & waste management. Smart transportation and hospitality, Role and scope of IOT in present and the future marketplace, Industrial IoT.	**8**
	Total	**45**

Text Books:

1. Surjeet Dalal ,Vivek Jaglan "Green Internet of Things for Smart Cities: Concepts, Implications, and Challenges", CRC Press; 1st edition, 2021"
2. Sudip Misra, Anandarup Mukherjee, Arijit Roy, "Introduction to IoT" Cambridge University Press 2021.
3. Hakima Chaouchi, "The Internet of Things Connecting Objects to the Web" ISBN:978-1-84821- 140-7, Wiley Publications 2010
4. Olivier Hersent, David Boswarthick, and Omar Elloumi, "The Internet of Things: Key Applications and Protocols", Wiley Publications 2012

Reference Books:

1. Vincenzo Piuri, Rabindra Nath Shaw, "AI and IoT for Smart City Applications", Springer; 1st ed. 2022 edition
2. Alfredo Barton, Raymond Manning, "Smart Cities:Technologies, Challenges and Future Prospects" Nova Science Pub Inc 2017
3. Ibrahim El Dimeery, Moustafa Baraka, Syed M. Ahmed, "Design and Construction of Smart Cities" Amin Akhnoukh, Springer; 1st ed. 2021 edition
4. Ricardo Armentano, Robin Singh Bhadoria , Parag Chatterjee , "The Internet of Things: Foundation for Smart Cities", eHealth, and Ubiquitous Computing" Chapman and Hall/CRC; 1st edition 2017
5. Daniel Minoli, "Building the Internet of Things with IPv6 and MIPv6: The Evolving World of M2M Communications", ISBN:978-1-118-47347-4,Willy Publications 2013.
6. Pethuru Raj and Anupama C. Raman, "The Internet of Things: Enabling Technologies, Platforms, and Use Cases", CRC Press 2017.

NPTEL Online Courses / MOOCs

1. NPTELcourse on Fundamentals of Electric vehicles: Technology & Economics, IIT Madras, Prof. Ashok Jhunjhunwala Prof. Prabhjot Kaur Prof. Kaushal Kumar Jha Prof. L Kannan
   https://nptel.ac.in/courses/108106170
2. NPTEL course onElectric Vehicles - Part 1, IIT Delhi, Prof. Amit Jain https://nptel.ac.in/courses/108102121
3. NPTEL Archives on Electricvehicles and renewable energy, IIT Madras https://archive.nptel.ac.in/courses/108/106/108106182/
4. Electric Vehicles Comprehensive Course, Udemy.com https://www.udemy.com/course/electric-vehicles-comprehensive-course/

Program:	**B. Tech. (E&TC)**				Semester: **VI**		
Course : **Modeling and Simulation with MATLAB**					Code : **BET5602**		
Teaching Scheme				**Evaluation Scheme**			
Lecture	**Practical**	**Tutorial**	**Credit**	**IE**	**MTE**	**ETE**	**Total**
3	-	-	3	20	30	50	100

Prior Knowledge of

- Engineering Mathematics
- Basics of OOPs is essential

is essential.

Course Objectives:

1. To apply basic modeling techniques and tools to develop Simulink block diagrams.
2. To Model and simulate continues and discrete systems in Simulink
3. To get acquainted with neural networks and its modeling.
4. To get acquainted with fuzzy set and its modeling

Course Outcomes:

After learning the course, the students will be able to:

1. Understand the basic tools used in Matlab programming.
2. Understand the techniques of modeling in the context of hierarchy ofknowledge about a system and develop the capability to apply the same to study systems.
3. Understand different types of simulation techniques
4. Understand different optimization methods.
5. Simulate the models for the purpose of optimum control by using software.
6. Design and simulate the Fuzzy controllers to solve engineering problems.

Detailed Syllabus

Unit	Description	Duration (Hrs)
1.	**Introduction to Matlab:** Programming environment, input and output variables, State variables, basic syntax; Deterministic linear model, Array mathematics in Matlab, Plotting, Static andDynamic systems; Hierarchy of knowledge about a system and Modeling Strategy.	**6**
2.	**Physical Modeling:** Dimensions analysis, Dimensionless grouping of input and output variables of find empirical relations, similarity criteria and their application to physical models. Stochastic modeling.	**7**
3.	**Modeling of System with Known Structure:** Review of conservation laws and the governingequation for heat, mass and momentum transfer, Deterministic model: distributed parameter models in terms of partial identification and their solutions and lumpedparameter models in terms of differential and difference equations, state space model,transfer functions block diagram and sub systems, stability of transfer functions, modelingfor control.	**8**

4.	**Optimizations and Design of Systems:** Summary of gradient based techniques : Nontraditional Optimizations techniques, genetic Algorithm (GA)- coding, GA operations, elitism, Application using MATLAB: Simulated Annealing, Introduction to GUI,GUI Programming.	**7**
5.	**Introduction to Neural Network Modeling:** Basics of Neural Network, Neural Network Modeling of Systems only with Input-output Database: Neurons, architecture of neural networks, knowledge representation, learning algorithm. Multilayer feed forward network and its back propagation learning algorithm, Application to complex engineering systems and strategy for optimum output..	**9**
6.	**Modeling Based on Expert Knowledge:** Fuzzy sets, Membership functions, Fuzzy Inference systems, Expert Knowledge and Fuzzy Models, Design of Fuzzy Controllers, Simulation of Engineering Systems: Monte-Carlo simulation, Simulation of continuous and discrete processes with suitable examples from engineering problems.	**8**
	Total	**45**

Text Books:

5. Zeigler B.P. Praehofer. H. and Kim I.G. "Theory of modeling and simulation", 2 nd Edition. Academic press 2000"
6. Ogata K “Modern control Engineering" 3 rd edition. Prentice hall of India 2001
7. Jang J.S.R. sun C.T and MizutaniE,, "Neuro-Fuzzy and soft Computing ", 3 rd edition, Prentice hall of India 2002
8. Shannon, R. E., “System Simulation: the Art and Science”, Prentice Hall Inc. 1990
9. Pratab.R " Getting started with MATLAB" Oxford university Press 2009

Reference Books:

1. Steven I Gordon. Brian Guilfoos.“Introduction to modeling and simulation using MATLAB & Python” CRC press
2. Dr.Shailendra Jain.” Modeling and simulation using MATLAB-Simulink “,2 ndEdition,Wiley

Online course link:https://in.mathworks.com/learn/training/simulink-fundamentals.html

Program:	**B. Tech. (All Programs)**			Semester :	**V**		
Course :	**Statistical Data Analysis Using R**			Code :	**BAS5607**		
Teaching Scheme				**Evaluation Scheme**			
Lecture	**Practical**	**Tutorial**	**Credit**	**IE**	**MTE**	**ETE**	**Total**
3	-	-	3	20	30	50	100

Prior Knowledge of:

1. Descriptive Statistics
2. Inferential Statistics
3. Probability

are essential.

Course Objectives:

1. This course aims at enabling the students to learn data collection, visualization, and preprocessing techniques for data science.

Course Outcomes:

After learning the course, the students will be able to:

1. **Understand** the data properties and **Identify** the R packages related to data science.
2. **Make use of** data preprocessing methods and generate quality data for analysis.
3. **Apply** different data visualization techniques to understand the data.
4. **Analyze** the data using analytical methods for regression for numerical data using the R.
5. **Develop** a model for Prediction and Decision Making for a data set along with some of their characteristics, strengths, limitations, and applications.
6. **Construct** the hypothesis for the data and test it for data set in R.

Detailed Syllabus

Unit	Description	Duration (Hrs)
1	**Introduction to Data Analysis and R Software Fundamentals** Understanding the Data, R Packages for Data Science, Importing and Exporting Data in R Software, Getting Started: Analyzing Data in R Software, Accessing Databases with R Software.	**7**
2	**Data Wrangling** Pre-processing Data in R Software, Dealing with Missing Values in R Software, Data Formatting in R Software, Data Normalization in R Software, Binning in R Software, Turning categorical variables into quantitative variables in R Software.	**8**
3	**Data Visualization in R Software** Histogram, Bar/ Line Chart, Box Plot (including group-by option), Scatter Plot (including 3D and other features), Mosaic Plot, Heat Map, Correlogram (GUIs)	**8**
4	**Statistical Data Analysis:** Probability, Sampling & Sampling Distributions **Exploratory Data Analysis:** Central & Descriptive Statistics, Hypothesis Testing	**7**
5	**Model Development** Linear regression and multiple linear regression, model evaluation using visualization, prediction and decision making	**8**

6	**Data Analysis Using R** use a dataset from kaggle (Link is given below). Identify the problem statement for the given data and by applying data analysis techniques analyze the data. Draw inferences from the data. https://www.kaggle.com/code/cvaisnor/heart-2020/data https://www.kaggle.com/code/kailash068/crop-recommendation/data https://www.kaggle.com/datasets/debajyotipodder/co2-emission-by-vehicles https://www.kaggle.com/datasets/csafrit2/higher-education-students-performance-evaluation	**7**
	Total	**45**

Reference Books:

1. Montgomery and Runger, "Applied Statistics and Probability for Engineers", Wiley, India, 6 Edition, ISBN: 9788126562947.
2. R. Johnson, "Probability and Statistics for Engineers", Prentice India Ltd, 8 Edition, ISBN 13:978-8120342132.
3. S.P.Gupta, "Statistical Methods", Papperbook publication, 43 edition, ISBN: 9788180549892, 8180549895.
4. Victor A. Bloomfield, "Using R for Numerical Analysis in Science and Engineering", CRC Press, First Edition, ISBN: 9781315360492

e-sources:

NPTEL Course lectures links:

https://www.youtube.com/watch?v=VVYLpmKRfQ8&list=PL6C92B335BD4238AB (Probability)

https://nptel.ac.in/courses/111104100 (Introduction to R software)

https://www.youtube.com/watch?v=WbKiJe5OkUU&list=PLFW6lRTa1g83jjpIOte7RuEYCwOJa-6Gz (Descriptive statistics using R software)

Program:	**B. Tech. (Mechanical)**					Semester: **V**	
Course:	**Industry 4.0 (Open Elective-II)**					Code**: BME5602A**	
Teaching Scheme				**Evaluation Scheme**			
Lecture	**Practical**	**Tutorial**	**Credit**	**IE**	**MTE**	**ETE**	**Total**
3	**--**	**-**	**3**	**20**	**30**	**50**	**100**

Prior Knowledge of

1. Basic programming skills
2. Mathematical skills

is essential.

Course Objectives:

1. The concept of smart factories for future, especially the various technical pillars of the smart manufacturing.
2. The role and importance of each technical pillar involved within smart manufacturing.
3. The applications and scope for technological pillars involved in smart manufacturing.

Course Outcomes:

After learning this course, the students will be able to:

1. Apply the knowledge of PLC language for designing a PLC system for relevant application
2. Understand the key concepts and describe the technological pillars of Industry 4.0
3. Understand the role of cloud computing and how cloud computing is applied to protect cyber-physical systems in Industry 4.0
4. Apply the knowledge of sensors and robots for designing a system
5. Understand the role of simulation techniques and how these software tools used for advanced simulations in Industry 4.0
6. Understand the importance of hardware and software technologies used in AR and VR

Detailed Syllabus

Unit	Description	Duration (Hrs)
1.	**Introduction to Industrial Revolutions** History of industrial revolution, Industry 3.0: Automation and Mechanization, Types of automation, features of hard and soft automation, classification of production system, adaptive control, overview of terminologies like CAD, CAM, CAE, CAPP etc., Introduction to PLC, framework, and design of PLC system.	**9**
2.	**Introduction to Industry 4.0:** Introduction to industry 4.0, need for Industry 4.0, Framework for Industry 4.0, technological pillars of industrial 4.0, applications, challenges and scope for industry 4.0	**6**
3.	**Technological developments in Industry 4.0:** Introduction to Smart Manufacturing, overview of big data and analytic techniques, cyber security, Internet of things (IoT), Industrial Internet of things (IIoT), Cloud computing, artificial intelligence.	**8**
4.	**Robotics and Sensors:** Introduction to technological components of Robot, classification of sensors and its applications in Manufacturing industry, Role of robots in Industry 4.0, Internet of Robotic Things, Cloud Robotics, and Cognitive Architecture for Cyber-Physical Robotics	**8**
5.	**Simulation, Augmented Reality and Virtual Reality in Industry 4.0:** Introduction to simulation, methods for simulation of physical processes, interconnectivity using simulation softwares, Introduction to Augmented reality and Virtual reality, classification of AR and VR, Difference between AR and VR, Hardware and Software Technology for AR and VR, Applications of AR and VR	**8**

6.	**Ecosystem for Industry 4.0:** Economic aspects, opportunities and skills required for industry 4.0, Effects of 4-M Man, Machine, Material and Method in Industry 4.0, current state of industry 4.0 in India	**6**
	Total	**45**

Text Books:

1. M. P. Groover, Automation, Production Systems, and Computer Integrated Manufacturing, Pearson Publication, 2005
2. Lamb, Frank. Industrial Automation: Hands On, McGraw-Hill Professional, 2013.
3. W. Leong, Nine pillars of technologies for Industry 4.0, IET publishers, 2020
4. A. Gilchrist, Industry 4.0, Apress Publication, 2016

Reference Books:

1. C. Schröder, The Challenges of Industry 4.0 for Small and Medium-sized Enterprises, 2021.
2. Chua C. K., Leong K. F., Lim C. S., Rapid Prototyping, World Scientific, 2012.
3. A. Nayyar and A. Kumar, A Roadmap to Industry 4.0: Smart Production, Sharp Business and Sustainable Development-Springer International Publishing, 2020. https://doi.org/10.1007/978-3-030-14544-6
4. K. Kumar, D. Zindani, J. P. Davim, Industry 4.0: Developments towards the Fourth Industrial Revolution, Springer Singapore, 2019.

E-sources:

- **https://nptel.ac.in/courses/108105063**

Program:	**B. Tech. (Mechanical)**				Semester: **V**		
Course:	**Safety, Health and Environment (Open Elective- II)**				Code: **BME5602B**		
Teaching Scheme				**Evaluation Scheme**			
Lecture	**Practical**	**Tutorial**	**Credit**	**IE**	**MTE**	**ETE**	**Total**
3	**-**	**-**	**3**	**20**	**30**	**50**	**100**

Prior knowledge of: None

Course Objectives:

1. To provide exposure to the students about safety and health provisions.
2. To create awareness on safety standards in residential, commercial and agricultural applications.
3. To help students to learn about Factory act 1948, Environment act 1986 and rules framed under the act.
4. To describe the chemistry of fire & explosion and select & use appropriate fire-fighting and explosion proof equipment,
5. To teach about various safety education and training.
6. Identify ergonomic hazards and recommend appropriate controls.

Course Outcomes:

Upon successful completion of the course, the student will be able to

1. Demonstrate the safety and ethical issues that may arise from industrial processes
2. Identify the safety standards in residential, commercial and agricultural applications
3. List out important legislations related to Health, Safety and Environment
4. Select a suitable method for prevention of fire and explosion.
5. Develop appropriate safety education and training program.
6. Analyze and calculate the level of risk in a job causing stress, fatigue and musculoskeletal disorders and select appropriate work systems.

Detailed Syllabus

Unit	Description	Duration (Hrs)
1	**Concepts and Techniques:** History of safety movement – Evolution of modern safety concept, safety survey, safety inspection, safety sampling. Safety Audits- Non-Conformity Reporting (NCR), audit checklist- identification of unsafe acts of workers and unsafe conditions in the industry.	**7**
2	**Safety in residential, commercial, agricultural, installation & Protective equipment:** Electricity, its Usefulness and Hazards, statutory Provisions, Indian Standards, Effects of Electrical parameters on human body, Safety measures for electric shock, portable electrical apparatus, Electric work in hazardous atmosphere.	**8**
3	**Factories Act – 1948 & Environment Act – 1986:** **Factories Act – 1948:** Statutory authorities – inspecting staff, health, safety, provisions relating to hazardous processes, welfare, working hours, employment of young persons – special provisions – penalties and procedures-Maharashtra Factories Rules 1963. **Environment Act – 1986:** General Powers of the central government, prevention, control and abatement of environmental pollution-The noise pollution (Regulation and control) Rules, 2000-The Batteries (Management and Handling Rules) 2001. Air Act 1981 and Water Act 1974 -audit, penalties and procedures.	**8**
4	**Fires and Explosions and concepts to prevent fires and explosions:** Fire triangle, Distinction between fires and explosions, Flammability characteristics of liquids and vapors, limiting oxygen concentration and inerting, Controlling static electricity, Explosion-proof equipment and instruments, Ventilation.	**8**

5	**Safety Education and Training:** Importance of training-identification of training needs, methods – method of promoting safe practice - motivation – communication - role of government agencies and private consulting agencies in safety training – creating awareness, awards, celebrations, safety posters, safety displays, safety pledge, safety incentive scheme, safety campaign – domestic Safety and Training.	**7**
6	**Ergonomics at Work Place:** Ergonomics Task analysis, Preventing Ergonomic Hazards, Work space Envelops, Visual Ergonomics, Ergonomic Standards, Ergonomic Programs.	**7**
	Total	**45**

Reference books:

1. Philip E. Hagan, John F. Montgomery, James T. O'reilly "Accident Prevention Manual for Business and Industry: Administration and Programs", 14th Edition, National Safety Council, Illinois, Chicago, 2015.
2. Heinrich H.W. "Industrial Accident Prevention" McGraw-Hill Company, New York, 1980. Krishnan N.V. "Safety Management in Industry" Jaico Publishing House, Bombay, 1997.

Program:	**B. Tech (All Programs)**				Semester: **V**		
Course : **Principles of Management**					Code : **BHM5113**		
Teaching Scheme				**Evaluation Scheme**			
Lecture	**Practical**	**Tutorial**	**Credit**	**IE**	**MTE**	**ETE**	**Total**
2	-	-	2	30	-	20	50

Course Objectives:

1. To help the students gain understanding of the functions and responsibilities of managers and common frameworks used in business organizations.
2. To enable the students to analyze and understand the environment of the organization.
3. To provide them tools and techniques to be used in the performance of the managerial job.

Course Outcomes:

After learning the course, the students will be able to:

1. **Understand** the concept of Management and Strategic Management with their implications.
2. **Identify** the importance of human resource in every organization.
3. **Apply** necessary skills to incorporate innovative management in various business sectors.
4. **Analyze** organizational ecology in various business domains.

