

# **NGF College of Engineering & Technology**

## **Overview of the Department of Computer Science (DCS)**

Welcome to the Department of Computer Science (DCS), where innovation meets education. Our department is dedicated to providing students with a comprehensive understanding of both the theoretical and practical aspects of computing and technology. DCS has programs that have a presence in every field of life and, in the last two decades, has shown immense potential and growth, benefiting individuals and industries alike. Today, we cannot imagine our lives without computers and computing technology.

The Department is headed by Prof. (Dr.) Kuldeep Tomar has been a pioneering force since the establishment of the college. Under his leadership, the department has developed in leaps and bounds, continuously adapting to the rapidly changing landscape of information technology. As we move forward into the new millennium, it is crucial to remain abreast of the latest developments in computer technology, and the department is focused on guiding students in the right direction to meet these challenges.

At DCS, students explore the fundamental principles of computer science, alongside advanced techniques that are essential for the development of practical systems. This includes studying core areas such as algorithms, data structures, programming, artificial intelligence, machine learning, software engineering, and more. As we venture deeper into the digital age, DCS continues to transform various sectors like healthcare, finance, entertainment, education, and more, proving its undeniable impact on modern life.

The department has been committed to ensuring that both its curriculum and its students are in line with the latest industry trends and demands. It has been a consistent endeavour of the department to adapt itself and its students to mirror the evolving requirements of the Information Technology environment, both in India and internationally. By focusing on cutting-edge technologies and industry best practices, we equip our students to become leaders in the field of computer science and engineering.

Our faculty consists of highly qualified and experienced professionals who bring a wealth of knowledge and research expertise into the classroom. With a focus on both foundational knowledge and cutting-edge advancements, our department ensures that students are well-equipped to tackle challenges and shape the future of technology.

We emphasize hands-on learning, providing students with numerous opportunities to engage in real-world projects, internships, and research activities. Our state-of-the-art laboratories and modern teaching methods prepare students for careers in a fast-paced and ever-evolving technological landscape.

The Department fosters a collaborative environment, encouraging students to work together, think critically, and apply their knowledge to solve complex problems. Our diverse and dynamic curriculum is designed to meet the demands of the global tech industry, as well as the growing need for expertise in research and innovation within computer science.

## **Programs Offered by Department of Computer Science**

### **Undergraduate Programs**

#### **1. B.Tech in Computer Science and Engineering (CSE)**

- This program provides a comprehensive understanding of computer science and engineering fundamentals, software development, algorithms, data structures, and modern technologies.
- **Key Areas:** Programming languages (C, C++, Python), database management, operating systems, computer networks, artificial intelligence, Cyber Law and web development etc.

#### **2. B.Tech in CSE (Artificial Intelligence and Machine Learning (AI & ML))**

- This specialized program focuses on the rapidly growing field of AI and ML, equipping students with skills in data modelling, deep learning, and intelligent systems.
- **Key Areas:** AI & Expert Systems, IOT, Big Data Analysis, Data Structures, COA, Operating Systems, DBMS, CN, Neural networks, natural language processing, data science, predictive analytics, and automation etc.

#### **3. Bachelor of Computer Applications (BCA)**

- The BCA program is designed to provide a strong foundation in computer applications and software development.
- **Key Areas:** Programming languages (C, C++, Java, Python), database management, web development, DE, CN, LOC, Wireless communication and software engineering etc.

#### 4. **BCA in Data Science**

- This program focuses on data analysis, visualization, and interpretation, preparing students for the data-driven world.
- **Key Areas:** Programming languages (C, C++, Java, Python, R programming), AI, database management, web development, DS, CN, CO, Wireless Communication, , machine learning, big data processing, and data visualization tools etc.

#### **Postgraduate Program**

#### 5. **M.Tech in Computer Science and Engineering (CSE)**

- The M.Tech program offers advanced-level education in computer science, focusing on research, development, and innovation.
- **Key Areas:** Advanced algorithms, distributed computing, Cloud computing, Cybersecurity, ML, IS, NLP, data analysis, Software Testing, Research Methodology, Advanced wireless & Mobile Networks etc.

#### **Key Highlights of the Department**

- **State-of-the-art labs** equipped with the latest hardware and software technologies.
- **Industry collaborations** with tech giants for internships, placements, and projects.
- **Research opportunities** in AI, data science, cloud computing, and cybersecurity.
- **Workshops, hackathons, and seminars** to foster practical skills and innovation.
- **Career support and guidance** through placement drives and training programs.

The **Department of Computer Science** is committed to empowering students with the knowledge and skills necessary to thrive in the ever-evolving tech industry. If you're passionate about developing software solutions, understanding the inner workings of computers, or pushing the boundaries of artificial intelligence, the Computer Science Department provides the foundation, resources, and opportunities for you to thrive.

*Join us as We continue to shape the future of technology and play a pivotal role in every aspect of life.*

## **NGF COLLEGE OF ENGINEERING AND TECHNOLOGY**

**Established in 2008, Under the NEW GREEN FIELD EDUCATIONAL SOCIETY**

### **B.Tech Artificial Intelligence and Machine Learning**

#### **Mission**

- Develop intelligent systems that enhance human capabilities and decision-making.
- Automate complex tasks and processes across various industries.
- Drive innovation through continuous learning and adaptation of algorithms.
- Improve efficiency, accuracy, and performance in diverse fields like healthcare, finance, and education.
- Empower businesses and individuals with data-driven insights and solutions.
- Promote the ethical use of AI and ML technologies to ensure fairness, transparency, and accountability.

#### **Vision**

- Create a future where intelligent systems seamlessly integrate into everyday life.
- Build autonomous, adaptive systems capable of understanding, learning, and predicting accurately.
- Drive global progress by transforming industries, improving productivity, and solving societal challenges.
- Ensure the ethical development of AI and ML, addressing issues like bias, privacy, and security.
- Enhance the quality of life by leveraging AI and ML for personalized, efficient, and innovative solutions.
- Foster an inclusive environment where AI and ML technologies contribute to global well-being and sustainability.

**B.Tech Computer science and engineering (AI/ML):  
Program Educational Objectives**

<b>PEO</b>	<b>Engineering Graduates will be able to:</b>
<b>PEO1</b>	To create knowledge about core areas related to the field of computer science and information technology.
<b>PEO2</b>	To enable students to apply mathematics, science and computer engineering principles to model, design and implement software projects to meet customers' business objectives.
<b>PEO3</b>	To develop the ability to evaluate the computing systems from view point of quality, security, privacy, cost effectiveness, utility and ethics.
<b>PEO4</b>	To inculcate lifelong learning by introducing principles of group dynamics, public policies, environmental and societal context

**B.Tech Computer Science and Engineering (Artificial Intelligence and Machine - Learning) Engineering Graduates will be able to**

PO1	<b>Engineering knowledge:</b> Apply the knowledge of mathematics, science, engineering fundamentals, and an engineering specialization to the solution of complex engineering problems.
PO2	<b>Problem analysis:</b> Identify, formulate, review research literature, and analyze complex engineering problems reaching substantiated conclusions using first principles of mathematics, natural sciences, and engineering sciences.
PO3	<b>Design/development of solutions:</b> Design solutions for complex engineering problems and design system components or processes that meet the specified needs with appropriate consideration for the public health and safety, and the cultural, societal, and environmental considerations.
PO4	<b>Conduct investigations of complex problems:</b> Use research-based knowledge and research methods including design of experiments, analysis and interpretation of data, and synthesis of the information to provide valid conclusions.
PO5	<b>Modern tool usage:</b> Create, select, and apply appropriate techniques, resources, and modern engineering and IT tools including prediction and modeling to complex engineering activities with an understanding of the limitations.
PO6	<b>The engineer and society:</b> Apply reasoning informed by the contextual knowledge to assess societal, health, safety, legal and cultural issues and the consequent responsibilities relevant to the professional engineering practice.
PO7	<b>Environment and sustainability:</b> Understand the impact of the professional engineering solutions in societal and environmental contexts, and demonstrate the knowledge of, and need for sustainable development.
PO8	<b>Ethics:</b> Apply ethical principles and commit to professional ethics and responsibilities and norms of the engineering practice.
PO9	<b>Individual and team work:</b> Function effectively as an individual, and as a member or leader in diverse teams, and in multidisciplinary settings.
PO10	<b>Communication:</b> Communicate effectively on complex engineering activities with the engineering community and with society at large, such as, being able to comprehend and write effective reports and design documentation, make effective presentations, and give and receive clear instructions.
PO11	<b>Project management and finance:</b> Demonstrate knowledge and understanding of the engineering and management principles and apply these to one's own work, as a member and leader in a team, to manage projects and in multidisciplinary environments.
PO12	<b>Life-long learning:</b> Recognize the need for, and have the preparation and ability to engage in independent and life-long learning in the broadest context of technological change.

**B.Tech Computer science and engineering (AI/ML):**  
**Programme Specific outcome**

<b>PSO</b>	<b>Engineering Graduates will be able to:</b>
<b>PSO1</b>	Solve complex engineering problems in computing by applying the principles in Artificial Intelligence, Machine Learning, Network Engineering, Software Engineering, Data Engineering and Intelligent Systems..
<b>PSO2</b>	Design & develop projects using modern software tools to provide the effective solutions to Artificial Intelligence and Machine Learning real life problems related to the society and environment.



J.C. Bose University of Science & Technology, YMCA, Faridabad, Haryana  
(A Haryana State Government University)  
(Established by Haryana State Legislative Act No. 21 of 2009 & Recognised by UGC Act 1956 u/s 22 to Confer Degrees)  
Accredited 'A+' Grade by NAAC

Ref No. CE/2024/1713

Date 18/09/2024

## Certificate

This is to certify that the scheme & syllabi of Computer Science & Engg (Artificial Intelligence and Machine Learning) (Course name & Scheme) is duly approved by the competent body/authority and to the best of my knowledge the content of the same, are correct in all respect.

The scheme & syllabus has been updated & approved in 18<sup>th</sup> BOS held on 18/3/2024 and

Applicable for the students admitted in the Session/Batch 2021-2022 w.e.f. for the Semester (s) 3<sup>rd</sup> to 8<sup>th</sup> Sem [1<sup>st</sup>, 2<sup>nd</sup> Sem is common in all Engg. branches]

Date: 18/09/2024

Signature & Stamp of Chairperson

Name: Ahmed Khan

Deptt. Name: CE

Professor and Chairman  
Dept. of Computer Engineering  
J.C. Bose University of Science and Technology  
YMCA, Faridabad

Ahmed Khan  
Dean Academic Affairs  
J.C. Bose University of  
Science & Tech. YMCA  
Faridabad, Haryana (India)

Academic Branch







**SCHEME & SYLLABUS**  
**OF**  
**UNDERGRADUATE DEGREE COURSES**  
**IN**  
**COMPUTER SCIENCE AND ENGINEERING (ARTIFICIAL**  
**INTELLIGENCE AND MACHINE LEARNING)**  
**2022-23**  
**(B.Tech 1<sup>st</sup> Yr admitted 2021-22 and B.Tech LEET 2022-23)**



**Department of Computer Engineering**  
**J. C. Bose University of Science & Technology, YMCA**  
**Faridabad, Haryana**

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### **Program Educational Objectives (PEO's)**

PEO1	To create knowledge about core areas related to the field of computer science and information technology.
PEO2	To enable students to apply mathematics, science and computer engineering principles to model, design and implement software projects to meet customers' business objectives.
PEO3	To develop the ability to evaluate the computing systems from view point of quality, security, privacy, cost effectiveness, utility and ethics.
PEO4	To inculcate lifelong learning by introducing principles of group dynamics, public policies, environmental and societal context



## PROGRAM OUTCOMES (POs)

**B.Tech Computer Science and Engineering (Artificial Intelligence and Machine Learning)**  
**Engineering Graduates will be able to**

PO1	<b>Engineering knowledge:</b> Apply the knowledge of mathematics, science, engineering fundamentals, and an engineering specialization to the solution of complex engineering problems.
PO2	<b>Problem analysis:</b> Identify, formulate, review research literature, and analyze complex engineering problems reaching substantiated conclusions using first principles of mathematics, natural sciences, and engineering sciences.
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PO9	<b>Individual and team work:</b> Function effectively as an individual, and as a member or leader in diverse teams, and in multidisciplinary settings.
PO10	<b>Communication:</b> Communicate effectively on complex engineering activities with the engineering community and with society at large, such as, being able to comprehend and write effective reports and design documentation, make effective presentations, and give and receive clear instructions.
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PO12	<b>Life-long learning:</b> Recognize the need for, and have the preparation and ability to engage in independent and life-long learning in the broadest context of technological change.



### **PROGRAM SPECIFIC OUTCOMES (PSOs)**

<b>PSO1</b>	Ability to design and develop computing systems using concepts of Mathematics, Computer Engineering and other related disciplines to meet customers' business objectives.
<b>PSO2</b>	Ability to test and analyze the quality of various subsystems and to integrate them in order to evolve a larger computing system.

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### GRADING SCHEME

Marks %	Grade	Grade	Category
90-100	O	10	Outstanding
80≤marks<90	A+	9	Excellent
70≤marks< 80	A	8	Very good
60≤marks< 70	B+	7	Good
50≤marks< 60	B	6	Above
45≤marks< 50	C	5	Average
40≤marks< 45	P	4	Pass
<40	F	0	Fail
	Ab	0	Absent

Percentage calculation=CGPA\*9.5 Course

### COURSE CODE AND DEFINITIONS

Course Code	Definitions
L	Lecture
T	Tutorial
P	Practical
BSC	Basic Science Courses
ESC	Engineering Science Courses
HSMC	Humanities and Social Sciences including Management courses
PCC	Professional core courses
OEC	Open Elective courses
LC	Laboratory course
MC	Mandatory courses
PROJ	Project
MOOC	Massive Open Online Course
AC	Audit Course
VAC	Value Added Course



### SEMESTER WISE SUMMARY OF THE PROGRAM

S.No.	Semester	No. of Contact Hours	Marks	Credits
1.	I	25(A)/26(B)	650(A)/600(B)	19.5(A)/18.5(B)
2.	II	26(A)/25(B)	600(A)/650(B)	18.5(A)/19.5(B)
3.	III	35	800	25
4.	IV	34	850	24
5.	V	35	950	24
6.	VI	33	900	27
7.	VII	22	700	20
8.	VIII	One Semester	500	10
9.	MOOCs	-	-	12*
<b>Total</b>		<b>210</b>	<b>5950</b>	<b>180*</b>

\*Student has to earn at least 12 credits during the duration of Degree subject to passing of at least one MOOC course of 12 week duration (carrying minimum 3 credits) per year.



## GUIDELINES FOR TREE PLANTATION AND CARE

### Instructions for Students:

1. Tree Plantation: Each admitted student for undergraduate program of the University is required to plant at least 2-5 tree saplings during his/her first or second semester. The selected location for the plantation may be any place of their choice at/near their home places (e.g., parks, grounds, etc.). The student must capture geo-tagged photographs of the planted saplings and ensure to take proper care of their growth. Please note that the student should also be there in the geotagged photo along with the plant.

2. Submission of Documents: The student has to submit geo-tagged photographs of the planted saplings on university ERP platform in the given format, namely, plantation document including other details, viz., name of plant, date of plantation, and any additional information regarding the plantation.

3. Ongoing Care and Monitoring: After plantation, every student will take care for these plants and submit their updated geo-tagged photos in plantation document for 2nd and 3rd year also.

- Each student will have to submit the plantation document once in every year of the program.
- The plantation document including geo-tagged photos will be submitted for (N-1) times, where N is the total duration of the program in which student is admitted. For example, a student of 4 years B.Tech./B.Sc. program has to submit the plantation document for three consecutive years, i.e., till pre-final year indicating the growth and survival of the tree sapling planted by them.

4. Tree Survival: The student must ensure the successful survival of at least one tree out of 2-5 initially planted trees for being eligible for their degree.

5. Verification of Documents: The verification of submitted documents will be done by the respective teacher coordinator at each successive year during Practical Examinations towards the end of the semester as per the notified academic calendar for the session.

6. Certificate of Achievement: The certificate for eligible student will be auto generated, which may be downloaded from their respective ERP platform after due verification. **These students will thereby fulfil the requirement for degree conferral within their respective programs.**

Note: The students admitted through LEET will take part in the initiative after their admission in 2nd year of respective program and the requirement of submission of geotagged photographs will be (N-2) times for them as per point 3.