Detailed Syllabus

Unit	Description	Duration (Hrs)
1.	**Introduction to Management & Strategic Management** Concepts of Management, Definition of Management; Evolution of Management Thought: - Introduction to Scientific Management and Administrative Management, Is Management an Art, Science or Profession, Functions of Management, Levels of Management and Corresponding Skills, Four Roles of Manager, Concept of Strategic Management, Strategic Management Process, Vision and Mission, Contemporary Challenges faced by Management.	**6**
2.	**Organizational Ecology :** Concept & Definition of Organization, Organization and its Characteristics, Types of Business Organizations, Concept of Business Environment, Internal Factors of Business Environment, SWOT Analysis and PESTLE Analysis, Adapting to the Change in Environment, Assessing Success in Organization and Managing Change, Competitive Dynamics with examples. Case studies based on Business Environment	**6**
3.	**Organizational Design and Leadership:** Concept of Organization Design, Process of Organizational Design, Types of Organizational Design : Traditional and Contemporary Organizational Designs, Concept of Organizational Development, Process of Organizational Development, Concept of Organizational Culture, 4 Types of Organizational Cultures & their influences, Concept and definition of Leadership, Leader and Manager, Types of Leadership Styles.(Each concept to be explained with Case study / Examples)	**6**

4.	**Innovative Management :** Concept of Innovation, Creativity & Invention and its need. Concept and Definition of Innovative Management. Definition of Design Thinking, Stages in the Design Thinking Process, The Design Thinking Multi-Stage Model, What is the Difference between Project-Based Learning (PBL), Understanding by Design (UbD), and Design Thinking (DT). (Class Activity : Brain Storming on Innovative Management)	**6**
	Total	**30**

Text Books:

1. George R. Terry, Stephen G. Franklin; Principles of Management, A.I.T.B.S. Publishers

Reference Books:

1. Stephen Robbins, Organizational Behavior, New Delhi: Prentice- Hall, 2005
2. Veerabhadrappa and Havinal; Management and Entrepreneurship, New Age International Publishers, 2011
3. Chaudhary Omvir, Singh Prakash; Principles of Management, New Age International Publishers, 2011

E-sources:

1. https://nptel.ac.in/courses/122106031
2. https://www.coursera.org/learn/principles-of-management

Program:	**B. Tech. (IT)**				Semester: **V**		
Course : **Java Programming**					Code : **BIT5911**		
Teaching Scheme				**Evaluation Scheme**			
Lecture	**Practical**	**Tutorial**	**Credit**	**TW**	**OR**	**PR**	**Total**
-	2	-	0	-	-	-	-

Prerequisite Knowledge:

1. Object Oriented Programming with JAVA

is essential.

Course Objectives:

1. To illustrate Collection Framework and operations in Java.
2. To demonstrate multithreading and various operations on File.
3. To design GUI components with the Java AWT and Swing API.
4. To use JDBC Connectivity.

Course Outcomes:

After learning the course, the students will be able to:

1. **Use Collection Framework in Java.**
2. **Demonstrate various operations on File and multithreading.**
3. **Build an application interface using Swing API.**
4. **Make use of JDBC connectivity to provide a program level interface with databases**
5. **Implement client server application using socket communication .**

List of Assignments
(All assignments are compulsory)

Sr. No.	Description
1	Design a base class STACK and Handle runtime anomalies like Overflow when the stack is full and underflow when the stack is empty. Display error codes and messages by using appropriate try and catch block to handle the exceptions thrown. Accepts students name, id, and marks and display the highest score and the lowest score using Hashmap
2	Implement an application using Files in Java which calculates student percentage. Store the student record in a file with fields rollno, name, address and marks of 3 subjects.
3	Write a program to calculate matrix addition using the concept of thread in JAVA
4	Design calculator application using SWING in java with proper event handling
5	Store the employee record in a database with fields Empid, dept_name, Emp_name, Emp-type , DA, HRA and Basic. Design an application using Java which calculates the salary of an employee based on the type of employee. Use JDBC for database connectivity.
6	To develop client-server applications based on TCP/UDP java Sockets.

Text Books:

1. Java: A Beginner's Guide. Author: Herbert Schildt, 8th Edition, 2018, ISBN: 9781260440225.
2. Java For Dummies, Author: Barry A. Burd. 7th Edition. , 2017. ISBN: 9781119235552
3. Java: The Complete Reference, Author: Herbert Schildt , 11th Edition,2018, ISBN:9781260440232

Reference Books:

1. Head First Java- A Brain-Friendly Guide, 3rd edition, 2022, ISBN : 9781491910771
2. Java I/O Author: Elliotte Rusty Harold, O'Reilly ,ISBN number is 1-56592-485-1.
3. Beginning Java 2, Author: Ivor Horton ISBN : 1861002238
4. Java 2 Platform Unleashed, Author: Jamie Jaworski ISBN : 0672316315

Program:	B. Tech. (All Programs)			Semester :	V	
Course :	Professional Development Training-I			Code : BHM5917		
Teaching Scheme				Evaluation Scheme		
Lecture	Practical	Tutorial	Credit	TW	OR	PR
3	-	-	-	-	-	-

Course Objectives:

This course aims at enabling the students

1. To enhance the logical reasoning skills of the students and improve the problem-solving abilities.
2. To improve the overall professional development of students.

Course Outcomes: Students will be able to

After learning the course, the students will be:

1. Having adaptive thinking and adaptability through various Quantitative ability concepts.
2. Having critical thinking and innovative skills.
3. Having interest in lifelong learning & developing verbal competencies in the students.

Detailed Syllabus:

Unit	Description	Duration (Hrs)
1.	**Modern Maths** Profit loss, Ratio & Proportion, LCM & HCF, Time speed and Distance, Average, Mean, mode, median, permutation & combination, Probability, Pipe & systems, Mixture validation, Allegations and Mixtures, Simple Interest and Compound Interest.	**6**
2.	**Algebra** Linear equations, Quadratic equations, Triplets. **Geometry** Triangles, Polygons (questions on Area Perimeter).	**6**
3.	**Mensuration** Cube cuboids cone cylinder sphere (questions on volume surface Area) **Trigonometry, Number System, Statistics.**	**6**
4.	**Logical Reasoning** Clocks and Calendar, Direction sense, Family tree, Syllogism, Seating arrangement, Team formation, Coding and Decoding, Number Series and Letter Series, Ranking and Arrangements, Game-Based Aptitude.	**6**
5.	**Data Interpretation** Data charts, Data tables, Bar, Pie, Line graphs, Venn diagram.	**6**
6	**Verbal Ability & Reading Comprehension** Subject-Verb Agreement, Articles and Other Determiners, Prepositions, Tenses, Parts of Speech, Active and Passive Voice, Direct and Indirect Speech, Error Spotting and Sentence Correction, Sentence Completion, Synonyms and Antonyms, Reading Comprehension, Para Jumbles.	**6**
	Total Hrs	**36**

Reference Books:

1. Arun Sharma, Quantitative Aptitude, 2016, 7th Edition, McGraw Hill Education Pvt. Ltd.
2. ETHNUS, Aptimithra, 2013, 1stEdition, McGraw-Hill Education Pvt.Ltd.
3. R S Aggarwal, Quantitative Aptitude For Competitive Examinations, 2017, 3rd Edition, S. Chand Publishing, Delhi.
4. M. Tyra, Quicker Maths, 2018, 5th edition, 2018, BSC publishing company Pvt. Lt.

** Students should get a passing grade if they will clear at least two online aptitude tests and achieve minimum criteria of attendance.

Program:	B. Tech. (All Program)	Semester:	V
Course :	Constitution of India	Code :	BHM9962

Teaching Scheme				Evaluation Scheme			
Lecture	Practical	Tutorial	Credit	IE	MTE	ETE	Total
1	-	-	-	-	-	-	-

Prior knowledge: Nil

Course Objectives:

1. To enable the student to understand the importance of constitution
2. To identify individual role and ethical responsibility towards nation.
3. To understand human rights and its implications
4. To know about central and state government functionalities in India.

Course Outcomes:

After learning the course, the students will be able to:

1. Understand the functions of the Indian government and get acquainted with knowledge of Constitutional Amendments.
2. Identify and explore the basic features, modalities about Indian constitution and assessment of the Parliamentary System in India.
3. Differentiate and relate the functioning of Indian Political system at the Central and State level.
4. Comprehend the fundamental rights and abide the rules of the Indian constitution.

Detailed Syllabus

Unit	Description	Duration (Hrs)
1	**Introduction to Constitution** Meaning of the constitution law and constitutionalism, making of constitution, Salient features and characteristics of the Constitution of India, Preamble, Fundamental Rights, Directive Principles of State Policy, Fundamental Duties and it‘s legal status, Citizenship.	3
2	**System of Government- Center & State level and local level** Structure and Function of Central Government, President, Vice President, Prime Minister, Cabinet, Parliament, Supreme Court of India, Judicial Review, Federal structure and distribution of legislative and financial powers between the Union and the States, local self-government	3
3	**Judiciary** Governor, Chief Minister, Cabinet, State Legislature Judicial System in States, High Courts and other Subordinate Courts, Parliamentary Form of Government in India.	3
4	**Constitution Functions** Indian Federal System and it‘s characteristics, Center& State Relations, President‘s Rule, Constitutional Amendments and powers, Constitutional Functionaries, Emergency Provisions, Assessment of working of the Parliamentary System in India	3
	Total	**12**

Text Books:

1. Durga Das Basu, ―Introduction to the Constitution of India ―, Prentice Hall of India, New Delhi,24th edition, 2020, ISBN-109388548868
2. Clarendon Press, Subhash C, Kashyap, ―Our Constitution: An Introduction to India's Constitution and constitutional Law‖, NBT, 5th edition, 2014, ISBN-9781107034624

Reference Books:

1. Maciver and Page, ―Society: An Introduction Analysis ―, Laxmi Publications, 4th edition, 2007, ISBN-100333916166
2. PM Bhakshi, ―The constitution of India‖, Universal Law Publishing - An imprint of Lexis Nexis, 14th edition, 2017, ISBN-108131262375

Course Syllabus

Semester-VI

Program:	**B. Tech. I.T.**				Semester: **VI**		
Course : **Machine Learning**					Code : **BIT6401**		
Teaching Scheme				**Evaluation Scheme**			
Lecture	**Practical**	**Tutorial**	**Credit**	**IE**	**MTE**	**ETE**	**Total**
3	-	-	3	20	30	50	100

Prior knowledge of

1. Linear Algebra and Calculus, Probability Basics

is essential.

Course Objectives:

1. To understand the nature of problem solved with machine learning
2. To understand human learning aspects.
3. To study different supervised machine learning algorithms
4. To study different unsupervised machine learning algorithms

Course Outcomes:

After learning the course, the students will be able to:

1. Explain machine learning fundamentals.
2. Apply data pre-processing techniques.
3. **Apply regression techniques and evaluate their performance.**
4. Analyze and **analyze** different types of classification models
5. **Apply and analyze appropriate clustering techniques and association rule mining**.
6. **Apply machine learning techniques for various use cases**.

Detailed Syllabus

Unit	Description	Duration
1.	**Introduction to Machine Learning** What is Machine Learning, Real-life applications, Types of Machine Learning- Supervised, Unsupervised and Reinforcement Learning, Well-posed learning problems, Designing a learning system, Issues in machine learning. Bias, Variance, Underfitting, Overfitting, Training, Testing,	6
2.	**Data Pre-processing** Need of data pre-processing, data pre-processing methods, Data and Dimensionality: Feature Sets, Feature Extraction, Dimensionality reduction techniques- PCA	7
3.	**Regression** Linear regression with one variable, Cost function, Target Function, Gradient Descent, Gradient Descent For Linear Regression, Linear Regression with Multiple Variables, Multiple Features, Gradient Descent for Multiple Variables.	8
4.	**Classification** Need and applications of classification, Naïve Bayes Algorithm, K-Nearest Neighbours, Support Vector Machines, Decision Tree, Introduction to ANN, Random Forest and concept of Ensemble Learning, Evaluating classification models performance using Confusion matrix, (Sensitivity, Specificity, Precision, Recall, ROC Curves etc), Enhancing Performance of classification: Cross-Validation, Sub-Sampling, HyperParameter Tuning Techniques.	10
5.	**Clustering and Association Rule Mining** Need and applications of clustering, Partitioned methods, Hierarchical methods, Density based methods. Need and application of Association Rules learning, Basic concepts, Apriori Algorithm, FP-Growth, Performance Measures – Support and Confidence.	7
6.	**Machine Learning Use Cases** Stock Prediction, Medical Diagnosis, Image Recognition, Recommendation Engines etc.	7

	Total	**45**

Text Books:

1. Mitchell M., T., Machine Learning, McGraw Hill (1997) 1st Edition.
2. Alpaydin E., Introduction to Machine Learning, MIT Press (2014) 3rd Edition.

Reference Books:

1. Bishop M., C., Pattern Recognition and Machine Learning, Springer-Verlag (2011) 2nd Edition.
2. Michie D., Spiegelhalter J. D., Taylor C. C., Campbell, J., Machine Learning, Neural and Statistical Classification. Overseas Press (1994).

Program:	**B. Tech. I.T.**				Semester: **VI**		
Course : **Machine Learning Lab**					Code :**BIT6404**		
Teaching Scheme				**Evaluation Scheme**			
Lecture	**Practical**	**Tutorial**	**Credit**	**TW**	**PR**	**OR**	**Total**
-	2	-	1	-	25	-	25

Prior knowledge of

- Basics of Python Programming Language

is essential.

Course Objectives:

1. To make use of data sets in implementing the machine learning algorithms
2. To implement the machine learning concepts and algorithms
3. To implement classification, regression and clustering models in machine learning.

Course Outcomes:

After learning the course, the students will be able to:

1. **Analyze data sets in implementing the machine learning algorithms.**
2. **Select** Machine Learning algorithms to solve classification and clustering problems.
3. **Develop** different machine learning models.

Guidelines for Laboratory Conduction

Lab Assignments: Following is a list of suggested laboratory assignments for reference. The mini-project will be a mandatory part of laboratory work. The instructor may set multiple sets of assignments and distribute among batches of students. It is appreciated if the assignments are based on real-world problems/applications.

Tools: Python

	Suggested List of assignments (Any four)
1.	Assignment of exploring data analysis (Various operations on dataset)
2.	Assignment on Linear Regression
3.	Assignment on Decision Tree
4.	Assignment on Naïve Bayes
5.	Assignment on K-means
6.	Assignment on Apriori
7.	Assignment of Neural Network classifier.
8.	Assignment of Ensemble Learning
9.	Mini Project (Mandatory)

Text Books:

1. Mitchell M., T., Machine Learning, McGraw Hill (1997) 1st Edition.
2. Alpaydin E., Introduction to Machine Learning, MIT Press (2014) 3rd Edition.

Reference Books:

1. Bishop M., C., Pattern Recognition and Machine Learning, Springer-Verlag (2011) 2nd Edition.
2. Michie D., Spiegelhalter J. D., Taylor C. C., Campbell, J., Machine Learning, Neural and Statistical Classification. Overseas Press (1994).

Certification Courses:

https://www.coursera.org/professional-certificates/ibm-machine-learning
https://www.coursera.org/specializations/machine-learnin-theory-and-hands-on-practice-with-pythong-cu
https://www.coursera.org/learn/machine-learning-introduction-for-everyone

Program:	**B. Tech. I.T.**	Semester: **VI**
Course : Software Engineering and Project Management		Code : **BIT6402**

Teaching Scheme				**Evaluation Scheme**			
Lecture	**Practical**	**Tutorial**	**Credit**	**IE**	**MTE**	**ETE**	**Total**
3	-	-	3	20	30	50	**100**

Prior knowledge of

- Basics of Software

is essential.

Course Objectives:

1. To know the principles of Software Engineering and the SDLC and requirements engineering.
2. To understand the various Software Design Methodologies.
3. To learn the fundamentals of IT Project Planning and Management.
4. To learn software quality attributes and testing principles.
5. To know recent trends in Software Engineering.

Course Outcomes:

After learning the course, the students will be able to:

1. **Differentiate the software application domain and select appropriate SDLC process model for software development**
2. Analyze software requirements by using various modeling techniques.
3. Translate the requirement models into design models.
4. Design and create project estimation metric.
5. Use quality attributes and testing principles in software development life cycle.
6. Discuss recent trends in Software engineering by using agile tools

Detailed Syllabus

Unit No.	**Description**	**Duration**
1	**Introduction: Software Engineering** **Software Engineering:** Need for Software Engineering, Software Engineering Ethics, Software Process and Myths. Software Models: Generic Model, Linear Model, Iterative Model, Incremental Model, Introduction to Agility: Agile Process-Extreme Programming	**8**
2	**Software Requirements Engineering** **Requirements Analysis:** Types of requirements- Functional and Non-functional, User Requirement, System Requirement, Requirements Engineering, Rubrics-RTM, Requirement Documentation: SRS Analysis Model: Flow chart, Use case diagram, Class diagram, UML diagram etc.	**8**
3	**Software Design And Development** Software Design: Design Process, Parameters of Good Design, Design Model Heuristics-Architectural Design- View and Pattern, Pattern Based Design, Interface Design: User Interface Design, User Interface analysis, Component Level Design: Traditional Components, Class Based Components, Software Development Environment, Role of Softwares Developer	**8**

4	**Project Management** **Project Planning:** Project initiation, Project Planning and Scope Management, Creating the Work Breakdown Structure, Scheduling the Task and Developing the Schedule using Gantt Charts, PERT/ CPM, RFP Risk Identification and Management **Project Estimation:** Software Project Estimation, Make/Buy Decision COCOMO Model I & II, EOC , FP Based Estimation, Decomposition Techniques, Cost Estimation Tools and Techniques, **Project Management:** The Management Spectrum, People, Product, Process, Project, The W5HH Principle, Metrics in the Process and Project Domains, Software Measurement: size &function oriented metrics(FP & LOC), Metrics for Project	**8**
5	**Software Quality, Testing And Maintenance** Software Testing Fundamentals: Software Quality and achieving software quality by testing, Importance of Test Plan and Test Cases, Types of Testing: Internal and External Testing Views- White Box Testing, Black Box Testing, Regression Testing, Unit Testing , Integration Testing, Debugging: Defect Life Cycle, Bug Finding and Reporting.	**7**
6	**Recent Trends In Software Engineering** Evolution of Software Engineering Process and Tools, Global Software Development Challenges, , Agile Manifesto, Agile manifesto, agility principles, Agile methods, Introduction to Agile Tools Jira and Kanban	6
	Total	**45**

Text Books:

1. Roger S Pressman, Software Engineering: A Practitioner's Approach, Mcgraw-Hill, ISBN: 0073375977, Seventh or Eighth Edition.
2. Joseph Phillips, IT Project Management –On Track From Start to Finish, Tata Mc Graw-Hill, ISBN13: 978-0-07106727-0, ISBN-10: 0-07-106727-2.