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### ENGINEERING SCIENCE COURSE (ESC)

S.No.	Code No.	Course Title	Hours Per Week			Total Credits	Semester
			L	T	P		
1	ESC101	Basic Electrical Engineering	3	1	2	5	1 / 2
2	ESC102	Engineering Graphics & Design	0	0	4	2	1 / 2
3	ESC103	Programming for Problem Solving	3	0	2	5	1 / 2
4	ESC104	Workshop-I	0	0	4	2	1
5	ESC106	Workshop –II	0	0	4	2	2
6	ESC-302, ESC-304	Digital Electronics	3	0	4	5	3
Total Credits						21	

### PROFESSIONAL CORE COURSES (PCC)

S.No.	Code No.	Course Title	Hours Per Week			Total Credits	Semester
			L	T	P		
1	PCC-AI-301 PCC-AI-302	Introduction to AI & Expert Systems Introduction to AI & Expert Systems Lab	3	0	4	5	3
2	PCC-CS-301, PCC-CS-303	Data Structure & Algorithms	3	0	4	5	3
3	PCC-CS-302	IT Workshop	0	0	4	2	3
4	PCC-CS-401	Discrete Mathematics	3	1	0	4	4
5	PCC-CS-402, PCC-CS-405	Computer Organization & Architecture	3	0	4	5	4
6	PCC-CS-403, PCC-CS-406	Operating System	3	0	4	5	4
7	PCC-CS-404, PCC-CS-407	Design & Analysis of Algorithms	3	0	4	5	4
8	PCC-CS-501, PCC-AI-504	Database Management System Database Management System and AI lab	3	0	4	5	5
9	PCC-CS-602	Computer Networks	3	0	0	3	3
10	PCC-AI-502	Digital Image Processing	3	0	0	3	5
11	PCC-CS-503, PCC-CS-505	Object Oriented Programming	3	0	4	5	5



12	PEC-CS-S-703 PCC-AI-602	Internet of Things & Internet of Things Lab	3	0	4	5	6
13	PCC-AI-601 PCC-AI-604	Big Data Analytics & Big Data Analytics Lab	3	0	4	5	6
<b>Total Credits</b>						<b>57</b>	

### PROFESSIONAL ELECTIVE COURSES (PEC)

S.N	Course Title	Hours Per Week			Total Credits	Semester
		L	T	P		
1	Elective-I	3	0	0	3	5
2	Elective-II	3	0	0	3	6
3	Elective-III	3	0	0	3	6
4	Elective-IV	3	0	0	3	7
5	Elective-V	3	0	0	3	7
6	Elective-VI	3	0	0	3	7
<b>Total Credits</b>					<b>18</b>	

### OPEN ELECTIVE COURSES (OEC)

S. No.	Course Title	Hours Per Week			Total Credits	Semester
		L	T	P		
1	Open Elective-I	3	0	0	3	6
2	Open Elective-II	3	0	0	3	6
3	Open Elective-III	3	0	0	3	7
4	Open Elective-IV	3	0	0	3	7
<b>Total Credits</b>					<b>12</b>	



**J. C. BOSE UNIVERSITY OF SCIENCE AND TECHNOLOGY, YMCA, FARIDABAD**  
**B.Tech. (CSE(ARTIFICIAL INTELLIGENCE & MACHINE LEARNING))**

**Scheme of Studies/Examination**

**Semester- 3**

S. N o.	Category	Course Code	Course Title	Hours per week			Credits	Marks for Sessional Examination	Marks for End Term Examination	Total
				L	T	P				
1	PCC	PCC-AI-301	Introduction to Artificial Intelligence and Expert Systems	3	0	0	3	25	75	100
2	PCC	PCC-CS-301	Data Structures & Algorithms	3	0	0	3	25	75	100
3	ESC	ESC-302	Digital Electronics	3	0	0	3	25	75	100
4	BSC	BSC-301	Mathematics- III (Calculus and Ordinary Differential Equations)	3	0	0	3	25	75	100
5	HSMC	HSMC-01	Effective Technical Communication	3	0	0	3	25	75	100
6	Capstone Project	PROJ-CS-301	Project-I	0	0	4	2	25	75	100
7	PCC	PCC-CS-302	IT Workshop	0	0	4	2	15	35	50
8	PCC	PCC-AI-302	Introduction to Artificial Intelligence and Expert Systems Lab	0	0	4	2	15	35	50
9	ESC	ESC-304	Digital Electronics LAB	0	0	4	2	15	35	50
10	PCC	PCC-CS-303	Data Structure & Algorithms LAB	0	0	4	2	15	35	50
<b>Total</b>				<b>15</b>	<b>0</b>	<b>20</b>	<b>25</b>	<b>210</b>	<b>590</b>	<b>800</b>

Note: Theory exams will be of 03 hours' duration and Practical exams will be of 02 hours' duration

(a) Additional 3 credits per year to be earned through MOOCs



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**Scheme of Studies/Examination**

**Semester- 4**

S. No.	Category	Course Code	Course Title	Hours per week			Credits	Marks for Sessional	Marks for End Term Examination	Total
				L	T	P				
1	PCC	PCC-CS-401	Discrete Mathematics	3	1	0	4	25	75	100
2	PCC	PCC-CS-402	Computer Organization & Architecture	3	0	0	3	25	75	100
3	PCC	PCC-CS-403	Operating System	3	0	0	3	25	75	100
4	PCC	PCC-CS-404	Design & Analysis of Algorithms	3	0	0	3	25	75	100
5	HSMC	HSMC-02	Economics for Engineers	3	0	0	3	25	75	100
6	MC	MC-03	Environmental Sciences	2	0	0	0	25	75	100
7	Capstone Project	PROJ-CS-401	Project-II	0	0	4	2	25	75	100
8	PCC	PCC-CS-405	Computer Organization & Architecture LAB	0	0	4	2	15	35	50
9	PCC	PCC-CS-406	Operating System LAB	0	0	4	2	15	35	50
10	PCC	PCC-CS-407	Design & Analysis of Algorithms LAB	0	0	4	2	15	35	50
<b>Total</b>				<b>17</b>	<b>1</b>	<b>16</b>	<b>24</b>	<b>220</b>	<b>630</b>	<b>850</b>

Note:

- (a) Theory exams will be of 03 hours duration and Practical exams will be of 02 hours duration
- (b) Additional 3 credits per year to be earned through MOOCs



**J. C. BOSE UNIVERSITY OF SCIENCE AND TECHNOLOGY, YMCA, FARIDABAD**  
**B.Tech. (CSE(ARTIFICIAL INTELLIGENCE & MACHINE LEARNING))**

**Scheme of Studies/Examination**  
**Semester- 5**

S. No.	Category	Course Code	Course Title	Hours per week			Credits	Marks for Sessional	Marks for End Term Examination	Total
				L	T	P				
1	PCC	PCC-CS-602	Computer Networks	3	0	0	3	25	75	100
2	PCC	PCC-CS-501	Database Management Systems	3	0	0	3	25	75	100
3	PCC	PCC-AI-502	Digital Image Processing	3	0	0	3	25	75	100
4	PCC	PCC-CS-503	Object Oriented Programming	3	0	0	3	25	75	100
5	BSC	BSC-01	Biology	2	1	0	3	25	75	100
6	PEC	PEC-CS- <Stream>-501	Elective -I	3	0	0	3	25	75	100
7	MC	MC-01	Constitution of India	2	0	0	0	25	75	100
8	VAC	H-102	Universal Human Values 2: Understanding Harmony	0	0	2	0	15	35	50
9	Capstone Project	PROJ-CS-501	Project-III	0	0	4	2	25	75	100
10	PCC	PCC-CS-504	Database Management Systems Lab	0	0	4	2	15	35	50
11	PCC	PCC-CS-505	Object Oriented Programming LAB	0	0	4	2	15	35	50
<b>Total</b>				<b>19</b>	<b>1</b>	<b>14</b>	<b>24</b>	<b>245</b>	<b>705</b>	<b>950</b>

Note:

- (a) Theory exams will be of 03 hours duration and Practical exams will be of 02 hours duration
- (b) Additional 3 credits per year to be earned through MOOCs



**J. C. BOSE UNIVERSITY OF SCIENCE AND TECHNOLOGY, YMCA, FARIDABAD**  
**B.Tech. (CSE(ARTIFICIAL INTELLIGENCE & MACHINE LEARNING))**

**Scheme of Studies/Examination**  
**Semester- 6**

S. No.	Category	Course Code	Course Title	Hours per week			Credits	Marks for Sessional	Marks for End Term Examination	Total
				L	T	P				
1	PCC	PEC-CS-S-703	Internet of Things	3	0	0	3	25	75	100
2	PCC	PCC-AI-601	Big Data Analytics	3	0	0	3	25	75	100
3	PEC	PEC-CS- <Stream >-601	Elective-II	3	0	0	3	25	75	100
4	PEC	PEC-CS- <Stream >-602	Elective-III	3	0	0	3	25	75	100
5	OEC	OEC-CS-601	Open Elective-I (Humanities)	3	0	0	3	25	75	100
6	OEC	OEC-CS-602	Open Elective-II	3	0	0	3	25	75	100
7	AC	AC-02-23	Message of Bhagwat Gita	2	1	0	3	25	75	100
8	Capstone Project	PROJ-CS-601	Project-IV	0	0	4	2	25	75	100
9	PCC	PCC-AI-602	Internet of Things Lab	0	0	4	2	15	35	50
10	PCC	PCC-AI-604	Big Data Analytics Lab	0	0	4	2	15	35	50
<b>Total</b>				<b>20</b>	<b>1</b>	<b>12</b>	<b>27</b>	<b>230</b>	<b>670</b>	<b>900</b>

Note:

- (a) Theory exams will be of 03 hours duration and Practical exams will be of 02 hours duration
- (b) Additional 3 credits per year to be earned through MOOCs



**J. C. BOSE UNIVERSITY OF SCIENCE AND TECHNOLOGY, YMCA, FARIDABAD**  
**B.Tech. (CSE(ARTIFICIAL INTELLIGENCE & MACHINE LEARNING))**

**Scheme of Studies/Examination**

**Semester- 7 (May be carried out in 8<sup>th</sup> Semester\*)**

S. N o.	Category	Course Code	Course Title	Hours per week			Credits	Marks for Sessional	Marks for End Term Examination	Total
				L	T	P				
1	PEC	PEC-CS-<Stream>-701	Elective-IV	3	0	0	3	25	75	100
2	PEC	PEC-CS-<Stream>-702	Elective-V	3	0	0	3	25	75	100
3	PEC	PEC-CS-<Stream>-703	Elective-VI	3	0	0	3	25	75	100
4	OEC	OEC-CS-701	Open Elective-III	3	0	0	3	25	75	100
5	OEC	OEC-CS-702	Open Elective-IV	3	0	0	3	25	75	100
6	HSMC	HSMC-03/HSMC-04	Organizational Behaviour / Finance & Accounting	3	0	0	3	25	75	100
7	Capstone Project	PROJ-CS-701	Project-V	0	0	4	2	25	75	100
<b>Total</b>				<b>18</b>	<b>0</b>	<b>4</b>	<b>20</b>	<b>175</b>	<b>525</b>	<b>700</b>

\* The course contents of 7<sup>th</sup> Semester may be pursued by the students of UTDs/Departments of Affiliated colleges in 8<sup>th</sup> semester. In the case of pursuance of internship in 7<sup>th</sup> semester, the course contents of 7<sup>th</sup> semester will be taught in 8<sup>th</sup> semester and vice-versa. The approval of such interchangeability should be requested from the authority before the commencement of 7<sup>th</sup> semester.

Note: Exams duration will be as under

- (a) Theory exams will be of 03 hours duration and Practical exams will be of 02 hours duration
- (b) Additional 3 credits per year to be earned through MOOCs



**J. C. BOSE UNIVERSITY OF SCIENCE AND TECHNOLOGY, YMCA, FARIDABAD**  
**B.Tech. (CSE(ARTIFICIAL INTELLIGENCE & MACHINE LEARNING))**

**Scheme of Studies/Examination**

**Semester- 8 (May be carried out in 7<sup>th</sup> semester\*)**

S. No.	Category	Course Code	Course Title	Duration	Credits	Marks for Sessional	Marks for End Term Examination	Total
1.	Project	PROJ-CS-801	Industry Internship*	6 Months	10	200	300	500
<b>Total</b>					<b>10</b>	<b>200</b>	<b>300</b>	<b>500</b>

Note: Additional 3 credits per year to be earned through MOOCs

**Procedure for Annual Examination and continuous Assessment**

**(A) Annual Exams Marks**

- |                       |           |
|-----------------------|-----------|
| 1. Project Evaluation | 100 Marks |
| 2. Project Seminar    | 50 Marks  |
| 3. Project Viva       | 150 marks |

**(B) Continuous Assessment Marks**

- |                                    |           |
|------------------------------------|-----------|
| 1. Assessment by Institute faculty | 50 Marks  |
| 2. Assessment by Industrial Guide  | 100 Marks |
| 3. Conduct Marks                   | 50 Marks  |

\* The Industry Internship may be pursued by UTDs/Departments of Affiliated colleges in 7<sup>th</sup> or 8<sup>th</sup> semester. In the case of pursuance of internship in 7<sup>th</sup> semester, the course contents of 7<sup>th</sup> semester will be taught in 8<sup>th</sup> semester and vice-versa. The approval of such interchangeability should be requested from the authority before the commencement of 7<sup>th</sup> semester.





### Professional Elective Courses

Electives		
<b>Elective-I</b>	Intelligent Systems (PCC-CS-601))	Basics of Machine Learning (PEC-CS-D-501)
<b>Elective-II</b>	Software Engineering (PEC-CS-S-601)	Data Mining (PEC-CS-D-601)
<b>Elective-III</b>	Distributed Systems (PEC-CS-S-602(I))	Soft Computing (PEC-CS-D-602)
<b>Elective-IV</b>	Advanced Operating System PEC-CS-S-701(I)	Speech and Natural Language Processing (PEC-CS-D-701)
<b>Elective-V</b>	Information Retrieval (PEC-CS-D-702(II))	Data Analytics (PEC-CS-D-702(I))
<b>Elective-VI</b>	Cryptography and Network Security (PEC-CS-A-703)	Neural Networks and Deep Learning (PEC-CS-D-703)



### OPEN ELECTIVE COURSES\*

Open Elective-I	Open Elective-II	Open Elective-III	Open Elective-IV
Soft Skills and Interpersonal Communication (OEC-CS-601(I))	Human Resource Management (OEC-CS-602(I))	Financial Management (OEC-CS-701(I))	Economic Policies in India (OEC-CS-702(I))
Cyber Law and Ethics (OEC-CS-601(II))	ICT for Development (OEC-CS-602(II))	E-commerce and Entrepreneurship (OEC-CS-701(II))	Basics of Cloud Computing (PEC-IT-I-703)
Data Analysis using Python (PCC-IT- 601)	Intellectual Property Rights (OEC-CS-602(III))	R programming (OEC-CS-701(III))	Optical Network Design (OEC-CS-702(III))
Electronic Devices (OEC-CS-601(IV))	International Business Environment (OEC-CS-602(IV))	Non-Conventional Energy Sources (OEC-CS-701(IV))	High Speed Network (OEC-CS-702(IV))
Digital System Design (OEC-CS-601(V))	Basics of Operations Research (OEC-CS-602(V))	-	-

\* The list is non-exhaustive and may be appended with new courses time to time with the approval of Board of Studies.



### VALUE ADDED COURSE [VAC]\*

S. No.	Code	Course Title	Hours Per Week			Semester
			L	T	P	
1.	HSMC (H-102)	Universal Human Values2: Understanding Harmony	0	0	2	V

### AUDIT COURSE [AC]\*

S. No.	Code	Course Title	Hours Per Week			Semester	Credits	Marks for Sessional	Marks for End Term Examination	Total
			L	T	P					
1.	AC-02-23	Message of Bhagwat Gita	2	1	0	VI	3	25	75	100
<b>Total</b>							<b>3</b>	<b>25</b>	<b>75</b>	<b>100</b>

\*As approved in 20<sup>th</sup> Meeting of Academic Council, the above subjects are to be included in the curriculum



## **ADDITIONAL REQUIREMENTS FOR B.TECH (Hons.)**

A student will be eligible to get Under-Graduate (B.Tech) with Honours if he/she completes additional credits through MOOC's. (AICTE Model Curriculum, Chapter1(B)). Following pattern will be followed for earning additional credits for the award of Honours degree:

<b>Program</b>	<b>Duration</b>	<b>Credits to be earned*</b>	<b>Minimum CGPA</b>
B.Tech	Semester I to VIII	12	8.0

Note: From session 2019-20 onwards, for B.Tech program, a student has to earn at least 12 credits during the duration of the Degree subject to the passing of at least one MOOC course (carrying minimum 3 credits) per year. The MOOC chosen by the student should not be on offer/scheme of the degree.

**The *Credit Transfer/Mobility Policy for Online Courses* approved in 17<sup>th</sup> Academic Council Dated 11.06.2019 may be referred for the same.**

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## **DETAILED 4-YEAR CURRICULUM CONTENTS**

**Undergraduate Degree in Engineering and Technology**

**Branch/Course: COMPUTER SCIENCE AND ENGINEERING**

**(ARTIFICIAL INTELLIGENCE AND MACHINE LEARNING)**

**Second year (Third semester onwards)**

<b>PROFESSIONAL CORE COURSES</b>
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**CODE: PCC-AI-301**

**SUBJECT NAME: ARTIFICIAL INTELLIGENCE AND EXPERT SYSTEMS**

**NO OF CREDITS: 3**

B.TECH 3<sup>rd</sup> SEMESTER

SESSIONAL: 25

L T P

THEORY EXAM: 75

3 0 0

TOTAL : 100

Pre-requisites:

**Course Objectives:** The purpose of the course is to:

1. Introduce the basic concepts of Artificial Intelligence (AI).
2. Familiarize the students with the use of AI to solve real world problems for which solutions are difficult to express using the traditional algorithmic approach.
3. Explore the essential theory behind methodologies for developing systems that demonstrate intelligent behaviour including dealing with uncertainty, learning from experience and following problem solving strategies found in nature.