Reference Books:

1. Pankaj Jalote, Software Engineering: A Precise Approach, Wiley India, ISBN: 9788126523115.
2. Marchewka, Information Technology Project Management, Wiley India, ISBN: 9788126543946. 3. Chris Dawson with Ben Straub, Building Tools with GitHub, O'Relly, Shroff publishers, ISBN: 978-93-5213-333-8.
3. C. Michael Pilato, Ben Collins-Sussman and Brian Fitzpatrick, Version Control with subversion, O'Relly, Shroff publishers, ISBN: 978-81-8404-728-8.
4. P.C. Tripathi, P.N. Reddy, Principles of Management, Tata McGrew Hill Education Private Limited, ISBN: 9780071333337, ISBN: 0071333339.

Program:	**B. Tech. I.T.**				Semester: **VI**		
Course : **Software Engineering and Project Management Lab**					Code : **BIT6403**		
Teaching Scheme				**Evaluation Scheme**			
Lecture	**Practical**	**Tutorial**	**Credit**	**TW**	**OR**	**PR**	**Total**
-	2	-	1	-	-	25	25

Prior knowledge of

- Basics of Software
- MS Office.

are essentials.

Course Outcomes:

After learning the course, the students will be able to

1. **Identify the solutions to real life problems and analyze its concerns through shared cognition.**
2. Apply learning by doing an approach in PBL to promote lifelong learning.
3. Tackle technical challenges for solving real world problems with team efforts.
4. Collaborate and engage in multi-disciplinary learning environments.

Guidelines for Laboratory Conduction

- Students will design and develop the mini-project as laboratory work.
- The instructor may set multiple sets of assignments and distribute among batches of students or initiate and guide students in ideation phase.
- It is appreciated if the assignments are based on real-world problems/applications.

Contents

Activity-1: Group Structure.

- Group structure should enable students to work in a team.
- The students plan, manage and complete a task/project / activity which addresses the stated problem.
- There should be a team of 3 to 6 students who will work cohesively.
- Instructor will monitor and approve the work by designing the rubrics for team selection and topic selection

Activity-2: Topic/Problem Statement Selection.

- Address the real time problem and provide a solution/Prototype solution to solve it.
- Carry out state of art survey to choose/define appropriate project domain
- Different alternate approaches such as theoretical, practical, working model, demonstration or software analysis should be used in solving/implementation of project/problem For problems that requires conceptual model development, prefer software tools
- Prefer the problem statements from a multidisciplinary environment/domain.
- Different alternate approaches such as theoretical, practical, working model, demonstration or software analysis should be used in solving/implementation of project/problem.

Activity-3: Project Design and Development.

- Gather requirements and Write the Software Requirement specification (SRS IEEE specs) document for the project.
- Develop workflow graph and carry project estimation, calculation of efforts, project planning (schedule) using automated tools.
- Draw different UML diagrams and System architecture for the proposed system. Use different open source tools for design

Activity-4: Project Testing.

- Draw different UML diagrams and System architecture for the proposed system. Use different open source tools for design.
- Develop Test cases. Propose solution for wrong results in test cases by focusing on regression testing.
- Write the constraints, advantages and disadvantages of your project over existing system.
- Write the future scope of your project. Develop help manual for maintenance and usability.

Assessment Guideline:

- It is recommended that the all activities are to be recorded on regular basis
- And proper documentation for the same to be maintained for individual /team members.
- Lab work should reflect software engineering study, punctuality, technical writing ability and work flow of the task undertaken.

Recommended parameters for assessment, evaluation and weightage:

- 1. Idea Inception (5%)
- 2. Outcomes of PBL/Problem Solving Skills/Solution provided/Final product(40%) (Individual assessment and team assessment)
- 3. Documentation (Gathering requirements, design & modeling, implementation/execution, use of technology and final report, other documents (25 %)
- 4. Innovation/Copy write/Potential for the patent(10%)
- 5. Demonstration (Presentation, User Interface, Usability etc.) (10%)
- 6. Contest Participation/ publication (5%)
- 7. Awareness/Consideration of Environment/ Social /Ethics/ Safety measures/Legal aspects (5%). Design the rubrics based on the above parameters for evaluation of student performance Faculty / Mentor is expected to perform following activities.

Reference Books:

1. "Handbook of Research on Technology Project Management, Planning, and Operations" by Terry T Kidd.
2. "The Software Development Project: Planning and Management" by Phillip Bruce and Sam M Pederson.

Program:	**B. Tech. I.T.**			Semester: **VI**			
Course : **Cloud Computing**				Code : **BIT6501**			
Teaching Scheme				**Evaluation Scheme**			
Lecture	**Practical**	**Tutorial**	**Credit**	**IE**	**MTE**	**ETE**	**Total**
02	-	-	02	20	30	50	100

Prior knowledge of

- Data Communication, Computer Networks

is essential.

Course Objectives:

1. To become familiar with Cloud Computing and its types.
2. To learn and understand cloud service types.
3. To develop competency for the design, coding and debugging in Cloud computing environment.
4. To learn the basics of virtualization and its importance.

Course Outcomes:

After learning the course, the students will be able to:

1. **Describe the cloud computing fundamentals.**
2. **Interpret Cloud Delivery models.**
3. **Apply Computing and collaboration through cloud environment**
4. **Explain the types of virtualization and hypervisors.**

Detailed Syllabus

Unit	Description	Duration
1.	**Fundamental of Cloud Computing** Cloud Computing Fundamentals: Cloud Computing definition, Types of cloud, Cloud services: Benefits and challenges of cloud computing, Evolution of Cloud Computing , usage scenarios and Applications , Business models around Cloud – Major Players in Cloud Computing - Issues in Cloud - Eucalyptus - Nimbus - Open Nebula, CloudSim.	7
2.	**Cloud Service Types** Types of Cloud services: Software as a Service - Platform as a Service – Infrastructure as a Service - Database as a Service - Monitoring as a Service - Communication as services - Service providers- Google App Engine, Amazon EC2 - Service providers- Google App Engine, Amazon EC2 - Introduction to MapReduce - GFS - HDFS - Hadoop Framework	7
3.	**Computing and Collaboration** Collaborating on Calendars, Schedules and Task Management – Collaborating on Event Management, Contact Management, Project Management – Collaborating on Word Processing , Databases – Storing and Sharing Files- Collaborating via Web-Based Communication Tools – Evaluating Web Mail Services – Collaborating via Social Networks – Collaborating via Blogs and Wikis.	8
4.	**Virtualization** Need for Virtualization – Pros and cons of Virtualization – Types of Virtualization – System Vm, Process VM, Virtual Machine monitor – Virtual machine properties - Interpretation and binary translation, HLL VM - Hypervisors – Xen, KVM , VMWare, Virtual Box, Hyper-V.	8
	Total	**30**

Text Books:

1. Jack J. Dongarra, Kai Hwang, Geoffrey C. Fox, Distributed and Cloud Computing: From Parallel Processing to the Internet of Things, Elsevier, ISBN :9789381269237, 9381269238, 1st Edition.
2. Thomas Erl, Zaigham Mahmood and Ricardo Puttini, Cloud Computing: Concepts, Technology & Architecture, Pearson, ISBN :978 9332535923, 9332535922, 1st Edition.

Reference Books:

1. Srinivasan, J. Suresh, Cloud Computing: A practical approach for learning and implementation, Pearson, ISBN :9788131776513.

Program:	**B. Tech. I.T.**	Semester: **VI**
Course : **Cloud Computing Lab**		Code :**BIT6504**

Teaching Scheme				**Evaluation Scheme**			
Lecture	**Practical**	**Tutorial**	**Credit**	**TW**	**OR**	**PR**	**Total**
-	2	-	1	25	-	-	25

Prior knowledge of

- Data Communication, Computer Networks

is essential.

Course Objectives:

1. To develop web applications in cloud.
2. To learn the design and development process involved in creating a cloud based application.
3. To learn the communication between two virtual environments.

Course Outcomes:

After learning the course, the students will be able to:

1. Practice cloud simulator.
2. Simulate the virtual machine using virtual box.
3. Experiment virtualization for a file transfer application.

Detailed Syllabus

Unit	**Description**	**Duration**
1.	Install and Configure Cloud Simulator.	
2.	Create Virtual Machines with the desired configurations.	
3.	Find a procedure to transfer the files from one virtual machine to another virtual machine.	

Text Books:

1. Srinivasan, J. Suresh, Cloud Computing: A practical approach for learning and implementation,Pearson, ISBN :9788131776513.

Reference Books:

1. https://code.google.com/archive/p/cloudsim/

Program:	**B. Tech. I.T.**				Semester: **VI**		
Course : **Deep Learning**					**Code : BIT6502**		
Teaching Scheme				**Evaluation Scheme**			
Lecture	**Practical**	**Tutorial**	**Credit**	**IE**	**MTE**	**ETE**	**Total**
2	-	-	2	20	30	50	100

Prior knowledge of

1. Knowledge of Programming
2. Engineering Mathematics

is essential.

Course Objectives:

1. To understand the human learning aspect and relate it with deep learning concepts.
2. To understand and implement a Deep Learning Algorithm.
3. To find optimized solutions for a given problem.
4. To learn- to implement train, and validate neural network, and improve understanding of various application areas of Deep Learning

Course Outcomes:

After learning the course, the students will be able to:

1. **Describe the theoretical foundations, algorithms, and methodologies of Deep Learning.**
2. **Analyze the performance of deep learning algorithms.**
3. **Apply the concepts of Convolution Neural Networks for implementing Deep Learning models.**
4. **Make use of Recurrent Neural Network and LSTM for implementing Deep Learning models.**

Detailed Syllabus

Unit	Description	Duration
1.	**Introduction** Basics: Learning, Underfitting, Overfitting, Estimators, Bias, Variance, Maximum Likelihood Estimation, Bayesian Statistics, Supervised Learning, Unsupervised Learning, Gradient Descent and Stochastic Gradient Descent Training, Testing and Validation set, K-fold cross validation, Building Model, Perceptron	6
2.	**Deep Neural Network** Deep Feed forward Network: Feed-forward Networks, Gradient-based Learning, Hidden Units, Activation functions, Architecture Design, Computational Graphs, Back-Propagation, Regularization, Parameter Penalties, Data Augmentation, Multi-task Learning, Bagging, Dropout and Adversarial Training and Optimization. Gradient Descent (GD) - Momentum Based GD, Nesterov Accelerated GD, Stochastic GD, AdaGrad, RMSProp Regularization- Bias Variance Tradeoff, L2 regularization, Early stopping, Dataset augmentation, Parameter sharing and tying, Injecting noise at input, Ensemble methods, Dropout	8
3.	**Convolutional Neural Network** Convolutional Neural Networks, Architectures, convolution / pooling layers, LeNet, AlexNet, ZF-Net, VGGNet, GoogLeNet, ResNet, Visualizing Convolutional Neural Networks, Guided Back propagation, Deep Dream, Deep Art, Fooling Convolutional Neural Networks.	8
4.	**Recurrent Neural Networks (Rnns)** Sequence Modeling: Recurrent Neural Networks (RNNs), Bidirectional RNNs, Encoder Decoder Sequence-to-Sequence Architectures, Deep Recurrent Network, Recursive Neural Networks and Echo State networks, LSTMs	8
	Total	**30**

Text Books:

1. Goodfellow I., Bengio,Y., and Courville, A., "Deep Learning", MIT Press, 2016.
2. Giuseppe Bonaccorso, "Machine Learning Algorithms", Packt Publishing Limited**,** ISBN-10: 1785889621**,** ISBN- 13: 978-1785889622
3. Umberto Michelucci "Applied Deep Learning. A Case-based Approach to Understanding Deep Neural Networks" Apress, 2018.

Reference Books:

1. Tom Mitchell "Machine Learning" McGraw Hill Publication, ISBN : 0070428077 9780070428072
2. Nikhil Buduma, "Fundamentals of Deep Learning", O"REILLY publication, second edition 2017, ISBN: 1491925612
3. Josh Patterson, Adam Gibson, "Deep Learning: A Practitioner's Approach", O"REILLY, SPD, ISBN: 978-93-5213- 604-9, 2017 Edition 1st.

Program:	B. Tech. I.T.	Semester: **VI**
Course : **Deep Learning Lab**		Code : **BIT6505**

Teaching Scheme				Evaluation Scheme			
Lecture	**Practical**	**Tutorial**	**Credit**	**TW**	**OR**	**PR**	**Total**
-	2	-	1	25	--	--	25

Prior knowledge of

- Knowledge of Programming
- Engineering Mathematics

is essential.

Course Objectives:

1. To understand the human learning aspect and relate it with deep learning algorithms.
2. Expert knowledge in solving real world problems using deep learning techniques.
3. To find optimized solutions for a given problem.
4. To implement, train, and validate neural network, and improve understanding of various application areas of Deep Learning

Course Outcomes:

After learning the course, the students will be able to:

1. **Apply the technique of Artificial Neural Network and Convolution Neural Network (CNN) for implementing Deep Learning models.**
2. **Make use of Recurrent Neural Network (RNN) and LSTM to solve real world Problems.**
3. **Evaluate the performance of the model build using Deep Learning.**

Detailed Syllabus

Expt.	Description	Duration
1.	Train a Deep learning model to classify a given image using a pre-trained model.	
2.	Object detection using Convolution Neural Network.	
3.	Study the effect of batch normalization and dropout in neural network classifiers.	
4.	Perform Sentiment Analysis in network graph using RNN	
5.	Image Captioning using LSTMs	
6.	Image Captioning using RNNs	

Text Books:

1. Goodfellow I., Bengio,Y., and Courville, A., “Deep Learning”, MIT Press, 2016.
2. Umberto Michelucci “Applied Deep Learning. A Case-based Approach to Understanding Deep Neural Networks” Apress, 2018.
3. Francois Chollet, “Deep learning with Python” – Manning Publications, 2017.

Reference Books:

1. Explore neural networks with Python", Packt Publisher, 2017
2. Antonio Gulli, Sujit Pal "Deep Learning with Keras", Packt Publishers, 2017.
3. Josh Patterson, Adam Gibson, “Deep Learning: A Practitioners Approach”, O‟REILLY, SPD, ISBN: 978-93-5213- 604-9, 2017 Edition 1st.

Program:	**B. Tech. I.T.**			Semester: **VI**			
Course : **Computer Vision**				Code :**BIT6503**			
Teaching Scheme				**Evaluation Scheme**			
Lecture	**Practical**	**Tutorial**	**Credit**	**IE**	**MTE**	**ETE**	**Total**
2	-	-	2	20	30	50	100

Prior knowledge of

- Knowledge of fundamental mathematics and data structures and algorithms.

is essential.

Prerequisite:

Course Objectives:

1. To know about digital image formation and its low level processing.
2. To learn feature extraction techniques in computer vision.
3. To make use of pattern analysis techniques in computer vision

Course Outcomes:

After learning the course, the students will be able to:

1. **Interpret Low level image processing**
2. **Experiment with feature extraction techniques**
3. **Analyze pattern analysis techniques in computer vision**
4. **Create computer vision applications.**

Detailed Syllabus

Unit	Description	Duration
1.	**Digital Image Formation** Overview and State-of-the-art, Image Formation **Low level Image Processing**Transformation: Orthogonal, Euclidean, Affine, Projective, etc; Fourier Transform, Convolution and Filtering, Image Enhancement, Restoration, Histogram Processing.	7
2.	**Feature Extraction** Edges - Canny, LOG, DOG; Line detectors (Hough Transform), Corners - Harris and Hessian Affine, Orientation Histogram, SIFT, SURF, HOG, GLOH, Scale-Space Analysis- Image Pyramids and Gaussian derivative filters, Gabor Filters and DWT.	7
3.	**Pattern Analysis** Clustering: K-Means, K-Medoids, Mixture of Gaussians, Classification: Discriminant Function, Supervised, Un-supervised, Semi-supervised; Classifiers: Bayes, KNN, ANN models; Dimensionality Reduction: PCA, LDA, ICA; Non-parametric methods..	9
4.	**Computer Vision Applications** CBIR, CBVR, Activity Recognition, Biometrics, Modern trends - super-resolution; GPU, Augmented Reality; cognitive models	7
	Total	**30**

Text Books:

1. Szeliski, R., Computer Vision: Algorithms and Applications, Springer-Verlag London Limited (2011), 1st Edition.
2. Forsyth, A., D. and Ponce, J., Computer Vision: A Modern Approach, Pearson Education (2012) 2nd E.

Reference Books:

1. Rafael C. Gonzalez, Digital Image Processing, 3rd edition.
2. NPTEL Course Material Computer Vision :https://onlinecourses.nptel.ac.in/noc19_cs58

Program:	**B. Tech. I.T.**					Semester: **VI**	
Course : **Computer Vision Lab**						Code : **BIT6506**	
Teaching Scheme				**Evaluation Scheme**			
Lecture	**Practical**	**Tutorial**	**Credit**	**TW**	**OR**	**PR**	**Total**
-	2	-	1	25	-	--	25

Prior knowledge of
C Fundamentals
is essential.

Course Objectives:

1. To learn image formation and low level processing
2. To learn how to use Open CV for computer vision

Course Outcomes:

After learning the course, the students will be able to:

1. Practice with computer vision software
2. Make use of feature extraction technique
3. Illustrate content based image retrieval techniques

Detailed Syllabus

Unit	Description	Duration
1.	Installation of image processing Software Matlab/OpenCVand download freely available image Dataset.	
2.	Perform Histogram equalization techniques on suitable images.	
3.	Perform edge detection using canny edge detector.	
4.	Perform Principal Components Analysis(PCA)	
5.	Develop any simple Content based image retrieval system for a simple search query in any image database.	

Reference Books:

3. Rafael C. Gonzalez, Digital Image Processing, 3rd edition.
4. NPTEL Course Material Computer Vision :https://onlinecourses.nptel.ac.in/noc19

Program:	B. Tech. I.T.	Semester: VI
Course: **Internet of Things**		Code : **BIT6507**

Teaching Scheme				Evaluation Scheme			
Lecture	**Practical**	**Tutorial**	**Credit**	**IE**	**MTE**	**ETE**	**Total**
2	-	-	2	20	30	50	100

Prior knowledge of

- Basic knowledge of C Programming & Python

Is essential.