### **MODULE – I**

Introduction to Artificial Intelligence Basic Concepts of AI, Elements of AI: Knowledge base, reasoning, learning and goal, AI programming techniques; Introduction to Intelligent Agents: Agents and environments.

### **MODULE - II**

Search Techniques Problem Solving Techniques, State space search, Blind search: Depth first search, Breadth first search, informed search: Heuristic search, Hill climbing search, Best first search, A\*, AO\*, Constraint satisfaction. Game Playing: Minimax search, Alpha – beta pruning, Mini-Max algorithm

### **MODULE – III**

Knowledge Representation Knowledge Predicate Logic (well-formed formulas, quantifiers, Prenex Normal Form, Unification, Modus ponens, Resolution refutation – various strategies), Rule Based Systems, (Forward reasoning: Conflict resolution, backward reasoning: Use of No. Backtracking, Structured Knowledge Representations (Semantic Net: slots, inheritance, Frames).

### **MODULE – IV**

Uncertain Knowledge and Reasoning Probabilistic reasoning: Bayes' theorem, representing knowledge in uncertain domain, Bayesian Networks, Dempster-Shafer Theory, Learning Techniques: Learning from observations: forms of learning, inductive learning, Knowledge in learning: Explanation based learning, Reinforcement learning, Neural network learning: Supervised and unsupervised learning.

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## **MODULE – V**

Applications and Expert System Computer Vision, Natural Language Processing and Understanding, Scientific Analysis, Medical Diagnosis Financial Analysis. Expert System: Need and Justification for expert systems- cognitive problems, Expert System: Architectures (Knowledge base, inference engine and its functions), overview of MYCIN.

**Course Outcomes:** After undergoing this course, the students will be able to:

1. Be familiar with Artificial Intelligence, its foundation and principles.
2. Examine the useful search techniques; learn their advantages, disadvantages and comparison. Understand important concepts like Expert Systems, AI applications.
3. Be exposed to the role of AI in different areas like NLP, Pattern Recognition etc.

### **TEXT BOOKS:**

1. Artificial Intelligence By Elaine Rich and Kevin Knight , Tata McGraw Hill.
2. Introduction to AI and Expert Systems By Dan W.Patterson, PHI.

### **REFERENCE BOOKS:**

1. Principles of Artificial Intelligence By Nils J.Nilsson, Narosa Pub. house.
  2. Foundation Artificial Intelligence & Expert Systems by VS Janakiraman K, Sarukesi P
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**CODE: PCC-CS-301**

**SUBJECT NAME: DATA STRUCTURES & ALGORITHMS**

**CREDITS: 3**

B.TECH. 3<sup>RD</sup> SEMESTER

L T P

3 0 0

SESSIONAL: 25

THEORY EXAM: 75

TOTAL: 100

Pre-requisites: Fundamentals of Computer and Programming in C

**Course Objectives:**

1. To impart the basic concepts of data structures and algorithms.
2. To understand concepts about searching and sorting techniques
3. To understand basic concepts about stacks, queues, lists, trees and graphs.
4. To enable them to write algorithms for solving problems with the help of fundamental data structures

**MODULE 1: INTRODUCTION**

Basic Terminologies: Elementary Data Organizations, Data Structure Operations: insertion, deletion, traversal etc.; Analysis of an Algorithm, Asymptotic Notations, Time-Space trade off.

**Searching:** Linear Search and Binary Search Techniques and their complexity analysis.

**MODULE 2: STACKS AND QUEUES**

ADT Stack and its operations: Algorithms and their complexity analysis, Applications of Stacks: Expression Conversion and evaluation – corresponding algorithms and complexity analysis. ADT queue, Types of Queue: Simple Queue, Circular Queue, Priority Queue; Operations on each types of Queues: Algorithms and their analysis.

**MODULE 3: LINKED LISTS**

Singly linked lists: Representation in memory, Algorithms of several operations: Traversing, Searching, Insertion into, Deletion from linked list; Linked representation of Stack and Queue, Header nodes, Doubly linked list: operations on it and algorithmic analysis; Circular Linked Lists: all operations their algorithms and the complexity analysis.

**Trees:** Basic Tree Terminologies, Different types of Trees: Binary Tree, Threaded Binary Tree, Binary Search Tree, AVL Tree; Tree operations on each of the trees and their algorithms with complexity analysis. Applications of Binary Trees, B Tree, B+ Tree: definitions, algorithms and analysis.

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## MODULE 4: SORTING AND HASHING

Objective and properties of different sorting algorithms: Selection Sort, Bubble Sort, Insertion Sort, Quick Sort, Merge Sort, Heap Sort; Performance and Comparison among all the methods. Hashing and collision resolution.

**Graph:** Basic Terminologies and Representations, Graph search and traversal algorithms and complexity analysis.

### Course Outcomes:

1. For a given algorithm student will able to analyze the algorithms to determine the time and computation complexity and justify the correctness.
2. For a given Search problem (Linear Search and Binary Search) student will able to implement it.
3. For a given problem of Stacks, Queues, linked list and Tree, student will able to implement it and analyze the same to determine the time and computation complexity.
4. Student will able to write an algorithm Selection Sort, Bubble Sort, Insertion Sort, Quick Sort, Merge Sort, Heap Sort and compare their performance in term of Space and Time complexity.
5. Student will able to implement Graph search and traversal algorithms and determine the time and computation complexity.

### REFERENCES

1. A. M. Tenenbaum, Langsam, Moshe J. Augentem , “*Data Structures using C,*” PHI Pub.
  2. A.V. Aho, J.E. Hopcroft and T.D. Ullman, “*Data Structures and Algorithms*” Original edition, Addison-Wesley, 1999, Low Priced Edition.
  3. Ellis Horowitz & Sartaj Sahni, “*Fundamentals of Data structures*” Pub, 1983,AW
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**CODE: ESC-302**

**SUBJECT NAME: DIGITAL ELECTRONICS**

**CREDITS: 3**

B.TECH. 3rd SEMESTER

L T P

3 0 0

SESSIONAL: 25

THEORY EXAM: 75

TOTAL : 100

**Course Objectives:** The purpose of the course is to:

1. Acquaint the students with the fundamentals of digital electronics.
2. Familiarize the students with design of various combinational circuits.
3. Acquaint the students with the design and analysis of various sequential circuits.
4. Familiarize the students with logic families and semiconductor memories.

### **MODULE 1: FUNDAMENTALS OF DIGITAL SYSTEMS AND LOGIC FAMILIES**

Digital signals, digital circuits, AND, OR, NOT, NAND, NOR and Exclusive-OR operations, Boolean algebra, examples of IC gates, number systems-binary, signed binary, octal hexadecimal number, binary arithmetic, one's and two's complements arithmetic, codes, error detecting and correcting codes, characteristics of digital ICs, digital logic families, TTL, Schottky TTL and CMOS logic, interfacing CMOS and TTL, Tri-state logic.

### **MODULE 2: COMBINATIONAL DIGITAL CIRCUITS**

Standard representation for logic functions, K-map representation, simplification of logic functions using K-map, minimization of logical functions. Don't care conditions, Multiplexer, De-Multiplexer/Decoders, Adders, Subtractors, BCD arithmetic, carry look ahead adder, serial adder, ALU, elementary ALU design, popular MSI chips, digital comparator, parity checker/generator, code converters, priority encoders, decoders/drivers for display devices, Q-M method of function realization.

### **MODULE 3: SEQUENTIAL CIRCUITS AND SYSTEMS**

A 1-bit memory, the circuit properties of Bistable latch, the clocked SR flip flop, J- K-T and D types flip flops, applications of flip flops, shift registers, applications of shift registers, serial to parallel converter, parallel to serial converter, ring counter, sequence generator, ripple (Asynchronous) counters, synchronous counters, counters design using flip flops, special counter IC's, asynchronous sequential counters, applications of counters.

### **MODULE 4: A/D AND D/A CONVERTERS**

Digital to analog converters: weighted resistor/converter, R-2R Ladder D/A converter, specifications for D/A converters, examples of D/A converter ICs, sample and hold circuit, analog to digital converters: quantization and encoding, parallel comparator A/D converter, successive approximation A/D converter, counting A/D converter, dual slope A/D converter, A/D converter using voltage to frequency and voltage to time conversion, specifications of A/D converters, example of A/D converter ICs



## **MODULE 5: SEMICONDUCTOR MEMORIES AND PROGRAMMABLE LOGIC DEVICES**

Memory organization and operation, expanding memory size, classification and characteristics of memories, sequential memory, read only memory (ROM), read and write memory (RAM), content addressable memory (CAM), charge de coupled device memory (CCD), commonly used memory chips, ROM as a PLD, Programmable logic array, Programmable array logic, complex Programmable logic devices (CPLDs), Field Programmable Gate Array (FPGA).

### **Course Outcomes:**

At the end of this course, students will demonstrate the ability to

1. Understand working of logic families and logic gates.
2. Design and implement Combinational and Sequential logic circuits.
3. Understand the process of Analog to Digital conversion and Digital to Analog conversion.
4. Use PLDs to implement the given logical problem.

### **REFERENCES:**

1. R. P. Jain, "Modern Digital Electronics", McGraw Hill Education, 2009.
  2. M. M. Mano, "Digital logic and Computer design", Pearson Education India, 2016.
  3. A. Kumar, "Fundamentals of Digital Circuits", Prentice Hall India, 2016.
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**CODE: BSC-301**

**SUBJECT NAME: CALCULUS AND ORDINARY DIFFERENTIAL EQUATIONS**

**NO OF CREDITS: 3**

B.TECH 3<sup>RD</sup> SEMESTER

SESSIONAL: 25

L T P

THEORY EXAM: 75

3 0 0

TOTAL: 100

Pre-requisites: Calculus, Multivariable Calculus (Differentiation)

**Course Objectives:** The purpose of the course is to:

1. Acquaint the students with mathematical tools needed in evaluating multiple integrals and their usage.
2. Familiarize the students with effective mathematical tools for the solutions of differential equations that model physical processes.
3. Acquaint the students with tools of differentiation and integration of functions of complex variable that are used in various techniques dealing engineering problems.

### **MODULE 1: SEQUENCES AND SERIES**

Convergence of sequence and series, tests for convergence, power series, Taylor's series. Series of exponential, trigonometric and logarithmic functions.

### **MODULE 2: MULTIVARIABLE CALCULUS (DIFFERENTIATION)**

Limit, continuity and partial derivatives, directional derivatives, total derivative; Tangent plane and normal line; Maxima, minima and saddle points; Method of Lagrange multipliers; Gradient, curl and divergence.

### **MODULE 3: MULTIVARIABLE CALCULUS (INTEGRATION)**

Multiple Integration: double and triple integrals (Cartesian and polar), change of order of integration in double integrals, Change of variables (Cartesian to polar). Theorems of Green, Gauss and Stokes, orthogonal curvilinear coordinates, Simple applications involving cubes, sphere and rectangular parallelepipeds.

### **MODULE 4: FIRST ORDER ORDINARY DIFFERENTIAL EQUATIONS**

Exact, linear and Bernoulli's equations, Euler's equations, Equations not of first degree: equations solvable for p, equations solvable for y, equations solvable for x and Clairaut's type.

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## MODULE 5: ORDINARY DIFFERENTIAL EQUATIONS OF HIGHER ORDERS

Second order linear differential equations with variable coefficients, method of variation of parameters, Cauchy-Euler equation; Power series solutions; Legendre polynomials, Bessel functions of the first kind and their properties.

**Course Outcomes:** On successful completion of this course, the students should be able to:

1. Develop mathematical tools needed in evaluating multiple integrals and their usage.
2. Understand effective mathematical tools for the solutions of differential equations that model physical processes built.
3. Understand differentiation and integration of functions of complex variable that are used in various techniques dealing engineering problems.

## REFERENCES

1. G.B. Thomas and R.L. Finney, "*Calculus and Analytic geometry*", 9th Edition, Pearson, Reprint, 2002.
  2. 2. Veerarajan T., "*Engineering Mathematics for first year*", Tata McGraw-Hill, New Delhi, 2008.
  3. Ramana B.V., "*Higher Engineering Mathematics*", Tata McGraw Hill New Delhi, 11<sup>th</sup> Reprint, 2010.
  4. N.P. Bali and Manish Goyal, "*A text book of Engineering Mathematics*", Laxmi Publications, Reprint, 2010.
  5. B.S. Grewal, "*Higher Engineering Mathematics*", Khanna Publishers, 35th Edition, 2000.
  6. Erwin Kreyszig, "*Advanced Engineering Mathematics*", 9th Edition, John Wiley & Sons, 2006.
  7. W. E. Boyce and R. C. DiPrima, "*Elementary Differential Equations and Boundary Value Problems*", 9th Edition, Wiley India, 2009.
  8. S. L. Ross, "*Differential Equations*", 3rd Ed., Wiley India, 1984.
  9. E. A. Coddington, "*An Introduction to Ordinary Differential Equations*", Prentice Hall India, 1995.
  10. E. L. Ince, "*Ordinary Differential Equations*", Dover Publications, 1958.
  11. G.F. Simmons and S.G. Krantz, "*Differential Equations*", Tata McGraw Hill, 2007.
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**CODE: HSMC-01**

**SUBJECT NAME: EFFECTIVE TECHNICAL COMMUNICATION**

**CREDITS: 3**

B.TECH. 3rd SEMESTER

SESSIONAL: 25

L T P

THEORY EXAM: 75

3 0 0

TOTAL : 100

Pre-requisites:

**Course Objectives:** The purpose of the course is to:

1. Generate the confidence to use written communication in work and personal experience beyond college.
2. Acquaint the students with the concept of a writer-reader relationship and identify the need for active participation from both writer and reader.
3. Acquaint the students with the skills needed to successfully communicate in a modern world through written materials.

### **MODULE 1: INFORMATION DESIGN AND DEVELOPMENT**

Different kinds of technical documents, Information development life cycle, Organization structures, factors affecting information and document design, Strategies for organization, Information design and writing for print and for online media.

### **MODULE 2: TECHNICAL WRITING, GRAMMAR AND EDITING**

Technical writing process, forms of discourse, Writing drafts and revising, Collaborative writing, creating indexes, technical writing style and language. Basics of grammar, study of advanced grammar, editing strategies to achieve appropriate technical style. Introduction to advanced technical communication, Usability, Human factors, Managing technical communication projects, time estimation, Single sourcing, Localization.

### **MODULE 3: SELF DEVELOPMENT AND ASSESSMENT**

Self assessment, Awareness, Perception and Attitudes, Values and belief, Personal goal setting, career planning, Self-esteem. Managing Time; Personal memory, Rapid reading, Taking notes; Complex problem solving; Creativity

### **MODULE 4: COMMUNICATION AND TECHNICAL WRITING**

Public speaking, Group discussion, Oral; presentation, Interviews, Graphic presentation, Presentation aids, Personality Development. Writing reports, project proposals, brochures, newsletters, technical articles, manuals, official notes, business letters, memos, progress reports, minutes of meetings, event report.

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## MODULE 5: ETHICS

Business ethics, Etiquettes in social and office settings, Email etiquettes, Telephone Etiquettes, Engineering ethics, Managing time, Role and responsibility of engineer, Work culture in jobs, Personal memory, Rapid reading, Taking notes, Complex problem solving, Creativity.

**Course Outcomes:** On successful completion of this course, the students should be able to:

1. Convey specialized information from a technical field to a non-specialized audience.
2. Understand and use appropriate formats and conventions derived from individual disciplines.
3. Understand effectiveness and validity of information sources, such as web sites, business documents and professional journals.
4. Develop strategies for information design, to include producing visually enhanced documents

## REFERENCES:

1. David F. Beer and David McMurrey, Guide to writing as an Engineer, John Willey. New York, 2004
  2. Diane Hacker, Pocket Style Manual, Bedford Publication, New York, 2003. (ISBN 0312406843)
  3. Shiv Khera, You Can Win, Macmillan Books, New York, 2003.
  4. Raman Sharma, Technical Communications, Oxford Publication, London, 2004.
  5. Dale Jungk, Applied Writing for Technicians, McGraw Hill, New York, 2004. (ISBN: 07828357-4)
  6. Sharma, R. and Mohan, K. Business Correspondence and Report Writing, TMH New Delhi 2002.
  7. Xebec, Presentation Book, TMH New Delhi, 2000. (ISBN 0402213)
-



**CODE: PCC-CS-302**

**SUBJECT NAME: IT WORKSHOP**

**CREDITS: 2**

B.TECH. 3rd SEMESTER	SESSIONAL:	15
L T P	PRACTICAL EXAM:	35
0 0 4	TOTAL :	50

Pre-requisites: There are no formal prerequisites for this course.

**Course Objectives:** The purpose of the course is to:

1. Acquaint the students with the basics of programming in general
2. Familiarize the students with MATLAB environment
3. Create the ability to develop the programming skill in Matlab and other languages.