Course Objectives:

1. To understand fundamentals of IoT and embedded systems including essence, basic design strategy, and process modeling.
2. To develop a comprehensive approach towards building a small low cost embedded IoT system using Physical Devices.
3. To understand the fundamentals of security in IoT.
4. To learn to cloud infrastructure use in IoT.

Course Outcomes:

Upon completion of the course, the student will be able to:

1. **Explain the various concepts, terminologies and architecture of IoT systems.**
2. **Distinguish horizontal and vertical applications and identify common underpinning technologies.**
3. **Establish a secure communication channel between IOT devices by applying IOT security protocol**
4. **Outline the web of things and cloud of things architecture**

Detailed Syllabus

Unit	Description	Duration
1.	**Introduction to Internet of Things and Embedded System** Internet of Things: Vision, Emerging Trends, Economic Significance, Technical Building Blocks, Physical design of IoT, Things of IoT, IoT Protocols, Logical design of IoT, IoT functional blocks, IoT communication models, IoT Communication APIs, IoT enabling technologies, IoT levels and deployment templates, IoT Issues and Challenges, Applications. Embedded Systems: Application Domain and Characteristic of Embedded System, Real time systems and Real time scheduling, Processor basics and System-On-Chip, Introduction to ARM processor and its architecture. IoT: Definition and characteristics of IoT.	7
2.	**Pillars of Embedded IoT and Physical Devices** Horizontal, verticals and four pillars of IoT, M2M: The internet of devices, RFID: The internet of objects, WSN: The internet of transducer, SCADA: The internet of controllers, DCM: Device, Connect and Manage, Device: Things that talk, Connect: Pervasive Network, Mangae: To create business values. IoT Physical Devices and Endpoints: Basic building blocks of and IoT device, Exemplary device: Raspberry Pi, Raspberry Pi interfaces, Programming Raspberry Pi with Python, Other IoT Devices.	7

3.	**IoT Protocols and Security** Protocol Standardization for IoT, Efforts, M2M and WSN Protocols, SCADA and RFID Protocols, Issues with IoT Standardization, Unified Data Standards, Protocols – IEEE 802.15.4, BACNet Protocol, Modbus, KNX, Zigbee Architecture, Network layer, APS layer. IoT Security: Vulnerabilities of IoT, Security Requirements, Challenges for Secure IoT, Threat Modeling, Key elements of IoT Security: Identity establishment, Access control, Data, and message security, non-repudiation and availability, Security model for IoT.	8
4.	**Web of Things and Cloud of Things** Web of Things versus Internet of Things, Two Pillars of the Web, Architecture Standardization for WoT, Platform Middleware for WoT, Unified Multitier WoT Architecture, WoT Portals, and Business Intelligence. Cloud of Things: Grid/SOA and Cloud Computing, Cloud Middleware, Cloud Standards – Cloud Providers and Systems, Mobile Cloud Computing, The Cloud of Things Architecture.	8
	Total	**30**

Text Books:

1. Arshdeep Bahga, Vijay Madisetti, ―Internet of Things – A hands-on approach‖, Universities Press, ISBN: 0: 0996025510, 13: 978-0996025515
2. Honbo Zhou, ―The Internet of Things in the Cloud: A Middleware Perspective‖, CRC Press, 2012. ISBN : 9781439892992
3. Dieter Uckelmann, Mark Harrison, Florian Michahelles, ―Architecting the Internet of Things‖, Springer, 2011. ISBN: 978-3-642-19156-5
4. Lyla B. Das, ―Embedded Systems: An Integrated Approach‖ Pearson , ISBN: 9332511675, 9789332511675

References:

1. David Easley and Jon Kleinberg, ―Networks, Crowds, and Markets: Reasoning About a Highly Connected World‖, Cambridge University Press, 2010, ISBN:10: 0521195330
2. Olivier Hersent, Omar Elloumi and David Boswarthick, ―The Internet of Things: Applications to the Smart Grid and Building Automation‖, Wiley, 2012, 9781119958345
3. Olivier Hersent, David Boswarthick, Omar Elloumi , ―The Internet of Things – Key applications and Protocols‖, Wiley, 2012, ISBN:978-1-119-99435-0
4. Barrie Sosinsky, ―Cloud Computing Bible‖, Wiley-India, 2010.ISBN : 978-0-470-90356-8

Program:	**B. Tech. I.T.**			Semester: **VI**			
Course: **Internet of Things Lab**				Code : **BIT6510**			
Teaching Scheme				**Evaluation Scheme**			
Lecture	**Practical**	**Tutorial**	**Credit**	**TW**	**OR**	**PR**	**Total**
-	2	-	1	25	-	--	25

Prior knowledge of

- Basic knowledge of C Programming & Python
- Is essential.

Course Objectives:

1. To understand functionalities of various single-board embedded platforms fundamentals
2. To develop a comprehensive approach towards building a small low cost embedded IoT system.
3. To implement the assignments based on sensory inputs.

Course Outcomes:

On completion of the course, the student will be able to–

1. **Design the minimum system for sensor-based application**
2. **Select and optimize device performance by choosing appropriate sensors and processors for specific applications**
3. Develop a full-fledged IoT application for a distributed environment

Detailed Syllabus

Unit	Description	Duration
Group A	1. Study of Raspberry-Pi, Beagle board, Arduino, and other micro controllers and understand the process of OS installation on Raspberry-Pi /Beagle board. 2. Study of Connectivity and configuration of Raspberry-Pi /Beagle board circuit with basic peripherals, LEDs. Understanding GPIO and its use in the program. 3. Understanding the connectivity of Raspberry-Pi / Arduino with temperature sensor. Write an application to read the environment temperature. If the temperature crosses a threshold value, the application indicated user using LEDs. 4. Understanding the connectivity of Raspberry-Pi / Arduino with IR sensor. Write an application to detect obstacles and notify users using LEDs.	
Group B	5. Understanding and connectivity of Raspberry Pi / Arduino with the camera. Write an application to capture and store the image. 6. Write an application using Raspberry-Pi Arduino to control the operation of the stepper motor. 7. Create a simple web interface for Raspberry-pi/ Arduino to control the connected LEDs remotely through the interface. 8. Create a small dashboard application to be deployed on the cloud using think speak. Different publisher devices can publish their information and interested application can subscribe.	

Group C	9. Develop a Real-time application like a smart home with the following requirements: When a user enters the house the required appliances like fan, and light should be switched ON. Appliances should also get controlled remotely by a suitable web interface. The objective of this application is for the student should construct a complete Smart application in a group. 10. Develop a Real-time application like a smart home with the following requirements: If anyone comes at the door the camera module automatically captures his image sends it to the email account of the user or sends a notification to the user. The door will open only after user ‘s approval.

References:

1. Nitesh Dhanjani, ―Abusing the Internet of Things‖, O'REILLY, ISBN: 13:978-93-5313-217-1
2. Cuno Pfister, ―Getting Started with the Internet of Things‖, O'REILLY, ISBN: 13:978-93-53023-413-6
3. Massimo Banzi and Michael Shiloh, ―Getting Started with Arduino‖, MAKER MEDIA, ISBN: 13:978-93-5110-907-5
4. Don Wilcher, ―BASIC Arduino Projects‖, MAKER MEDIA, ISBN: 13:978-93-5110-503-9
5. Cefn Hoile, Clare Bowman, Sjoerd Dirk Meijer, Brian Corteil, Lauren Orsini, ―Raspberry Pi and AVR Projects‖, MAKER MEDIA, ISBN: 13:978-93-5110-914-3
6. Wolfrom Donot, ―A Raspberry Pi Controlled Robot‖, MAKER MEDIA, ISBN: 13:978-93-5110-913-6 7. Kimmo Karvinen and Tero Karvinen, ―Arduino Bots and Gadgets‖, O'REILLY, ISBN: 13:978-93-5023-374-0 8. Derek Molley, ―Exploring Beaglebone‖, Willey, ISBN: 978-1-118-935125.

Program:	B. Tech. I.T.			Semester: **VI**			
Course : **Big Data Analytics**				Code : **BIT6508**			
Teaching Scheme				**Evaluation Scheme**			
Lecture	**Practical**	**Tutorial**	**Credit**	**IE**	**MTE**	**ETE**	**Total**
2	-	-	2	20	30	50	100

Prior knowledge of
Database Management Systems & Data Analysis
i**s essential.**

Course Objectives:

1. To understand the need of Big Data and its Use cases
2. To understand the different big data processing technologies such as Hadoop and MapReduce.
3. To provide hands on Hadoop EcoSystem
4. To apply analytics on Structured, Unstructured Data using R and Python

Course Outcomes:
After learning the course, the students will be able to:

1. **Explain Big Data and its Business Implications.**
2. **Make use of GFS, HDFS and Hadoop Ecosystem.**
3. **Analyze performance of PIG and HIVE shell commands**
4. **Discuss concept of big data analytics**

Detailed Syllabus

Unit	Description	Duration
1.	**Introduction To Big Data** Introduction to Big Data, Defining Big Data, Big Data examples, Characteristics of Big Data - Volume, Variety, Velocity, Veracity, Valence, Value, Big data infrastructure and challenges, Big Data Processing Architectures: Data Warehouse, Re-Engineering the Data Warehouse, Shared everything and shared nothing architecture, Big data learning approaches.	8
2.	**Big Data Processing** Big Data Analytics- Ecosystem and Technologies, Introduction to Google file system, Hadoop Architecture, Hadoop Storage: HDFS, HDFS Concepts, Command Line Interface, Hadoop file system interfaces, Data flow, Data Ingest with Flume and Scoop and Hadoop archives, Hadoop I/O: Compression, Serialization, Avro and File-Based Data structures. Common Hadoop Shell commands, Anatomy of File Write and Read, NameNode, Secondary NameNode, and DataNode, Hadoop MapReduce paradigm, Map Reduce tasks, Job, Task trackers, , Map Reduce Types and Formats, Map Reduce Features.	8
3.	**Hadoop Ecosystem** Pig : Introduction to PIG, Execution Modes of Pig, Comparison of Pig with Databases, Grunt, Pig Latin, User Defined Functions, Data Processing operators. Hive : Hive Shell, Hive Services, Hive Metastore, Comparison with Traditional Databases, HiveQL, Tables, Querying Data and User Defined Functions. Hbase : HBasics, Concepts, Clients, Example, Hbase Versus RDBMS, Introduction to NOSQL, Textual ETL processing.	8

4.	**Big Data Analytics** Data analytics life cycle introduction, Types of analysis, Analytical approaches, Data analytics with mathematical manipulations, Reading data sets from different sources, Data cleaning , Handling missing values, Data transformation, Data Standardization statistical and graphical analysis methods, Hive Data Analytics.	6
	Total	**30**

Text Books:

1. Krish Krishnan, Data warehousing in the age of Big Data, Elsevier, ISBN: 9780124058910, 1 stEdition.
2. DT Editorial Services, Big Data, Black Book, DT Editorial Services, ISBN: 9789351197577, 2016 Edition.
3. Tom White " Hadoop: The Definitive Guide" Fourth Edit on, O'reily Media, 2015

Reference Books:

1. EMC Education Services, Data Science and Big Data Analytics- Discovering, analyzing Visualizingand Presenting Data.
2. "Big Data Analytics", Seema Acharya, SubhasiniChellappan, Second Edition, 2019, Wiley India Pvt.Ltd, ISBN 978-81-2657-951-8.
3. Mueller Massaron, Python for Data science, Wiley, ISBN :978812655739
4. Judith Hurwitz, Alan Nugent, Big Data For Dummies, Wiley India, ISBN : 9788126543281
5. Michael Mineli, Michele Chambers, Ambiga Dhiraj, "Big Data, Big Analytics: Emerging Business Intelligence and Analytic Trends for Today's Businesses", Wiley Publications, 2013.
6. Glen J. Myat, "Making Sense of Data", John Wiley & Sons, 2007 • Pete Warden, "Big Data Glossary", O'Reily, 2011.
7. Alex Holmes, Hadoop in practice, Dreamtech press, ISBN:9781617292224.
8. Arvind Sathi, Big Data Analytics: Disruptive Technologies for Changing the Game, IBM Corporation, ISBN:978-1-58347-380-1.

Program:	**B. Tech. I.T.**					Semester: **VI**	
Course : **Big Data Analytics Lab**						Code : **BIT6511**	
Teaching Scheme				**Evaluation Scheme**			
Lecture	**Practical**	**Tutorial**	**Credit**	**TW**	**OR**	**PR**	**Total**
-	2	-	1	25	-	-	25

Prior knowledge of
Database Management Systems & Data Analysis
is essential.

Course Objectives:

1. To understand Big data primitives and fundamentals.
2. To Apply the different Big data processing techniques.
3. To Design Big data applications and perform querying operations.
4. To apply the Analytical concept of Big data using Python.

Course Outcomes:

After learning the course, the students will be able to:

1. **Apply Big data primitives and fundamentals for application development.**
2. **Apply HDFS, MapReduce, PIG and HIVE Shell commands**
3. **Apply the Analytical concept of Big data using Python.**

Detailed Syllabus (Any Four)

Expt.	Description	Duration
	Implement Any 6	
1.	Perform setting up and Installing Hadoop in its two operating modes. i. Standalone. ii. Pseudo distributed.	
2.	a. Implement the following file management tasks in Hadoop: 1. Adding files and directories 2. List files 3. Retrieving files 4. Deleting files 5. Shutting down HDFS b. Run a basic word count Map Reduce program to understand Map Reduce Paradigm.	
3.	Design a distributed application using MapReduce which processes weather data. Use weather file from the Internet and process it using a pseudo distributed mode on Hadoop platform Hint: Weather sensors collecting data every hour at many locations across the globe gather a large volume of log data, which is a good candidate for analysis with Map Reduce, since it is semi structured and record-oriented	
4.	a. Install and Run Hive then use Hive to create, alter, and drop databases, tables, views, functions, and indexes. b. Demonstrate the use of Hbase with any real time problem statement (case study)	
5.	Install and Run Pig then write Pig Latin scripts to sort, group, join, project, and filter your data	
6.	Perform the following operations using Python on the Iris/Facebook metrics data sets a. Create data subsets b. Merge Data c. Sort Data d. Transposing Data e. Shape and reshape Data	

7.	Perform the following operations using Python on the Flights/Air Quality data sets a. Data cleaning b. Data integration c. Data transformation d. Error correcting e. Data model building

Text Books:

1. Tom White " Hadoop: The Definitive Guide" Fourth Edit on, O'reily Media, 2015
2. Seema Acharya, Subhasini Chellappan, "Big Data Analytics" Second Edition,Wiley 2019.

Reference Books:

1. Data Analytics with Hadoop, Jenny Kim, Benjamin Bengfort, OReilly Media, Inc,June 2016
2. Python Data Science Handbook by Jake VanderPlas https://tanthiamhuat.files.wordpress.com/2018/04/pythondatasciencehandbook.pdf
3. Alex Holmes, Hadoop in practice, second edition,Dreamtech press, January 2015
4. Online References for data set: www.kaggle.com
5. Online References for data set: http://archive.ics.uci.edu/ml

Program:	B. Tech. I.T.	Semester: VI
Course : **Software Testing and Quality Assurance**		**Code : BIT6509**

Teaching Scheme				Evaluation Scheme			
Lecture	**Practical**	**Tutorial**	**Credit**	**IE**	**MTE**	**ETE**	**Total**
2	-	-	2	20	30	50	100

Prior knowledge of

- Software Engineering

i**s essential.**

Course Objectives:

1. To apply the testing strategies and methodologies in projects.
2. To understand test management strategies and tools for testing.
3. To apply software test automation and explore various tools.

Course Outcomes:

After learning the course, the students will be able to:

1. **Illustrate the basics of software testing**
2. **Analyze the scenario and select the proper testing technique**
3. **Explain different types of defects and defect tracking concepts.**
4. **Apply test automation concepts and use automation tools.**

Detailed Syllabus

Unit	Description	Duration
1.	**Software Testing Basics** Need of testing, Testing as an engineering activity, Basic concepts – errors, faults, defects, failures, test bed, Testing Principles, verification and validation, V-Model of testing, Testing Life Cycle – Roles and activities. software reviews- inspections and walk-thorough	**6**
2.	**Testing Techniques** Structural testing and Mutation testing, Black box approach: random testing, equivalence class partitioning and boundary value analysis, Cause-effect graphing White box approach: test adequacy criteria, code coverage and control flow graphs, paths, Data flow and loop testing. Writing Junit tests.	**10**
3.	**Levels Of Testing And Test Management** Levels of Testing- unit testing, integration testing, system testing, performance testing, recovery testing, regression testing, alpha, beta and acceptance testing. Test Planning, Test Reports, Origins of defects, Defect Types, Defect repository and test design, Defect severity, life cycle of defect. Defect Reports- Track, Retest and Close.	**8**
4.	**Software Test Automation** Software Test Automation, Skills needed for Automation, Scope of Automation, Design and Architecture for Automation, Challenges in Automation, Automated test generation- using Random testing, Property-Based Testing for Real-Time Systems, Introduction to test driven development	**6**
	Total	**30**

Text Books:

1. Iien Burnstein, “Practical Software Testing”, Springer Publication.
2. Srinivasan Desikan, Gopalaswamy Ramesh, “Software Testing: Principles and Practices”, PEARSON

Reference Books:

1. William E Perry, “Effective Methods for Software Testing”, Second Edition, Wiley Publication.
2. Coursera Course on “Introduction to Software Testing” by University of Minnesota available at https://www.coursera.org/learn/introduction-software-testing
3. Coursera Course on “Introduction to Automated Analysis” by University of Minnesota available at https://www.coursera.org/learn/automated-analysis

Program:	B. Tech. I.T.	Semester: **VI**
Course : **Software Testing and Quality Assurance Lab**		Code : **BIT6512**

Teaching Scheme				Evaluation Scheme			
Lecture	**Practical**	**Tutorial**	**Credit**	**TW**	**OR**	**PR**	**Total**
-	2	-	1	25	--	--	25

Prior knowledge of

- Software Engineering

i**s essential.**

Course Objectives:

1. To apply the testing strategies and methodologies in projects.
2. To understand test management strategies and tools for testing.
3. To learn quality assurance models and various tools used in quality management

Course Outcomes:

After learning the course, the students will be able to:

1. **Develop Manual test cases for the given application**
2. **Estimate cylomatic complexity and write white box test cases for the given code**
3. **Make use of defect tracking tools to detect, classify defect and generate the report.**
4. **Use automation tools to perform black box testing.**

Detailed Syllabus

Expt.	Description	Duration
1.	Write a black box functional test cases using manual testing for the given application	
2.	Write a test cases using white box testing for the given C code. 1. Calculate Cyclomatic complexity 2. Control flow testing 3. Data flow testing	
3.	Implement white box unit test cases using Junit for the given application	
4.	Prepare a Defect Tracking Report / Bug Report using MS-Excel or Defect Tracking Tool like Jira or BugZilla	
5.	Perform Black Box testing using automated testing tool on an application. Testing Points to be covered – data driven wizard, parameterization, exception handing	

Text Books:

1. Iien Burnstein, “Practical Software Testing”, Springer Publication.
2. Srinivasan Desikan, Gopalaswamy Ramesh, “Software Testing: Principles and Practices”, PEARSON

Reference Books:

1. Frank Appel , “Testing with JUnit”, Oreilly Publication, ISBN: 9781782166603
2. Udemy Course on “Practical Java Unit testing with Junit5” available online at https://www.udemy.com/course/junit5-for-beginners.
3. Coursera Course on “Introduction to Automated Analysis” by University of Minnesota available at https://www.coursera.org/learn/automated-analysis

Program:	B. Tech. (Civil Engineering)			Semester:	VI		
Course:	Remote Sensing and GIS (OEC-3)			Code:	BCI6603A		
Teaching Scheme				Evaluation Scheme			
Lecture	Practical	Tutorial	Credit	IE	MTE	ETE	Total
3	-	-	3	20	30	50	100

Prior Knowledge of:

- Fundamental related to Surveying
- Types and Importance of various surveys
- Global Positioning System **(GPS)**

Course Objectives: After Completing this course, student will have adequate background :

1. To comprehend fundamentals and principles of RS and GIS techniques.
2. To enhance students' capacity to interpret images and extract information of earth surface from multi-resolution imagery at multi-scale level.
3. To develop skills of Image processing and Geographical Information System
4. To study satellite image processing, satellite image interpretation, digitization and generation of thematic maps in a GIS.
5. To learn buffering and layer analysis for various engineering applications

Course Outcomes: After learning the course, the students will be able to:

1. Articulate fundamentals and principles of RS techniques.
2. Demonstrate the knowledge of remote sensing and sensor characteristics.
3. Distinguish working of various spaces-based positioning systems.
4. Analyze the RS data and image processing to utilize in civil engineering
5. Explain fundamentals and applications of RS and GIS
6. Acquire skills of data processing and its applications using GIS

Detailed Syllabus

Unit	Description	Duration (Hours)
1	**Introduction to Remote Sensing:** Definition and scope, history and development of remote sensing technology, electromagnetic radiation (EMR) and electromagnetic spectrum, EMR interaction with atmosphere and earth surface; atmospheric window, RS platforms, elements of remote sensing for visual interpretation viz. tone, shape, size, pattern, texture, shadow and association, applications in civil engineering/town planning	07
2	**Remote Sensing Satellites and Sensor Characteristics:** Types and their characteristics, types of sensors, orbital and sensor characteristics of major earth resource satellites, Indian remote sensing satellite programs, introduction to various open-source satellite data portals, global satellite programs, sensor classification, applications of sensor, concept of Swath & Nadir, resolutions, digital image. Introduction to spatial resolution, spectral resolution, radiometric resolution and temporal resolution, visual image interpretation, image interpretation	08
3	**GPS and GNSS:** Introduction to GNSS and Types, IRNSS, GPS, GPS components, differential GPS, types of GPS tracking, application of GNSS in surveying, mapping and navigation	07
4	**Image Processing and Analysis:** Digital image, visual image interpretation, image interpretation keys, concept of spectral signatures curve, digital image processing, preprocessing and post processing, image	08

	registration, image enhancement, image transformations, digital image classification (supervised & unsupervised). Digital elevation model (DEM) and its derivatives, triangular irregular network model (TIN) and other models & their applications.	
5	**Fundamentals of GIS:** Geographic information system, definition, spatial and non-spatial data, data inputs, data storage and retrieval, data transformation, Introduction to cloud computing (types & applications), data reporting, advantages of GIS, essential elements of GIS hardware, software GIS data types, applications of RS and GIS in civil engineering, hydrogeology, engineering geology, surveying and mapping.	**07**
6	**GIS Data and Case Studies:** GIS data types and data representation, data acquisition, geo-referencing of data, projection systems, raster and vector data, raster to vector conversion, attribute data models and its types, remote sensing data in GIS, GIS database and database management system. Case studies:	**08**
	Total	**45**

Textbooks:

1. J. George "Fundamentals of Remote Sensing", Universities Press, Hyderabad, 2005
2. Principles of Remote Sensing, Panda B C, Viva Books Private Limited, 2008
3. Remote Sensing & Geographical Information System, M. Anji Reddy, BS Publications, Hyderabad, 4th Edition, 2022
4. S.K. Sinha "Fundamental of Remote Sensing and GIS", Ayushman Publication House,2014

Reference Books:

1. Remote Sensing & Digital Image Processing, John R. Jensen, Department of Geography University of South Carolina Columbia, 4th Edition, 2017
2. Remote Sensing and Image Interpretation, Lillesand Thomas M. and Kiefer Ralph, John, 7th Edition, 2015
3. Textbook on Remote Sensing, C. S. Agarwal and P. K. Garg, Wheeler Publishing House, 2000

E-Resources:

1. https://onlinecourses.nptel.ac.in/noc22_ce84/preview
2. https://onlinecourses.nptel.ac.in/noc23_ce52/preview
3. https://onlinecourses.nptel.ac.in/noc22_ce26/preview
4. https://elearn.nptel.ac.in/shop/nptel/remote-sensing-and-gis/
5. https://www.classcentral.com/course/swayam-remote-sensing-and-gis-14272

Program:	B. Tech. (Civil Engineering)			Semester:	VI		
Course:	Building Services and Maintenance (OEC-3)			Code:	BCI6603B		
Teaching Scheme				Evaluation Scheme			
Lecture	Practical	Tutorial	Credit	IE	MTE	ETE	Total
3	-	-	3	20	30	50	100

Course Objectives:

- To understand the different building services provisions.
- To study the suitable electrical and mechanical services, fire protection, acoustic, water supply and sound Insulations.
- To examine the the purpose and type of building maintenance.

Course Outcomes: After learning the course, the students should be able to:

1. Understand different building services provisions.
2. Interpret the importance of building ventilation.
3. Distinguish the suitable electrical as well mechanical services for particular requirements of buildings.
4. Discover the knowledge of Fire Protection, Acoustic, Sound Insulations.
5. Provide awareness of laws and regulations of water supply systems related to building services.
6. Select different types of maintenance in building services.

Detailed Syllabus

Unit	Description	Duration (Hours)
1	**Introduction to Building Services:** Definitions, Objective and uses of services different types building, Classification of building services, Types of services and selection of appropriate services for given project.	07
2	**Building Ventilation:** Natural and artificial lighting principles and factors, Arrangement of luminaries, Distribution of illumination, Utilization factors, Necessity of Ventilation Types – Natural and Mechanical Factors to be considered in the design of Ventilation.	08
3	**Electrical Services & Mechanical Services in Buildings:** Electrical services in the building technical terms and symbols for electrical installations and Accessories of wiring, Systems of wiring Plumbing & Air-Conditioning, Air Distribution system, Cleaners,	08
4	**Fire Protection, Acoustic and Sound Insulations:** Introduction, causes of fire and Effects of fire, General Requirements of Fire Resisting building as per IS and NBC 2005, Requirement of good Acoustic, Various sound absorbent, Factors to be followed for noise control in residential building.	08
5	**Water and Sanitation Water quality Purification and treatment:** Water supply systems-distribution systems municipal bye laws and regulations, Rain Water Harvesting Sanitation in buildings, arrangement of sewerage systems in housing.	07
6	**Building Maintenance:** Role of maintenance in durability and serviceability of buildings, Economic aspects of maintenance. Different types of maintenance.	07
	Total	45

Text Books:

1. A text book on Building Services R. UdaykumarEswar Press, Chennai
2. Building Services S. M. PatilSeema Publication, Mumbai Revised edition
3. National Building Code of India - 2005 Bureau of Indian Standards BIS, New Delhi.

Reference Books:

1. Building Construction Dr. B. C. PunmiaLaxmi Publications (P) Ltd., New Delhi
2. Building Construction P. C. Varghese PHI Learning (P) Ltd., New Delhi
3. Building repair and Maintenance Management P. S. Gahlot CBS Publishers &Distribution(P) Ltd .

E-resource-https://nptel.ac.in/courses/105102176

Program:	B. Tech. (Civil Engineering)			Semester:	VI		
Course:	Smart Cities & Building Automations (OEC-4)			Code:	BCI6604A		
Teaching Scheme				Evaluation Scheme			
Lecture	Practical	Tutorial	Credit	IE	MTE	ETE	Total
3	-	-	3	20	30	50	100

Prior Knowledge of:

- Physics
- Mathematics
- Programming Language

Course Objectives:

1. Tounderstand the concept of smart city and associated challenges
2. To understand latest technologies used in intelligent building
3. To recognize the concepts of Internet of Things and able to build IoT applications
4. To apply the programming and use of Arduino and Raspberry Pi boards for Smart Cities

Course Outcomes:

After learning the course, the students will be able to:-

1. Understand the concept of smart city and associated challenges
2. Identify latest technologies used in intelligent building
3. Implement program and configure Arduino boards for various designs
4. Demonstrate Python programming and interfacing for Raspberry Pi.
5. To design IoT applications in different domains

Detailed Syllabus

Unit	Description	Duration (Hours)
1	**Introduction to Smart cities** Introduction to city planning, Concept, Principle stakeholders, key trends in smart cities developments	07
2	**Smart Cities Regulations** Understanding smart cities, Global Standards and performance benchmarks, Practice codes for smart city development	07
3	**Smart Cities Planning and Development** Smart city planning and development, Dimension of smart cities, Financing smart cities development, Governance of smart cities	07
4	**IoT in Construction** Introduction to Internet of Things, Characteristics of IoT, Physical design of IoT, Functional blocks of IoT, Sensing, Actuation, Basics of Networking, Communication Protocols, Sensor Networks.	08
5	**Introduction to Arduino Programming,** Integration of Sensors and Actuators with Arduino for smart city applications	08
6	**Introduction to Python and Raspberry pi for Smart Cities** Python programming, Introduction to Raspberry Pi, Interfacing Raspberry Pi with basic peripherals, Implementation of IoT with Raspberry Pi for Smart Cities and Smart Homes	08
	Total	45

Text Books:

1. Jo Beall (1997); "A city for all: valuing differences and working with diversity"; Zed books limited, London (ISBN: 1-85649-477-2).
2. UN-Habitat; "Inclusive and sustainable urban planning: a guide for municipalities"; Volume 3: Urban Development Planning (2007); United Nations Human Settlements Programme (ISBN: 978- 92-1-132024-4).
3. Arup Mitra; "Insights into inclusive growth, employment and wellbeing in India"; Springer (2013), New Delhi (ISBN: 978-81-322-0655-2).
4. "The Internet 'of Things: Enabling Technologies, Platforms, and Use Cases"(2018), by Pethuru Raj and Anupama C. Raman (CRC Press).
5. "Make sensors"(2014) Terokarvinen, Kemo, Karvinen and VilleyValtokari, 1st edition, Maker media.
6. "Internet of Things: A Hands-on Approach"(2018), by ArshdeepBahga and Vijay Madisetti.

Reference Books

1. "Urban Planning and cultural identity" (2004); William J. V. Neill, Routledge, London (ISBN: 0-415-19747-3)
2. "Remaking the city: Social science perspective on urban design"(2015) John S. Pipkin, Mark E. La Gory, Judith R. Balu (Editors); State University of New York Press, Albany (ISBN: 0-87395-678-8)
3. "Smart cities – Ranking of European medium-sized cities". Smart Cities. Vienna: Centre of Regional Science (2007) Giffinger, Rudolf; Christian Fertner; Hans Kramar; Robert Kalasek; NatašaPichler-Milanovic; Evert Meijers
4. "Draft Concept Note on Smart City Scheme". Government of India – Ministry of Urban Development (http://indiansmartcities.in/downloads/CONCEPT_NOTE_-.12.2014__REVISED_AND_LATEST_.pdf)
5. "Internet of Things: A Hands-On Approach"(2018) Vijay Madisetti, ArshdeepBahga,
6. "Fundamentals of Wireless Sensor Networks: Theory and Practice" (2018), Waltenegus Dargie,Christian Poellabauer, Beginning Sensor networks with Arduino and Raspberry Pi (2013) Charles Bell, A press.

e-References

1. Smart City Mission Guidelines, India, https://smartcities.gov.in/guidelines
2. Smart Cities – Management of Smart Urban Infrastructures by Coursera, https://www.coursera.org/learn/smart-cities
3. e-Learning Course on Smart City by edx, https://www.edx.org/course/smart-city

Program:	B. Tech. (Civil Engineering)			Semester:	VI		
Course:	Mechanical Electrical Plumbing (MEP) Systems (OEC-4)			Code:	BCI6604B		
Teaching Scheme				Evaluation Scheme			
Lecture	Practical	Tutorial	Credit	IE	MTE	ETE	Total
3	-	-	3	20	30	50	100

Prior Knowledge of:

- Basics of air conditioning
- Basics of Electrical Engineering
- Basics of Mechanical Engineering

Course Objectives:

After Completing this course, student will have adequate background :

1. To learn the concept of HVAC
2. To recognize the technologies used in electrical services
3. To understand the concepts of plumbing services
4. To learn the fire protection system

Course Outcomes: After learning the course, the students will be able to:

1. Analyse and design HVAC system
2. Implement the technologies used in electrical services
3. Apply plumbing services
4. Design fire protection system

Detailed Syllabus

Unit	Description	Duration (Hours)
1	**HVAC** Introduction to HVAC, Basic Components of Air-Conditioning and Refrigeration machines, Classification of Air-Conditioning System , Categories of Air Conditioning , Study of sychometric Charts , Load Calculation, Air Distribution System, Static Pressure Calculation, Hydronic System, VRF/VRV System, Air Conditioning Concepts, Ventilation systems.	07
2	**Basics of Electrical Implementations** General, Codes & Standards to be followed, Electrical equipment's and its application used in the installation, Means of electrical distribution for installation, Major electrical loads used in the installation, Electrical design calculations, Various design stages & Sequence of electrical design procedure.	08
3	**Electrical Analysis and Design** Major electrical loads used in the installation, Electrical design calculations, Various design stages & Sequence of electrical design procedure.	07
4	**Plumbing** Plumbing Systems, Design of Domestic Water Supply and Distribution System, Design of Sanitary Drainage System, Drawings – Plumbing Layouts.	08
5	**Fire Protection system** Introduction To Fire Fighting, Classification Of Fire (Description), Fire Extinguisher Types- Using Procedure And General Maintenance, Fire Protection	07

	Systems-1. Active 2. Passive Refuge Areas – Rules & Regulations.	
6	**Fire Alarm System** Designing of fire alarm system, NFPA, NBA & FSAI Code For Fire Fighting System Designing, Fire Fighting, Hydraulic Calculation For High Rise Buildings, Fire norms for new project construction.	**08**
	Total	**45**

Text Books:

1. Design of Mechanical & Electrical Systems. Trost, Pearson Publishing, ISBN 978-0-13097235-4 .
2. MEP Planning Manual : Become a Professional Construction Engineer : 1 (Arabmep H), ISBN-10 : 1677068930, ISBN-13 : 978-1677068937.
3. MEP Databook (Construction Databooks) Hardcover – 16 August 2000 by Sidney Levy, McGraw-Hill Education.
4. Electrical and Mechanical Services in High Rise Building (English, Paperback, Mittal A.K.), CBS Publisher and DistrubutorPvt.Ltd.

Reference Books

1. MEP Guide for Planning and Scheduling by Planningengineer.net
2. Handbook of Building Construction; Data for Architects, Designing and Construction Engineers, and Contractors byHool George, Publisher: Nabu Press.

e-Reference

1. Online Mechanical, Electrical and Plumbing Design Training Course by Advance Electrical Design & Engineering Institute (AEDEI) https://www.advanceelectricaldesign.com/
2. Revit MEP Essentials by CADD Centre, India. https://www.cloudkampus.com/clp/revit-mep-essentials
3. MEP Course by MEP Training Institute, India. https://www.mepcentre.com/course/mep
4. Foundation Course on Building MEP Services by MEPA (Mechanical Electrical Plumbing engineers Association) http://www.mepaworld.com/training

Program:	**B. Tech. (E&TC)**				Semester: **VI**		
Course : **Designing with Raspberry Pi (OEC-3)**					Code : **BET6601**		
Teaching Scheme				**Evaluation Scheme**			
Lecture	**Practical**	**Tutorial**	**Credit**	**IE**	**MTE**	**ETE**	**Total**
3	-	-	3	20	30	50	100

Prior Knowledge of
Basics of Programming
is essential.

Course Objectives:

1. To explain fundamentals of Raspberry pi (Rpi) and installation of OS in Rpi.
2. To demonstrate the Python programming and interfacing of sensors and actuators with Rpi
3. To describe the Node-RED tool used in Rpi and its applications.

Course Outcomes:

After learning the course, the students will be able to:

1. **Describe** the basic specifications and operating systems of Raspberry Pi.
2. **Illustrate** the usage of Node-RED tool for Raspberry Pi programming.
3. **Understand** the Python programming concepts
4. **Apply** the concepts of programming for sensor interfacing with RPi**.**
5. **Apply** the concepts of programming for actuator interfacing with RPi.
6. **Design** IoT based applications with Python programming and Raspberry Pi.