### **MODULE 1: INTRODUCTION**

*Data types and variables:* Introduction to MATLAB, Data Types, Inter-conversion of Data types, MATLAB Variables, Keywords and Constant, Session Command. *MATLAB Operators and Operations:* Operators (Arithmetic, Relational, Logical, Bitwise), Set Operations, Operator Precedence, Mathematical Functions.

### **MODULE 2: PROGRAMMING IN MATLAB**

*Script and Function:* Decision Making, Loops, branches, Functions, Working on Script File (Creating, Saving and Executing), MATLAB I/O, Formatted I/O Method,.

### **MODULE 3: ARRAYS AND GRAPHICS**

*Matrices and Arrays:* Introduction to Matrices, Operations on Arrays/Matrices, Manipulations of Arrays/Matrices, Expansion of Matrix Size, Reduction of Matrices/Arrays order,

*Graphics:* Introduction to plot, Basic 2-D Plots( Style options, Labels, Axis control, etc.), specialized 2-D Plots, drawing multiple plots. Using MATLAB for fractals and chaos and Conway game of life

### **MODULE 4: FILE HANDLING AND DEBUGGING**

*File Handling:* Introduction to file handling, working on files, accessing of Text File, Saving/ Loading MATLAB Variables, reading data without opening file, reading and writing Excel.

*Debugging:* Introduction to debugging, Break points, debugger, stepping, watching variable values, debugging commands.

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**Course Outcomes:**

At the end of the course, students will be able to

1. Use MATLAB for programming purposes
2. Learn and explore MATLAB further on their own
3. Use this learning experience to learn other programming languages.

**REFERENCES:**

1. Delores M. Etter, David C. Kuncicky, Holly Moore, "*Introduction to MATLAB 7.0*", Pearson, 2013.
2. Rudra Pratap, "*Getting Started with MATLAB*", OXFORD University Press, 2010.
3. Agam Kumar Tyagi, "*MATLAB and Simulink for Engineers*", University Press, 2012.

**WEB REFERENCES**

<https://ocw.mit.edu/courses/mathematics/18-s997-introduction-to-matlab-programming-fall-2011/syllabus/>

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**CODE: PCC-CS-401**

**SUBJECT NAME: DISCRETE MATHEMATICS**

**NO OF CREDITS: 4**

B.TECH 4th SEMESTER

SESSIONAL: 25

L T P

THEORY EXAM: 75

3 1 0

TOTAL : 100

Course Objectives:

Throughout the course, students will be expected to demonstrate their understanding of Discrete Mathematics by being able to do each of the following:

1. Use mathematically correct terminology and notation.
2. Construct correct direct and indirect proofs.
3. Use division into cases in a proof.
4. Use counterexamples.
5. Apply logical reasoning to solve a variety of problems.

#### **MODULE-1:**

**Sets, Relation and function:** Operations and Laws of Sets, Cartesian Products, Binary Relation, Partial Ordering Relation, Equivalence Relation, Image of a Set, Sum and Product of Functions, Bijective functions, Inverse and Composite Function, Size of a Set, Finite and infinite Sets, Countable and uncountable Sets, Cantor's diagonal argument and The Power Set theorem, Schroeder-Bernstein theorem.

**Principles of Mathematical Induction:** The Well-Ordering Principle, Recursive definition, The Division algorithm: Prime Numbers, The Greatest Common Divisor: Euclidean Algorithm, The Fundamental Theorem of Arithmetic.

#### **MODULE-2:**

Basic counting techniques-inclusion and exclusion, pigeon-hole principle, permutation and combination.

#### **MODULE-3:**

**Propositional Logic:** Syntax, Semantics, Validity and Satisfiability, Basic Connectives and Truth Tables, Logical Equivalence: The Laws of Logic, Logical Implication, Rules of Inference, The use of Quantifiers.

**Proof Techniques:** Some Terminology, Proof Methods and Strategies, Forward Proof, Proof by Contradiction, Proof by Contraposition, Proof of Necessity and Sufficiency.

#### **MODULE-4:**

**Algebraic Structures and Morphism:** Algebraic Structures with one Binary Operation, Semi Groups, Monoids, Groups, Congruence Relation and Quotient Structures, Free and Cyclic Monoids and Groups, Permutation Groups, Substructures, Normal Subgroups, Algebraic Structures with two Binary Operation,



Rings, Integral Domain and Fields. Boolean Algebra and Boolean Ring, Identities of Boolean Algebra, Duality, Representation of Boolean Function, Disjunctive and Conjunctive Normal Form

#### **MODULE-5:**

Graphs and Trees: Graphs and their properties, Degree, Connectivity, Path, Cycle, Sub Graph, Isomorphism, Eulerian and Hamiltonian Walks, Graph Colouring, Colouring maps and Planar Graphs, Colouring Vertices, Colouring Edges, List Colouring, Perfect Graph, definition properties and Example, rooted trees, trees and sorting, weighted trees and prefix codes, Bi-connected component and Articulation Points, Shortest distances.

#### **Course Outcomes:**

1. For a given logic sentence express it in terms of predicates, quantifiers, and logical connectives
2. For a given a problem, derive the solution using deductive logic and prove the solution based on logical inference
3. For a given a mathematical problem, classify its algebraic structure
4. Evaluate Boolean functions and simplify expressions using the properties of Boolean algebra
5. Develop the given problem as graph networks and solve with techniques of graph theory.

#### **REFERENCES:**

1. Kenneth H. Rosen, Discrete Mathematics and its Applications, Tata McGraw – Hill
  2. Susanna S. Epp, Discrete Mathematics with Applications, 4th edition, Wadsworth Publishing Co. Inc.
  3. C L Liu and D P Mohapatra, Elements of Discrete Mathematics A Computer Oriented Approach, 3rd Edition by, Tata McGraw – Hill.
  4. J.P. Tremblay and R. Manohar, Discrete Mathematical Structure and It's Application to Computer Science", TMG Edition, TataMcgraw-Hill
  5. Norman L. Biggs, Discrete Mathematics, 2nd Edition, Oxford University Press. Schaum's Outlines Series, Seymour Lipschutz, Marc Lipson, Discrete Mathematics, Tata McGraw - Hill
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**CODE: PCC-CS-402**

**SUBJECT NAME: COMPUTER ORGANIZATION & ARCHITECTURE**

**NO OF CREDITS: 3**

B.TECH 4th SEMESTER

L T P

3 0 0

SESSIONAL: 25

THEORY EXAM: 75

TOTAL : 100

Pre-requisites: Digital Electronics

Course Objectives: To expose the students to the following:

1. How Computer Systems work and the basic principles.
2. Concept of computer architecture and Micro programming.
3. The basic principles for accessing I/O devices and memory unit.
4. Concepts of advanced processors, parallel and pipelining techniques.

#### **MODULE-1:**

**Functional blocks of a computer:** CPU, memory, input-output subsystems, control unit. Instruction set architecture of a CPU – registers, instruction execution cycle, RTL interpretation of instructions, addressing modes, instruction set. Case study – instruction sets of some common CPUs.

**Data representation:** signed number representation, fixed and floating point representations, character representation. Computer arithmetic – integer addition and subtraction, ripple carry adder, carry look-ahead adder, etc. multiplication – shift-and add, Booth multiplier, carry save multiplier, etc. Division restoring and non-restoring techniques, floating point arithmetic.

#### **MODULE-2:**

**Introduction** to x86 architecture.

**CPU control unit design:** hardwired and micro-programmed design approaches, Case study – design of a simple hypothetical CPU.

**Memory system design:** semiconductor memory technologies, memory organization.

**Peripheral devices and their characteristics:** Input-output subsystems, I/O device interface, I/O transfers – program controlled, interrupt driven and DMA, privileged and non-privileged instructions, software interrupts and exceptions. Programs and processes – role of interrupts in process state transitions, I/O device interfaces – SCSI, USB

#### **MODULE-3:**

**Pipelining:** Basic concepts of pipelining, throughput and speedup, pipeline hazards.

**Parallel Processors:** Introduction to parallel processors, Concurrent access to memory and cache coherency.

#### **MODULE-4:**

Memory organization: Memory interleaving, concept of hierarchical memory organization, cache memory, cache size Vs block size, mapping functions, replacement algorithms, write policies.

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### **Course Outcomes:**

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

1. Draw the functional block diagram of single bus architecture of a computer and describe the function of the instruction execution cycle, RTL interpretation of instructions, addressing modes, instruction set.
2. Write assembly language program for specified microprocessors using different data representations.
3. Design the ALU, Control Unit and CPU of a computer system.
4. Design a memory module and analyze its operation by interfacing with a given CPU organization and instruction
5. Given a CPU organization, assess its performance, and apply design techniques to enhance performance using pipelining, parallelism and RISC methodology.