Detailed Syllabus

Unit	Description	Duration (Hrs)
1.	**Getting started with Raspberry Pi** Basic functionality of Raspberry Pi board, Physical design and specifications, GPIO Pin description of Rpi, Reading the datasheet of RPi, comparison of various Rpi models, Rpi as mini- computer. Introduction of various operating systems of Rpi, Installation of Raspbian/Noobs/OSMC operating system on Rpi, first boot and basic configuration of Rpi, Introduction to Linux commands required to configure Rpi, Overview of Graphic User Interface (GUI).	**8**
2.	**Getting started with Node-RED tool on Rpi** Prerequisite for Node-RED, Installing and upgrading Node-RED, Running Node-RED app locally and as a service on network, auto-start on boot, opening the editor, installation of various libraries for Node-RED, adding node, add debug node, wire the nodes, deploy the flow.	**6**
3.	**Programming the Raspberry Pi** Introduction to Python programming language: Python Programming Environment, Python Expressions, Strings, Functions, Data types in python, importing libraries, flow control, conditional statement, Loops.	**10**
4.	**Sensor interfacing with Rpi** Basics of sensors: What are sensors? Types of sensors Sensor interfacing: Temperature and Humidity sensor (DHT11), PIR Motion sensor, obstacle detection using Ultrasonic sensor, soil moisture sensor	**6**

5.	**Actuator interfacing with Rpi** Basics of actuators: What are actuators?, Their need in making a closed loop system Actuator interfacing: Electronic Relays, LED's, Buzzers/Fan, DC Motor, Stepper motor, LCD.	**7**
6.	**Case Study based following topics** Home Automation, Smart City, Smart Farming, Smart Transportation, Health and Lifestyle, Pollution Monitoring system	**8**
	Total	**45**

Text Books:

1. Gary Mitnick,"Raspberry Pi 3: An Introduction to using Python Scratch, javascript and more", 1st edition Createspace Independent publishing Platform 2017"
2. Tim Cox, "Raspberry Pi for python program cookbook" Packt Publishing Limited, 2nd edition, 2016"
3. John C. Shovic,"Raspberry Pi IoT Projects: Prototyping Experiments for Makers", 1st edition Apress Berkeley CA, 2016"

Reference Books:

1. Sean McManus, Mike Cook, "Raspberry Pi for Dummies", Wiley Publishers, 4th edition, 2021
2. Maik Schmidt, "Raspberry Pi: A Quick-Start Guide", The pragmatic programmers, 1st edition LLC, 2012
3. Simon Monk,"Programming the Raspberry Pi", 2nd Edition, McGraw Hill publications 2012.
4. Matt Richardson,"Getting started with Raspberry pi", 3rd Edition, Make community, LLC 2016
5. Derek Molloy,"Exploring Raspberry pi", 1st Edition, Wiley, 2016

MOOCs Courses:

1. https://onlinecourses.nptel.ac.in/noc20_cs66/preview
   https://onlinecourses.nptel.ac.in/noc22_cs74/preview

Program:	**B. Tech. (E&TC)**				Semester: **VI**		
Course : **Basics of Automotive Electronics**					Code : **BET6602**		
Teaching Scheme				**Evaluation Scheme**			
Lecture	**Practical**	**Tutorial**	**Credit**	**IE**	**MTE**	**ETE**	**Total**
3	-	-	3	20	30	50	100

Prior Knowledge of

- Electrical and Electronics

is essential.

Course Objectives:

1. To introduce Electronics Control Unit(ECU) used in Automotive applications.
2. To apply operatingprinciples of sensors and actuators used in automotive
3. To explore the role of electronic systems in Active and passive safety systems.

Course Outcomes:

After learning the course, the students will be able to:

1. To apply the concept of electronics systems in automotive applications.
2. To explore different sensors and actuators.
3. Illustrate vehicle motion control systems
4. Understand algorithms used in Engine Control System.
5. Describe the role of electronics in Active and passive safety systems.
6. Make use of automotive components, subsystems, and basics of Electronic Engine Control inthe automotive industry.

Detailed Syllabus

Unit	Description	Duration (Hrs)
1.	**Automotive Systems Overview:** Automotive vehicle technology, Present trends in automobiles with emphasis on increasing role of electronics and software, Overview of typical automotive subsystems and components, Body, Chassis, and Powertrain Electronics	**7**
2.	**Sensors :** Basic sensor arrangement, Types of sensors such as oxygen sensors, Crankshaft angle position sensors, Fuel metering/ vehicle speed sensors, Flow sensor, Temperature, Exhaust Gas Oxygen (O2/EGO), Air mass flow sensors, Throttle position sensor, Strain Gauge MAP sensor, Magnetic Reluctance Position Sensor, Hall effect Position Sensor, Engine Coolant Temperature (ECT) Sensor, Piezoelectric Knock Sensor. **Actuators :** Solenoids, Stepper Motors, Relays, Fuel Injector, EGR Actuator, Ignition System.	**9**
3.	**Vehicle Motion Control:** Typical Cruise Control System, Digital Cruise Control System, Digital Speed Sensor, Throttle Actuator, Digital Cruise Control configuration, Cruise Control Electronics (Digital only), Antilock Brake System (ABS).	**7**
4.	**Engine Control System:** Algorithms for engine control including open loop and closed loop control system, Electronic ignition, EGR for exhaust emission control.	**7**

5.	**Active and passive safety systems:** Body electronics including lighting control, Remote keyless entry, Immobilizers, Electronic instrument clusters and dashboard electronics, Antilock braking system, Computer vision based ADAS.	**7**
6.	**Future Automotive Electronic Systems:** Alternative Fuel Engines, Electric and Hybrid vehicles, Fuel cell powered cars, Collision Avoidance Radar warning Systems, Low tire pressure warning system, Voice Recognition Cell Phone dialing, Advanced Cruise Control, Stability Augmentation, Automatic driving Control.	**8**
	Total	**45**

Text Books:

1. William B. Ribbens, "Understanding Automotive Electronics- An Engineering Perspective", 7th edition, Butterworth-Heinemann Publications, 2017"
2. Ronald K. Jurgen, "Automotive Electronics Handbook", Mc-Graw Hill, 1999
3. oliver scheid , "Autosar Compendium, Part 1: Application & RTE", Create Space Independent Publishing Platform, 2015

Reference Books:

1. Robert Bosch, "Automotive Hand Book", 10th edition, Wiley Publications, 2018
2. Kiencke, Uwe, Nielsen & Lars, "Automotive Control Systems for Engine, Driveline and Vehicle", Second edition, Springer Publication, 2005
3. John F. Kershaw, James D. Halderman, "Automotive Electrical and Electronic Systems", 5th Edition, Pearson Prentice Hall, 2007
4. https://autosartutorials.com/
5. https://www.udemy.com/course/learn-autosar-from-scratch/

Program:	B. Tech. (All Programs)				Semester :	VI	
Course :	Multivariate Data Analysis Using R (OEC-4)				Code :	BAS6608	
Teaching Scheme					Evaluation Scheme		
Lecture	Practical	Tutorial	Credit	IE	MTE	ETE	Total
3	-	-	3	20	30	50	100

Prior Knowledge of

1. Descriptive Statistics
2. Inferential Statistics
3. Probability

is essential

Course Objectives:

1. This course aims at enabling the students to learn multivariate data collection, visualization, and preprocessing techniques for data science.

Course Outcomes:

After learning the course, the students will be able to:

1. **Apply** data preprocessing methods in R and generate quality data for analysis.
2. **Implement** R packages and related functions to data science to analyze multivariate data.
3. **Apply** different data visualization techniques to understand the multivariate data.
4. **Analyze** the multivariate data using dependent analysis methods using the R.
5. **Analyze** the multivariate data using independent analysis methods using the R.
6. **Develop** a model for Prediction and Decision Making for a data set.

Detailed Syllabus:

Unit	Description	Duration [Hrs]
1	**Data Wrangling** Understanding the multivariate data, Standardizing Variables, Accessing Databases with R Software, Merging multiple data sources into a single dataset for analysis, Dealing with Missing values, dealing with extreme outliers in data, discrepancies or removing.	**7**
2	**Multivariate Data and Multivariate Analysis** Calculating Summary Statistics for Multivariate Data: Means and Variances Per Group, Between-groups Variance and Within-groups Variance for a Variable, Between-groups Covariance and Within-groups Covariance for Two Variables, Calculating Correlations for Multivariate Data, The multivariate normal density function.	**8**
3	**Multivariate Data Visualization in R Software** Geometric projection techniques: Scatter plot matrix, Hyper box, Trellis display, Parallel coordinates, Icon-based techniques: Chernoff faces, Stick figures, Star plots, Color icons, Pixel-oriented techniques: Query-independent techniques: visualize the entire dataset, Query-dependent techniques: visualize a subset of data that are relevant to the context of a specific user query, Hierarchical techniques, Hybrid techniques	**8**
4	**Dependent Analysis** Multiple linear regression, Conjoint Analysis, Multiple Discriminant Analysis, Linear Probability Analysis, Multivariate analysis of variance (MANOVA), Canonical Correlation Analysis, Structural Equation Modeling	**7**

5	**Independent Analysis** Factor Analysis: Factor analysis model, the k-factor analysis model, Estimating the parameters in the k-factor analysis model. Cluster Analysis: Cluster analysis, K-means clustering, Displaying clustering solutions graphically, multidimensional Scaling, Correspondence Analysis	**7**
6	**Multidimensional Scaling** Models for proximity data, Spatial models for proximities: Multidimensional scaling, Classical multidimensional scaling, non-metric multidimensional scaling. **Linear Discriminant Analysis :** Loadings for the Discriminant Functions, Separation Achieved by the Discriminant Functions, A Stacked Histogram of the LDA Values, Scatter plots of the Discriminant Functions, Allocation Rules and Misclassification Rate.	**8**
	Total	**45**

Reference Books:

1. Montgomery and Runger, "Applied Statistics and Probability for Engineers", Wiley, India, 6 Edition, ISBN: 9788126562947.
2. R. Johnson, "Probability and Statistics for Engineers", Prentice India Ltd, 8 Edition, ISBN 13:978- 8120342132.
3. S.P.Gupta, "Statistical Methods", Papperbook publication, 43 edition, ISBN: 9788180549892, 8180549895.
4. Everitt and Hothorn , "Use R!" series on using R for multivariate analyses, An Introduction to Applied Multivariate Analysis with R.
5. Barbara G. Tabachnick, Using Multivariate Statistics (4th Edition), Allyn & Bacon; 4th edition (August 9, 2000), ISBN-10:0321056779.
6. Yasunori Fujikoshi, Vladimir V. Ulyanov, Ryoichi Shimizu, Multivariate Statistics: High-Dimensional and Large-Sample Approximations, John Wiley & Sons, 15-Aug-201, ISBN:0470539860

E-sources:

NPTEL Course lectures links:

1. https://nptel.ac.in/noc/courses/noc20/SEM2/noc20-ma53 (Introduction to R software)
2. https://nptel.ac.in/noc/courses/noc21/SEM1/noc21-ma37 (Descriptive statistics using R software)

Program:	**B. Tech (Mechanical)**			Semester : **VI**			
Course :	**3D Printing and Modeling (Open Elective-III)**			Code: **BME6603A**			
Teaching Scheme				**Evaluation Scheme**			
Lecture	**Practical**	**Tutorial**	**Credit**	**IE**	**MTE**	**ETE**	**Total**
3	**--**	**-**	**3**	**20**	**30**	**50**	**100**

Prior knowledge of

- Materials Engineering
- CAD software

is essential.

Course Objectives:

1. To understand the importance of 3D Printing process for various applications.
2. To be familiar with the different 3D printing process.
3. To create CAD model that satisfy product development/prototyping requirements.

Course Outcomes:

The Students will be able to,

1. Understand the meaning and generic steps of the 3D printing process.
2. Identify the effects of critical parameters in the Stereo lithography and Solid ground curing process.
3. Identify the effects critical parameters in the Laminated object manufacturing and Fused Deposition Modeling Process.
4. Identify the effects critical parameters in the Selective laser sintering process and Direct Energy deposition.
5. Develop the .STL file and create sliced model by using open source software
6. Understand the various application of 3D printing process.

Detailed Syllabus

Unit	Description	Duration (Hrs)
1.	**Introduction to 3D Printing:** Meaning of 3D Printing, The Generic/steps in 3D printing Process, Materials used in 3D Printing, Types of 3D Printing process and Benefits of 3D printing, Design for Additive manufacturing (DFAM).	**8**
2.	**Liquid based systems:** Stereo lithography apparatus (SLA): Specifications, parameters, process, working principle, photopolymers, photo polymerization, layering technology, laser and laser scanning, applications, advantages and disadvantages. Solid ground curing (SGC): Specifications, parameters, process, working, principle, applications, advantages and disadvantages.	**7**
3.	**Solid based systems:** Laminated object manufacturing (LOM): Specifications, parameters, Process, Working principle, Applications, Advantages and disadvantages. Fused Deposition Modeling (FDM): Specifications, Process, parameters, Working principle, Applications, Advantages and disadvantages.	**7**
4.	**Powder Based Systems:** Selective laser sintering (SLS): Specifications, process, parameters, working principle, applications, advantages and disadvantages. Direct Energy deposition (DED): Specification, parameters, process, working principle, applications, advantages and disadvantages.	**8**

5.	**Modelling in 3D printing:** Meaning of STL file, Special rules for the STL format, Meaning of Slicing, Components of Slicing software, Preparation of CAD models, Converting into STL file, slicing by using open source software.	**8**
6.	**Applications of 3D Printing:** Prototyping and manufacturing, Medical applications, Automotive applications, Aerospace & Defence applications, Constructions applications. Art and Jewellery applications.	**7**
	Total	**45**

Text Books:

1. Ian Gibson, David Rosen, Brent Stucker, Additive Manufacturing Technologies, Second Edition, Springer Publications, ISBN 978-1-4939-2112-6.
2. Vannessa Goodship , Bethany Middleton, Ruth Cherrington, Design and Manufacture of Plastic Components for Multi functionality, Elsevier Publications, ISBN: 978-0-323-34061-8.

Reference books:

1. Henrique Amorim Almeida and Paulo Jorge da Silva Bártolo, Mathematical Modeling of 3D Tissue Engineering Constructs, Springer International Publishing, ISBN: 978-3-319-45444-3.

Program:	**B Tech. (Mechanical)**					Semester : **VI**	
Course :	**Material Informatics (Open Elective-III)**					Code: **BME6603B**	
Teaching Scheme				**Evaluation Scheme**			
Lecture	**Practical**	**Tutorial**	**Credit**	**IE**	**MTE**	**ETE**	**Total**
3	**-**	**-**	**3**	**20**	**30**	**50**	**100**

Prior knowledge of :

1. Data Science
2. Machine Learning
3. Pyton / R programming

is essential

Course Objectives:

1. To Aquitaine students about materials, their properties, structure property relationship.
2. To create awareness about the importance of statistics in materials data analysis.
3. To imbibe significance of data science, machine learning in use, selection and analysis of materials.

Course Outcomes:

The Students will be able to,

1. Compare different materials based on their structures.
2. Interpret material property data and draw conclusions.
3. Apply statistical methods for materials data analysis.
4. Use programming languages like python/R programming for materials data analysis.
5. Apply machine learning algorithm for interpretation of materials data.

Detailed Syllabus

Unit	Description	Duration (Hrs)
1.	**Introduction to materials:** Classification of materials, structure of materials **:**Atomic structure, crystal structure and microstructure, material properties: Physical, Mechanical, Electrical, Magnetic etc.	**7**
2.	**Materials Information:** Structure property relationship**,** Applications and selection of materials, Analysis and synthesis of materials.	**7**
3.	**Statistics and Materials:** Basic probability and statistics, basic R/ Python , Inaccurcacies and error and its propagation, Descriptive data analysis, Probability distributions, Probability distributions using R/Python, Fitting functions to data: regression, testing significance of fit.	**8**
4.	**Experimental data:** Processing of experimental data using R/Python, R/Python for graphical handling of data and fitting.	**7**
5.	**Feature extraction:** Statistical features, Principal Component Analysis. Feature selection: Ranking, Decision tree - Entropy reduction and information gain, Exhaustive, best first, Greedy forward & backward, Applications of feature extraction and selection algorithms in materials Engineering.	**8**
6.	**Classification:** Decision tree, Random forest, Naive Bayes, Support vector machine. Regression: Logistic Regression, Support Vector Regression. Regression trees: Decision tree, random forest, K-Means, K-Nearest Neighbor (KNN). Applications of classification and regression algorithms in materials Engineering.	8

	Total	**45**

Text Books:

1. William D.Callister, ‘Material Science and engineering an introduction’, Wiley Publication, 2013
2. B Joshi, ‘Machine Learning and Artificial Intelligence’, Springer, 2020.
3. Emmanuel Paradis, ‘R for Beginners’, Open source online
4. Databases: MaterialsProject.org, MaterialsWeb.org
5. PYMATGEN, MPINTERFACES software for materials analysis.

Reference books:

1. O. Isayev, A. Tropsha and S. Curtarolo, ‘Materials Informatics: Methods, Tools, and Applications’, Wiley, 2019
2. K. Rajan, ‘Informatics for Materials Science and Engineering’, Elsevier, 2013
3. Solanki, Kumar, Nayyar , ‘Emerging Trends and Applications of Machine Learning’, IGI Global, 2018.

Program:	**B. Tech. (E&TC)**				Semester: **VI**		
Course : **Designing with Arduino platform (OEC-4)**					Code : **BET6603**		
Teaching Scheme				**Evaluation Scheme**			
Lecture	**Practical**	**Tutorial**	**Credit**	**IE**	**MTE**	**ETE**	**Total**
3	-	-	3	20	30	50	100

Prior Knowledge of
The Basics of programming
is essential.

Course Objectives:

1. To make the students aware of the Arduino platform in terms of the physical board, Arduino IDE and libraries.
2. To make the students aware of circuit prototyping, and interfacing of peripherals with Arduino.

Course Outcomes:

After learning the course, the students will be able to:

1. Summarize the features of the Arduino board.
2. Apply the programming concepts to the Arduino board.
3. Make use of analog and digital pins of Arduino
4. Develop a system to monitor the real-time parameters using Arduino.
5. Illustrate the Object detection using Arduino.
6. Realize the Sound sensing and distance measurement using Arduino.

Detailed Syllabus

Unit	Description	Duration (Hrs)
1.	**Knowing Your Arduino:** Introduction of Arduino Uno, Atmega328P,Arduino Shields, getting to know the Arduino Uno Pins, power, clock, Using the digital input and output pins, analog input and output pins, Introduction to Serial (UART) communications, I²C (TWI) communications, SPI communications	**7**
2.	**Arduino Ide And Programming Concepts.** An introduction to the Arduino IDE: Getting and installing the Arduino IDE and uploading a sketch to your Arduino. An introduction to Arduino programming, Understand the basic parts of an Arduino sketch, custom functions Creating custom functions and the return keyword, Using variables, constants, Introduction to control structures: The "if”,” while", "For”,” Switch" statement	**8**
3.	**Arduino Programming Hands On** Digital input/output - how to read the state of a button control an LED, Analog input/ output - how to read the state of a potentiometer and create a fading LED, Introduction to the RGB (color) LED, Wiring the RGB LED, RGB LED: creating colors, using a library to control an RGB LED with PWM.	**8**
4.	**Monitoring Real Time Parameters Using Arduino** Interfacing of Ultra -violet light sensor, RGB color sensor, DHT22 sensor, LM 35 to Arduino for monitoring the parameters like temperature, humidity, etc.	**7**

5.	**Interfacing With Arduino - I.** Introduction to detecting acceleration with the ADXL335, Plugging the ADXL335 directly in the Arduino, and detect its orientation, A demonstration of using the IR and PIR sensor with the Arduino	**7**
6.	**Interfacing With Arduino - II.** Introduction to the ultrasonic distance sensor, Wiring and understanding Trigger and Echo, and calculating distance. Introduction to the analog sound sensor, A demonstration and sketch of the analog sound sensor and the digital sound sensor. Case study elaborating the use of Arduino in various applications.	**8**
	Total	**45**

Text Books:

1. Arduino-Based Embedded Systems: By Rajesh Singh, Anita Gehlot, Bhupendra Singh, and Sushabhan Choudhury, CRC Press, Taylor & Francis Group, 1st edition 2017
2. Arduino Made Simple by Ashwin Pajankar, BPB Publication, 1st edition 2018.

Reference Books:

1. Exploring Arduino: Tools and Techniques for Engineering Wizardry,by Jeremy Blum ,Wiley Publication, 2013, 1st Edition, ISBN- 13: 978-1118549360,ISBN-10: 1118549368

Online Links :

https ://www.arduino.cc/en/Tutorial/HomePage
https://spoken-tutorial.org/tutorial-search/?search_foss=Arduino&search_language=English

Program: B. Tech. (E&TC)				Semester: VI			
Course: Communication Protocols for e-Vehicle				**Code: BET6604**			
Teaching Scheme				**Evaluation Scheme**			
Lecture	**Practical**	**Tutorial**	**Credit**	**IE**	**MTE**	**ETE**	**Total**
3	-	-	3	20	30	50	100

Prior knowledge of

- Fundamentals of computer networks
- Electric machines

Is essential

Course Objectives:

1. To make student understand basics of EVs, including EV Components, architecture, and energy management.
2. To make student able to compare various topologies of EV communication systems.
3. To introduce student about connectors and chargers in EV's
4. To make student to evaluate the impact of EVs in Connected Mobility and Autonomous Mobility

Course Outcomes: On completion of the course, learner will be able to–

1. Illustrate the EV Components and controlling units.
2. Understand the basics of EV Communication protocols & their need in e-Mobility business
3. Understand the fundamentals of EVSE Communication
4. Realize with Charging Communication in EVs
5. Apply the knowledge of e-Mobility through Indian Roadmap Perspective to various applications

Detailed Syllabus:

Unit	Description	Duration
1	**EV Basics** Overview of EVs and challenges, the architecture of EVs, EV market and promotion, infrastructure needs, energy sources used in EVs & HEVs, medium of power transfer (conductive and wireless), and wireless power transfer.	**07**
2	**EV Components** Battery Management System (BMS), BLDC Motors, Inverter Unit, Powertrain Unit and Couplers with Chassis, PDU (Power Distribution Unit), BCM (Body Control Module, ECU, and Tuning Parameters.	**07**
3	**EV Communication protocols** Communication Systems in EV (CAN and LIN), V2V, V2G and its applications in power systems, power saving & coordinated charging, the layout of power converters, electrification challenges	**08**
4	**Electric vehicle supply equipment (EVSE)** Basics of EVSE, EVSE Power Module selection and technical specification, Selection of EVSE Communication Protocol (PLC / Ethernet / Modbus/ CAN Module), Communication gateway	**08**

5	**Connectors and Chargers** Types of EV charging connectors, EV Plug Standards, Selection and Sizing of Common Types of Connectors and Applications, Selection of AC and DC charger types.	**07**
6	**Charging communication & e-Mobility** Communication Interface between the charger and CMS, CCS (Combined Charging System), CHAdeMO, Tesla, Specification of open charge point protocol, Connected Mobility and Autonomous Mobility, e-Mobility: Indian Roadmap Perspective, EV integration in smart grid, social dimensions of EVs.	**08**
	Total Hrs.	**45**

Text Books:

1. William Ribbens, Understanding Automotive. Electronics. An Engineering Perspective. 7th edition, 2017.
2. Jack Erjavec and Nathan Smith, Hybrid, Electric and Fuel-Cell Vehicles, 3rd Edition, 2022.
3. Tom Denton, Electric and Hybrid Vehicles, 2nd Edition, 2016.

Reference Books:

1. Wireless Communications Principles and Practice; by Theodore S Rappaport, Pearson Education, 2nd edition 2018
2. Iqbal Hussein, Electric and Hybrid Vehicles: Design Fundamentals, CRC Press, 2010.
3. Wei Liu (General Motors, USA), Hybrid Electric Vehicle System Modelling and Control, John Wiley & Sons, Inc., 2nd edition, 2017.
4. Teresa Donateo, Hybrid Electric Vehicles, , Published by ExLi4EvA,1st edition , 2017

NPTEL Links :

1. NPTEL course on Fundamentals of Electric vehicles: Technology & Economics, IIT Madras, Prof. Ashok Jhunjhunwala, Prof. Prabhjot Kaur, Prof. Kaushal Kumar Jha, Prof. L Kannan, https://nptel.ac.in/courses/108106170
2. NPTEL course on electric Vehicles - Part 1, IIT Delhi, Prof. Amit Jain, https://nptel.ac.in/courses/108102121
3. NPTEL Archives on Electricvehicles and renewable energy, IIT Madras, https://archive.nptel.ac.in/courses/108/106/108106182/
   Electric Vehicles Comprehensive Course, Udemy.com, https://www.udemy.com/course/electric-vehicles-comprehensive-course/

Program:	**B. Tech. (Mechanical)**					Semester **: VI**	
Course :	**Model Based System Engineering (Open Elective IV)**					Code **: BME6604A**	
Teaching Scheme				**Evaluation Scheme**			
Lecture	**Practical**	**Tutorial**	**Credit**	**IE**	**MTE**	**ETE**	**Total**
3	**-**	**-**	**3**	**20**	**30**	**50**	**100**

Prior knowledge of : – Not Required

Course Objectives:

1. Acquire Fundamentals of systems and subsystems which should include different processes, properties.
2. Develop structural and behavioural aspects of general diagramming.
3. Perform a functional analysis.
4. Construct systems engineering requirements.

Course Outcomes:

After learning the course, the students will be able to:

1. DESCRIBE the methods, Processes and practices of systems engineering.
2. UNDERSTAND Fundamentals of systems and subsystems.
3. DIFFERENTIATE between traditional document-based and model based systems engineering.
4. ANALYZE three pillars of MBSE: languages, methods, and tools.
5. CREATE models and diagrams using modelling language.
6. APPLY Model Based Systems Engineering (MBSE) approach to Engineering problems.

Detailed Syllabus

Unit	Description	Duration (Hrs)
1.	**Introduction to Systems Engineering** History / Background, Industrial revolution, Discover Systems Engineering, Systems Engineering definition INCOSE, V-Cycle. Cyber physical systems – Advantages, Necessity and its challenges: a) Security: Control of interfaces, emergent vulnerabilities. b) Data: Privacy, data capture, analysis, access issues, data adequacy and accuracy. c) Regulations and Standards: Policy, Standards. d) Life cycle Sustainment.	**8**
2.	**Fundamentals of MBSE :** Introduction, Systems, subsystems and levels, Concrete and abstract objects, Properties, States, event, process, behavior and fact, Systems of interest.	**8**
3.	**Three Pillars of MBSE :** Modelling methods, Modelling tools and Modelling language	**7**
4.	**Overview of System Modeling Language** SysML Diagram overview, General diagram concepts**,** the structural aspect and the behavioural aspect, The relationships between behavioural diagrams and structural diagrams	**8**
5.	**Process Modelling with MBSE** Approach, The Process Modelling Framework, Using the process modelling framework	**7**
6.	**Requirements Modelling with MBSE** Introduction, The Requirements modelling Framework, Using the Requirements modelling Framework (ACRE Process)	**7**
	Total	**45**

Text Books:

1. **SysML for Systems Engineering, A model-based approach**, Jon Holt and Simon Perry, 3rd Edition, The Institution of Engineering and Technology, 2019

Reference books:

1. **Practical Model-Based Systems Engineering**, Jose L. Fernandez and Carlos Hernandez, Artech House, 2019
2. **System Requirements Analysis**, Jeffrey O. Grady, Elsevier, 2nd Edition, 2016.
3. **Systems Engineering Fundamentals and Applications,** Reinhard Haberfellner, Olivier de Weck Ernst Fricke, Siegfried Vössner, Springer Nature Switzerland AG 2019.
4. **NASA Systems Engineering Handbook**, National Aeronautics and Space Administration NASA Headquarters Washington, D.C. 20546 December 2007.
5. **Systems Engineering: Design Principle and Models, Dahai Liu,** CRC Press Taylor & Francis Group, 2016.
6. **Systems Engineering Guidebook-A process for developing systems and Products,** James N Martin, CRC Press, 2000.
7. **INCOSE Systems Engineering Handbook: A Guide for System Life Cycle Processes and Activities**, Wiley, 2015.

Program:	**B. Tech. (Mechanical)**					Semester : **VI**	
Course :	**Electronics Cooling (Open Elective-IV)**					Code : **BME6604B**	
Teaching Scheme				**Evaluation Scheme**			
Lecture	**Practical**	**Tutorial**	**Credit**	**IE**	**MTE**	**ETE**	**Total**
3	**-**	**-**	**3**	**20**	**30**	**50**	**100**

Prior knowledge of

- Engineering Physics
- Electronics Components and its mountings
- Electronics Packaging

is essesntial.

Course Objectives:

1. To describe the need for thermal management of electronic components.
2. To introduce the fundamental heat transfer mechanisms of conduction, convection and radiation.
3. To introduce the concept of thermal resistance and illustrate its applications.
4. To provide simple equations and tabulate commonly used thermal properties to enable the learner to perform a first order analysis of heat transfer from an electronic package.
5. To describe various cooling methods typically used or considered.

Course Outcomes:

After learning the course, the students will be able to

1. Realize the need of thermal management of electronics.
2. Summarize sources of heat generation and modes of heat dissipation.
3. Apply the concept of electrical analogy to determine thermal resistance.
4. Examine the appropriate cooling methods as per the application.
5. Evaluate the cooling requirement of electronic packages.
6. Compare the methods of cooling employed in diverse electronics applications.

Detailed Syllabus

Unit	Description	Duration (Hrs)
1.	**Introduction to Thermal Management:** Electronics Component Packaging Trends, Sources of heat generation, Electronic component failure analysis, Need of Thermal Management, modes of heat dissipation	**7**
2.	**Heat Transfer Principals in Electronics Cooling:** Conduction Heat Transfer, Steady and Transient Conduction, Natural Convection in Electronic Devices, Forced Convection Heat Transfer, Radiation Heat Transfer	**7**
3.	**Thermal Resistance:** Concept of Electrical Analogy, Thermal Resistance of conduction, convection and radiation, Thermal Contact Resistance, Thermal resistance network, thermal interface material applications, thermal adhesives	**8**
4.	**Electronics Cooling Methods in Industry:** Thermal interface and phase change materials, Passive and novel air cooling approaches, microchannel, jet impingement, Thermoelectric Cooling, Immersion Cooling, Vapor Chambers, Cooling Techniques for High Density Electronics.	**8**
5.	**Evaluating Cooling Requirement:** Conduction cooling for chassis and circuit boards, Concentrated heat sources, distributed heat sources, Circuit boards with Aluminum Heat Sink, heat transfer across interfaces by conduction and convection	**8**
6.	**Electronics Cooling Applications:** Avionics, Data Centers, Mobile, High-Performance Computing, Automotive	**7**
	Total	**45**

Text Books:

1. Dave S. Steinberg, Cooling Techniques for Electronic Equipment, a Wiley-Interscience Publication, John Wiley & Sons, Inc, 1991
2. S M Sohel Murshed, Electronics Cooling, ExLi4EvA Publication, 2016.

Reference Books:

1. Y.A. Cengel and A. J. Ghajar, Heat and Mass Transfer – Fundamentals and Applications, Tata McGraw Hill Education Private Limited, 2019
2. F.P. Incropera, D.P. Dewitt, Fundamentals of Heat and Mass Transfer, John Wiley, 2009
3. J. P. Holman, Heat Transfer, McGraw – Hill publications, 2008

Program:	**B. Tech (All Branches)**			Semester: **VI**			
Course : **Entrepreneurship Development**				Code : **BHM6116**			
Teaching Scheme				**Evaluation Scheme**			
Lecture	**Practical**	**Tutorial**	**Credit**	**IE**	**MTE**	**ETE**	**Total**
2	-	-	2	30	-	20	50

Course Objectives:

This course aims at enabling students:

1. To understand the role and importance of entrepreneurship for economic development
2. To seek necessary knowledge and develop skills required for organizing and carrying out entrepreneurial activities.
3. To develop the ability to analyze and understand business situations in which entrepreneurs act.

Course Outcomes:

After learning the course, the students will be able to:

1. **Understand** the entrepreneurship as an opportunity
2. **Optimize** the business opportunities that suit aspirant entrepreneurs
3. **Appraise** the financial schemes and support systems for Entrepreneurship Development.
4. **Design** a comprehensive business plans.

Detailed Syllabus

Unit	Description	Duration (Hrs)
1.	**Introduction to the Entrepreneurship Development :** Concept and definition of Entrepreneurship, The concept of Opportunity Window, Challenges and Misconceptions Related to Entrepreneurship with Indian Context, McClelland's Need Achievement Theory, Concept of Entrepreneur, Entrepreneurship as a Career, Traits of Successful Entrepreneur, Types of Entrepreneur (proprietary, partnership, collaboration etc), Entrepreneur v/s Intrapreneur, Woman Entrepreneur – A Paradigm Shift , Factors Affecting Entrepreneurship, Types of Enterprises and their Features: Manufacturing, Service and Trading Case Study: Indian Entrepreneurs Pre and Post Covid World, Success stories for few Entrepreneurs.	**8**
2.	**Entrepreneurial Opportunities and Process Selection:** Concept of Business Opportunity, How to Generate Business Ideas? Identification of Ideal and Viable Business Opportunities, Elements of a good business idea. the entrepreneurial process, Challenges in the Selection of Business Opportunities, Business Opportunities Identification Process, Required Licenses, Approvals and Expertise, Business Value Chain, Different Sections of the Business Value Chain for Potential Opportunities, Understanding Product Costs and Operations Costs; Legal Aspects.	**8**

3.	**Finance and Support Systems:** Raising Capital, Venture Capital, Angel Investors, Seed Funding, Role of Government in Promoting Entrepreneurship in India, Start-up India, Atmanirbhar Bharat, Make in India, Assistance to an Entrepreneur, Industrial park, Special Economic Zone, MSME Act, MSME Policy in India, Financial Assistance to MSME, Various Government Schemes - PMEGP, CGTMSE, PMKVY, Mudra Loan, Incubation, Role of Incubation Centers, Support from Incubation Centers	**7**
4.	**Business Plan:** Concept and definition of Business Plan, Contents of Business Plan: Executive Summary, Business Concept, Business Strategy, Management Summary, Marketing Plan, Operations Plan, Financial Plan, Presenting Business Plan, Procedure for setting up an Enterprise, Why Do Some Business Plans Fail?	**7**
	Total	**30**

Text Books:

1. C. B. Gupta and N. P. Srinivasan, Entrepreneurial Development, Sultan Chand & Sons, New Delhi, 2008

Reference Books:

1. Dr. Radha, Entrepreneurial Development, Prasana Publishers, Chennai, 2007.
2. S.S.Khanka, Entrepreneurial Development, Sultan Chand & Co., Ltd., New Delhi 2005.
3. Stevenson, H. Perspective on entrepreneurship. Boston: Harvard Business Press, 2007

E-sources:

1. https://www.entrepreneur.com/
2. http://dst.gov.in/scientific-programme/t-d-tdb.htm
3. https://www.youtube.com/

Program:	**B. Tech (All Branches)**					Semester: **VI**	
Course : **Financial Management**						Code : **BHM6115**	
Teaching Scheme				**Evaluation Scheme**			
Lecture	**Practical**	**Tutorial**	**Credit**	**IE**	**MTE**	**ETE**	**Total**
2	-	-	2	30	-	20	50

Prior Knowledge of

- Basic Financial Literacy

is essential.

Course Objectives:

This course aims at enabling students:

1. To develop an understanding of day-to-day working capital decisions; and also longer-term dealing, involving major capital investment decisions and raising long-term finance.
2. To improve students'understanding of the time value of money concept and the role of finance in the current competitive business scenario.

Course Outcomes:

After learning the course, the students will be able to:

1. **Understand** the basics of financial management and its terms and concepts
2. **Understand** financial markets and the role of financial institutions
3. **Apply** knowledge of capital budgeting; its allocation, management and funding.
4. **Analyse** financial statements and read documents and books of accounts.

Detailed Syllabus

Unit	Description	Duration (Hrs)
1.	**Introduction to Financial Management:** Concept of Business Finance, Goals & Objectives of the Firm, Objective function in Finance, Traditional and Modern Approaches to Financial Management, Financial Planning - Principles and Steps in Financial Planning and its practical approach.	**7**
2.	**Financial Markets, Institutions and instruments:** Introductions to Financial Markets – Nature –Functions and Types of Financial markets, Different Financial Instruments, Sources of financing -Shares, Debentures, Term Loans, Lease & Hire, Purchase, Retained Earnings, Public Deposits, Bonds (Types, Features &Utility), Introduction; Bank Finance, Trade Credit & Bills Discounting, Interest Rates Introduction to Bank Finance.	**8**
3.	**Time Value of Money and capital budgeting:** Cash Flow, Time Line, Stream of Cash Flow, Timelines for cash flow, Annuities, Perpetuities Need and Importance of Capital Budgeting, Different Techniques of Evaluating the Project on the Basis of Payback Period, ARR, NPV,IRR,PPP	**8**
4.	**Financial Statement Analysis:** Reading Financial Statements Purpose and Parties involved, Concept of Financial Statements: Balance Sheet, Profit and Loss Statement, Cash Flow Statement, Assets, Tools of Analysis of Financial Statements: Comparative Statements, and Ratio analysis.	**7**
	Total	**30**

Text Books:

1. Prasanna Chandra, Financial Management, Tata McGraw Hill, 2011

Reference Books:

1. Agrawal M R, Financial Management, Garima Publications, Jaipur, 2021
2. Khanand Jain, Financial Management, Tata McGraw Hill, 2008
3. Paramasivan C, Subramanian T, Financial Management, New Age International(L) Publishers, 2017
4. R.M.Srivastava, Financial Management, Himalaya Publishers, 2005
5. Vanhorne J, Financial Management & Policy, Pearson Education, Delhi, 2015
6. Gupta Pratik, Arora Amit, Financial Management, Vayu Education of India, 2020

E-sources:

1. https://www.youtube.com/watch?v=TgF2XvjquUU&list=PLLy_2iUCG87CXY2B6fPex1SOIqxzzD5Wj
2. https://www.youtube.com/watch?v=CCQwz_Gwo6o
3. https://www.youtube.com/watch?v=OT5RdoJAkhY&list=PLPjSqITyvDeUTeAOGhip_ubjN3y8oqT13

Program:	**B. Tech (All Branches)**			Semester: **VI**			
Course : **Project Management**				Code : **BHM6114**			
Teaching Scheme				**Evaluation Scheme**			
Lecture	**Practical**	**Tutorial**	**Credit**	**IE**	**MTE**	**ETE**	**Total**
2	-	-	2	30	-	20	50

Course Objectives:

1. To help the students gain understanding regarding the concept of projects and Project Management
2. To enable the students to know the key components of project management including project time, cost & Risk management.
3. Recognize issues in a realistic project scenario.

Course Outcomes:

After learning the course, the students will be able to:

1. **Understand** how to initiate, define and organize a project.
2. **Optimize** results while managing the triple constraints.
3. **Apply** appropriate approaches to plan a new project and develop project schedule
4. **Analyze** and Monitor the risk associated with various project

Detailed Syllabus

Unit	Description	Duration (Hrs)
1.	**Introduction to Project Management:** Concept and Definition of Project, Characteristics of Project, Concept and definition of Project Management, Functions of Project Management, Importance of Project Management, Who is a Project Manager, Roles & Responsibilities of Project Manager. Understanding the Phases in the Lifecycle of Projects and their Significance, Different types of Projects: Industrial, Telecommunication, Research and more, Project Selection Methods : Agile method & Waterfall methods	**8**
2.	**The Triple Constraint in Project Management :** The concept of the Triple Constraint in Project Management : Scope, Cost and Time, Project Cost Management : Concept, Consideration, Five types of Costs involved in a project, Cost Management process, Project Time Management and methods of Time estimation, Communications Management in Project , Work Breakdown Structure (WBS). Case studies based on Mega Projects of the World.	**7**
3.	**Planning and Execution of Project:** Developing a Mission, Vision, Goals of the project. Concept and definition of Project Planning. Importance of Project Planning. Concept and definition of Network Scheduling ,Critical Path Method, Concept of Project Execution, Phases of Project Execution, Project Evaluation; The Review Technique – Planning and Scheduling of Activity Networks - Concept of PERT/CPM, Assumptions in PERT Modeling – Time-cost, Trade-offs, HRM issues in Project Management & How they can be tackled, Quality Circle, Reasons for Failures of Project , Case Study with respect to different Domains	**8**
4.	**Project Monitoring and Risk Management :** Concept of Project Monitoring , How to Building a Suitable Monitoring; Control System, Concept of Conflict Management, Concept & Definition of Risk and Risk Management, Concept of Risk Matrix Analysis, Strategies to Manage Risks, An Overview of Useful Techniques and Tools Used in Project Management. Case Studies	**7**

	Total	**30**

Text Books:

1. Joseph Heagney, Fundamentals of Project Management, American Management Association, 2012

Reference Books:

1. Erik W Larson, Clifford Gray, Rohit Joshi; Project Management-The managerial process, MacGraw Hill Publication, 2021
2. Punmia, Project Management with CPM /PERT, Laxmi Publications, 2001
3. Robert L Kimmons, Project Management Basics, Taylor & Francis Ltd, 2018
4. N. D. Vohra, Quantitative Techniques in Management, Tata McGraw Hill Book Co. Ltd

E-sources:

1. https://www.youtube.com/watch?v=RjOA7AxOVj8&list=PLLy_2iUCG87AUusGVo2wsXvRZ4zlbbKUu
2. https://www.youtube.com/watch?v=W2EdffbwgcM&list=PL3MO67NH2XxIRneBXA3yA1RacZQIuX7Yl
3. https://www.youtube.com/watch?v=RQNZWCl6eXI&list=PLBd76GK9sWTwVXm9FlVHOTXXbGY2vZR8z

Program:	B. Tech. IT			Semester:	VI		
Course : Advance Web Technology					Code : BIT6911		
Teaching Scheme				Evaluation Scheme			
Lecture	Practical	Tutorial	Credit	IE	MTE	ETE	Total
-	2	-	0	-	-	-	-

Prior Knowledge of
Java Programing (PFC- II)
Is essential

Course Objectives:

1. To know Servlet life cycle in Java.
2. To build interactive & complex web applications.
3. To know how a Single Page React application works .
4. To develop an application from scratch using React.

Course Outcomes:

After learning the course, the students will be able to:

1. Compare and implement the concepts of server-side technologies for dynamic web applications.
2. Implement an interactive Web application using HTML forms and JSP.
3. Build a website using React components.

Detailed Syllabus

Unit	Description	Duration (Hrs)
1.	(A) Develop an application using HTTP servlet to process the form data. (B) Write a program that creates an HTTP servlet to perform session tracking	6
2.	(A) Write a program using the request.getParameter() method to enter the Name and Password of a user and display the output on another JSP page. (B) Write a JSP application to count the total number of visits on your website	6
3.	Develop a React E-commerce website using (A) Product screen (B) Product Details Screen (C) Shopping cart Screen	12
	Total	**24**

Text Books:

1. Head First Servlets and JSP, 2nd Edition, O'Reilly Media,ISBN: 9780596516680.
2. AngularJS Book by Brad Green and Shyam Seshadri ISBN ISBN · 9781449344856
3. Learn React Hooks: Build and Refactor Modern React.js Applications Using Hooks/ISBN 9781838640514

Reference Books:

1. Head First Java- A Brain-Friendly Guide, 3rd edition, 2022, ISBN : 9781491910771
2. Java: The Complete Reference, Author: Herbert Schildt , 11th Edition,2018, ISBN:9781260440232
3. Pro Angular JS - Wiley India ,ISBN: 9788132230960.
4. Fullstack React: The Complete Guide to ReactJS and Friends, Author: Anthony Accomazzo, Ari Lerner, and Nate Murray, ISBN 9780991344628
5. https://www.udemy.com/course/react-js-basics-to-advanced/ online course
6. https://blog.glitch.com/post/react-starter-kit online free course

Program:	B. Tech. (All Branches)			Semester :	VI		
Course :	Professional Development Training-II			Code : BHM6918			
Teaching Scheme				Evaluation Scheme			
Lecture	Practical	Tutorial	Credit	IE	MTE	ETE	Total
3	-	-	-	-	-	-	-

Course Objectives:

This course aims at enabling the students

1. To enhance the logical reasoning skills of the students and improve the problem-solving abilities.
2. To improve the overall professional development of students.

Course Outcomes:

After learning the course, the students will be:

1. Having adaptive thinking and adaptability through various Quantitative ability concepts.
2. Having critical thinking and innovative skills

Having interest in lifelong learning & developing verbal competencies in the students.

Detailed Syllabus:

Unit	Description	Duration (Hrs)
1.	**Modern Maths** Profit loss, Ratio & Proportion, LCM & HCF, Time speed and Distance, Average, Mean, mode, median, permutation & combination, Probability, Pipe & systems, Mixture validation, Allegations and Mixtures, Simple Interest and Compound Interest.	6
2.	**Algebra** Linear equations, Quadratic equations, Triplets. **Geometry** Triangles, Polygons (questions on Area Perimeter).	6
3.	**Mensuration** Cube cuboids cone cylinder sphere (questions on volume surface Area) **Trigonometry** **Number System** **Statistics.**	6
4	**Logical Reasoning** Clocks and Calendar, Direction sense, Family tree, Syllogism, Seating arrangement, Team formation, Coding and Decoding, Number Series and Letter Series, Ranking and Arrangements, Game-Based Aptitude.	6
5	**Data Interpretation** Data charts, Data tables, Bar, Pie, Line graphs, Venn diagram.	6
6	**Verbal Ability & Reading Comprehension** Subject-Verb Agreement, Articles and Other Determiners, Prepositions, Tenses, Parts of Speech, Active and Passive Voice, Direct and Indirect Speech, Error Spotting and Sentence Correction, Sentence Completion, Synonyms and Antonyms, Reading Comprehension, Para Jumbles.	6
	Total Hrs	**36**

Reference Books:

1. Arun Sharma, Quantitative Aptitude, 2016, 7th Edition, McGraw Hill Education Pvt. Ltd.
2. ETHNUS, Aptimithra, 2013, 1stEdition, McGraw-Hill Education Pvt.Ltd.
3. R S Aggarwal, Quantitative Aptitude For Competitive Examinations, 2017, 3rd Edition, S. Chand Publishing, Delhi.
4. M. Tyra, Quicker Maths, 2018, 5th edition, 2018, BSC publishing company Pvt. Lt.

Program: B. Tech. (All Branches)				Semester: VI			
Course : Emotional Intelligence				**Code :BHM9963**			
Teaching Scheme				**Evaluation Scheme**			
Lecture	**Practical**	**Tutorial**	**Credit**	**IE**	**MTE**	**ETE**	**Total**
1	-	-	-	-	-	-	-

Prior knowledge: Nil

Course Objectives:

1. To develop an awareness of Emotional Intelligence models
2. To understand intelligence and develop emotional competence
3. To understand how you use emotion to facilitate thought and behaviour
4. To know and utilize the difference between reaction and considered response

Course Outcomes:

After completion of this course, the students will be able to,

1. Understand how to manage emotions, behaviour and self-control in any situation resulting in better productivity
2. Employ emotional intelligence competencies to effectively interact with people, colleagues and employees in building stronger relationships at work and at home
3. Articulate emotions using the right verbal and non-verbal language
4. Use tools to regulate their emotions and recognize and respond appropriately to emotions in self and others.

Detailed Syllabus:

Unit	Description	Duration (H)
1	**Introduction to Emotional Intelligence (EI):** What is Emotional Intelligence, Emotional Intelligence and various EI models, The EQ competencies of self-regulation, motivation, empathy and interpersonal skills, Understand EQ and its importance in life.	3
2	**Self-awareness (SA):** Seeing the other side, giving in without giving up. **Tools** : Think, Feel, Act Cards, Plutchik's Wheel of Emotions& Emotional intelligence test **Self-Regulation/Managing Emotions:**The science of Emotions, Self-emotional quotient	3
3	**Gaining Control:** Use of Coping Thoughts and Relaxation Techniques to manage emotions**,** **Activities:** Be the Fog, Temperament Analysis. **Emotion recognition in others:** The universality of emotional expression, perceiving emotions accurately in others to build empathy **Activities :** Mindful Listening, Perceptual Positions	3

4.	**Emotional Intelligence at Work place:** Importance of Emotional Intelligence at Work place, role of empathy and trust in relationships, building effective work relationships,conflict resolution strategy, Cohesive team building, **Tests** : My Colored Hat, ―I Am‖ Circle, Empathy Cards	**3**
	Total	**12**

Text Books:

1. Daniel Goleman, ―Emotional Intelligence – Why It Matters More Than IQ,‖, Bantam, 10th Anniversary edition, 2005, ISBN: 978-0553383713
2. Steven C. Hayes, Spencer Smith, ―Get Out Of Your Mind And Into Your Life: The New Acceptance and Commitment Therapy‖, Read How You Want, [Large Print] edition, 2009, ISBN-13 : 978-1458717108

Reference Books:

1. Steven Stein, ―The EQ Edge‖, Jossey-Bass, 3rd edition, 2011, ISBN-13: 978-0470681619
2. Drew Bird , ―The Leader‘s Guide to Emotional Intelligence‖, Createspace Independent Pub, Kindle Edition, 2016, ISBN-13 : 978-1535176002

Program: B. Tech. (All Branches)				Semester : VI			
Course: Entrepreneurship Development				**Code :BHM9964**			
Teaching Scheme				**Evaluation Scheme**			
Lecture	**Practical**	**Tutorial**	**Credit**	**IE**	**MTE**	**ETE**	**Total**
1	-	-	-	-	-	-	-

Prior knowledge : Nil

Course Objectives:

1. To inspire students and help them imbibe an entrepreneurial and start-up mind-set
2. To develop and strengthen entrepreneurial quality among students.
3. To understand the abilities to become an Entrepreneur.
4. To acquaint with legalities in product development, IPR, Trademarks, Copyright and patenting
5. To know the facets of Business plans, Entrepreneurial Finance

Course Outcomes:

After learning the course, the students will be able to:

1. Develop an entrepreneurial mind-set by learning key skills such as product design, salesmanship, marketing and interpersonal skills.
2. Interpret their own business plan and analyse factors that contributed to the failure of a start-up
3. understand how to determine the best source of capital for a company and how to find revenue and expense assumptions
4. Understand the legalities in product development, IPR, Trademarks, Copyright and patenting

Detailed Syllabus:

Unit	Description	Duration (H)
1	**Concept and Scope:** Entrepreneurship as a career, Traits of Successful Intrapreneur/ Entrepreneur, Why to become entrepreneur, Entrepreneurship Development Phases, Problem Solving and Ideation Process, Design Validation, Types of Start-ups	3
2	**Creating Entrepreneurial Venture :** Sources of Innovation, methods of generating ideas, Prototype preparation and validation, Legal Issue, Private/Public Limited Company formation requirements, Intellectual Property Protection: Patents Trademarks and Copyrights, **Entrepreneurial Failure** : Case study of patterns, Early failures: Good idea bad planning, False start , False positive, Late-stage failures: Speed trap, Cascading miracle , False confidence	3
3	**Business Plan Preparation:** Sources of product for business: Feasible study, Ownership, capital, budgeting, Marketing plan for the new venture, steps in preparing	3

	marketing plan, Business Model Canvas (BMC), Financial plan- proforma income statements, Ratio Analysis.	
4	**Financial Modeling and Metrics:** Spreadsheets, Benchmarks, Revenue assumptions, expense assumptions, Metrics customer Acquisition cost and life time model, Metrics viral coefficient, Funnel Analysis, **Entrepreneurial Finance:** venture capital, financial institutions supporting entrepreneurs, Lease Financing; Funding opportunities for Start-ups in India, Crowdfunding, Angel investing	**3**
	Total	**12**

Text Books:

1. Kumar Arya, ―Entrepreneurship: Creating and Leading an Entrepreneurial Organization‖, Pearson Education India, First edition, 2012, ISBN-10: 8131765784; ISBN-13: 978-8131765784
2. S.S.Khanka, ―Entrepreneurial Development‖, S Chand and Company Limited, Revised 2012th edition, 2012, ISBN : 81-219-1801-4

Reference Books:

1. Taneja, Gupta, Entrepreneur Development New Venture Creation‖, Galgotia Publishing Company, 2nd edition. 2017, ISBN: 9788185989594
2. Charantimath, Poornima, ―Entrepreneurship Development and Small Business Enterprises‖ Pearson Education, 3rd edition, 2018, ISBN: 8177582607, 9788177582604
3. Blake Masters and Peter Thiel, ―Zero to One‖, Plata Publishing, 2nd edition, 2014, ISBN-10 : 9780804139298 - ISBN-13 : 978-0804139298

Program: B. Tech. (All Branches)				Semester: VI			
Course: Research Article Writing				Code: BHM9965			
Teaching Scheme				Evaluation Scheme			
Lecture	Practical	Tutorial	Credit	IE	MTE	ETE	Total
1	-	-	-	-	-	-	-

Prior knowledge: Nil

Course Objectives:

1. To understand about how to write effective research article
2. To create awareness about grammar, lexical choices, citations in the text
3. To develop a full-length article, proposal or conference presentation
4. To familiarize the basic methods and techniques of research writing

Course Outcomes:

After completion of this course, the students will be able to,

1. Understand necessary traits to write effective research article with appropriate grammatical and lexical choices in text
2. Comprehend the importance of citations, indexing, indexed articles and plagiarism
3. Develop an ability of critical thinking necessary to analyse a research reports
4. Write a research article, review article, thesis chapter and other related academic research text effectively and demonstrate importance of revising and proofreading for writing research article

Detailed Syllabus:

Unit	Description	Duration (H)
1	**Introduction to Research Writing:** What is a research article? Understanding what is _Research Writing‘, Qualities and skills required in a Research writer, Types of Research writing, choosing a suitable journal/conference/book chapter, How to conduct an effective Research, Abstract Writing, Selection of keywords, defining problem statement.	3
2	**Sources of citations:** Understanding of giving citation to other works, Identifying relevant citations, Understanding impact factor, Importance of Indexing and Indexed articles, learning to scan research articles quickly and effortlessly, Using Your Sources Wisely**:** what to cite, where to find good sources and how to use them, avoiding plagiarism **Plagiarism tools**: iThenticate, Grammarly **Citation Tools :**Mendeley, ,BibMe, Citefast, APA, MLA	3

3	**Drafting:** Structure of a basic research paper, stages of writing and research, learn to write the first draft, Understanding the components of an article: Abstract, Introduction, Preliminary concepts, proposed system, Experimental section, result analysis and discussion, Conclusion, Reference.	**3**
4	**Revising and Editing:** Importance of revision, Understanding the comments of reviewer, Point-to-Point address of reviewer comments, What/Whatnot to revise, Emphasis on Journal formats, Proper usage of Grammar and sentence formatting, Steps for submitting the revised manuscript/article	**3**
	Total	**12**

Text Books:

1. Charles A. MacArthur , ―Handbook of Writing Research‖, The Guilford Press; 2nd edition, 2016, ISBN- 10: 1462529313, ISBN-13: 978-1462529315
2. Margaret Cargill, Patrick O'Connor, ―Writing Scientific Research Articles‖, Wiley-Blackwell, 2nd Edition, 2013, ISBN: 978-1-118-57070-8

Reference Books:

1. Booth W., Colomb G. and Williams J., ―The Craft of Research‖, University of Chicago Press,4th edition, 2016, ISBN-13: 978-0226239736
2. Jennifer Peat, Elizabeth Elliott, Louise Baur, Victoria Keena ,―Scientific Writing Easy when you know how‖, Wiley & Sons, Inc, 2nd edition, 2013, ISBN:9780727916259

Vision and Mission of Department

VISION

To develop Information Technology professionals through Quality Education with dedicated faculty.

MISSION

Foster the development of Information Technology professionals with focus on Excellent Academics, Research Aptitude, Overall Personality Development and Social Awareness.