### **REFERENCES:**

1. **“Computer Organization and Design: The Hardware/Software Interface”, 5th Edition by David A. Patterson and John L. Hennessy, Elsevier.**
  2. **“Computer Organization and Embedded Systems”, 6th Edition by Carl Hamacher, McGraw Hill Higher Education.**
  3. **“Computer Architecture and Organization”, 3rd Edition by John P. Hayes WCB/McGraw-Hill**
  4. **“Computer Organization and Architecture: Designing for Performance”, 10th Edition by William Stallings, Pearson Education.**
  5. **“Computer System Design and Architecture”, 2nd Edition by Vincent P. Heuring and Harry F. Jordan, Pearson Education.**
-



**CODE:PCC-CS-403**

**SUBJECTNAME:OPERATING SYSTEM**

**NO OF CREDITS: 3**

B.TECH4 <sup>th</sup> SEMESTER	SESSIONAL:	25
L TP	THEORYEXAM:	75
3 00	TOTAL:	100

Pre-requisites: Fundamentals of Computers, Computer Organization & Architecture

Course Objectives:

1. To understand evolution and types of OS and to understand the structure, components and functions of OS.
2. To learn about Processes, threads and various Scheduling policies.
3. To understand process concurrency and synchronization.
4. To understand the principles of concurrency and Deadlocks.
5. To understand various memory management schemes.
6. To understand virtual memory management, Disk management, I/O management and File systems

Course Contents:

MODULE-1:Introduction: Concept of Operating Systems, Generations of Operating systems, Types of Operating Systems, OS Services, System Calls, Structure of an OS - Layered, Monolithic, Microkernel Operating Systems and Hybrid architecture.

MODULE-2:Processes: Definition, Process Relationship, Different states of a Process, Process State transitions, Process Control Block (PCB), Context switching, Concept of multithreads.

Process Scheduling: Scheduling objectives, Types of Schedulers, Scheduling criteria: CPU utilization, Throughput, Turnaround Time, Waiting Time, Response Time; Scheduling algorithms: Pre-emptive and Non pre-emptive, FCFS, SJF, RR, Multilevel.

MODULE-3:Inter-processCommunication:CriticalSection,RaceConditions,Mutual Exclusion, Hardware solution, Strict Alternation, Peterson's Solution, Semaphores. Classical IPC Problems: The Producer/Consumer Problem, Reader's & Writer Problem etc.

MODULE-4:Deadlocks:Definition,Necessary and sufficient conditions for Deadlock, Deadlock Prevention, Deadlock Avoidance: Banker's algorithm, Deadlock detection and Recovery.

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**MODULE-5:Memory Management:** Basic concept, Logical and Physical address map, Memory allocation: Contiguous Memory allocation –Fixed and variable partition –Internal and External fragmentation and Compaction; Paging: Principle of operation –Page allocation –Hardware support for paging, Protection and sharing, Disadvantages of paging, segmentation.

Virtual Memory: Basics of Virtual Memory, Locality of reference, Page fault, Working Set, Dirty page/Dirty bit –Demand paging, Page Replacement algorithms: Optimal, First in First out (FIFO) and Least Recently used (LRU).

**MODULE-6:I/O Hardware:** I/O devices, Device controllers, Direct memory access, Principles of I/O Software: Goals of Interrupt handlers, Device drivers, Device independent I/O software, Secondary-Storage Structure: Disk structure, Disk scheduling algorithms

File Management: Concept of File, Access methods, File types, File operation, Directory structure, File System structure, Allocation methods (contiguous, linked, indexed), Free-space management (bit vector, linked list, grouping), directory implementation.

**Course Outcomes:**

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

1. Learn the basic concepts of operating system, its various types and architecture
2. Learn and implement process management issues including process life cycle, scheduling, synchronization and deadlocks
3. Learn and implement memory management issues including memory partitioning, memory allocation and virtual memory concept
4. Learn and implement files systems and I/O systems including file management and disk management

**Reference Books:**

1. Abraham Silberschatz, Peter Galvin, Greg Gagne, “Operating System Concepts Essentials”, 9th Edition, Wiley Asia Student Edition.
2. Naresh Chauhan, "Principles of Operating Systems, “Oxford University Press India, 2014.
3. William Stallings, “Operating Systems: Internals and Design Principles”, 5th Edition, Prentice Hall of India



**CODE: PCC-CS-404**

**SUBJECT NAME: DESIGN & ANALYSIS OF ALGORITHMS**

**NO OF CREDITS: 3**

B.TECH 4<sup>th</sup> SEMESTER

SESSIONAL: 25

L T P

THEORY EXAM: 75

3 0 0

TOTAL : 100

Pre-requisites: Data Structures and Algorithms

**Course Objectives:**

1. Analyze the asymptotic performance of algorithms.
2. Write rigorous correctness proofs for algorithms.
3. Demonstrate a familiarity with major algorithms and data structures.
4. Apply important algorithmic design paradigms and methods of analysis.
5. Synthesize efficient algorithms in common engineering design situations.

**MODULE-1: INTRODUCTION**

Characteristics of algorithm, Analysis of algorithm: Asymptotic analysis of complexity bounds – best, average and worst-case behavior; Performance measurements of Algorithm, Time and space trade-offs, Analysis of recursive algorithms through recurrence relations: Substitution method, Recursion tree method and Masters' theorem.

**MODULE-2: FUNDAMENTAL ALGORITHMIC STRATEGIES**

Brute-Force, Greedy, Dynamic Programming, Branch and-Bound and backtracking methodologies for the design of algorithms; Illustrations of these techniques for Problem-Solving, Bin Packing, Knapsack, Job sequencing with deadline, Optimal Binary Search tree, N-Queen problem, Hamiltonian Cycle, TSP, Heuristics – characteristics and their application domains.

**MODULE-3: GRAPH AND TREE TRAVERSAL ALGORITHMS**

Depth First Search (DFS) and Breadth First Search (BFS); Shortest path algorithms, Transitive closure, Minimum Spanning Tree, Topological sorting, Network Flow Algorithm.

**MODULE-4: TRACTABLE AND INTRACTABLE PROBLEMS**

Computability of Algorithms, Computability classes – P, NP, NP-complete and NP-hard, Cook's theorem, Standard NP-complete problems and Reduction techniques.

**MODULE-5: ADVANCED TOPICS**

Approximation algorithms, Randomized algorithms, Class of problems beyond NP – P SPACE

**Course Outcomes:**

1. For a given algorithms analyze worst-case running times of algorithms based on asymptotic analysis and justify the correctness of algorithms.
2. Describe the greedy paradigm and explain when an algorithmic design situation calls for it. For a given problem develop the greedy algorithms.





3. Describe the divide-and-conquer paradigm and explain when an algorithmic design situation calls for it. Synthesize divide-and-conquer algorithms. Derive and solve recurrence relation.
4. Describe the dynamic-programming paradigm and explain when an algorithmic design situation calls for it. For a given problems of dynamic-programming and develop the dynamic programming algorithms, and analyze it to determine its computational complexity.
5. For a given model engineering problem model it using graph and write the corresponding algorithm to solve the problems.
6. Explain the ways to analyze randomized algorithms (expected running time, probability of error).
7. Explain what an approximation algorithm is. Compute the approximation factor of an approximation algorithm (PTAS and FPTAS).

## REFERENCES

1. Thomas H Cormen, Charles E Lieserson, Ronald L Rivest and Clifford Stein, “*Introduction to Algorithms*”, MIT Press/McGraw-Hill; 3rd edition, [ISBN: 978-0262533058], 2009.
2. Ellis Horowitz, Sartaj Sahni and SanguthevarRajasekaran, “*Fundamentals of Algorithms*”, Universities Press; 2nd edition [ISBN:978-8173716126],2008.
3. Jon Kleinberg and ÉvaTardos, “*Algorithm Design*”, Pearson Publisher; 1st edition [ISBN:978-0321295354],2012.
4. Michael T Goodrich and Roberto Tamassia, “*Fundamentals of Algorithms*” Wiley Press; 1st edition [ISBN:978-8126509867],2006.



**CODE: HSMC-02**

**SUBJECT NAME: ECONOMICS FOR ENGINEERS**

**NO OF CREDITS: 3**

B.TECH 4<sup>th</sup> SEMESTER

L T P

3 0 0

SESSIONAL: 25

THEORY EXAM: 75

TOTAL : 100

**Course Objectives:** The purpose of the course is to:

1. Acquaint the students with the use of EXCEL spreadsheets and financial functions to model and solve engineering economic analysis problems.
2. Familiarize the students with the time value of money.
3. Acquaint the students with the effects of depreciation, income taxes, inflation, and price change in engineering economic analysis problems.
4. Familiarize the students with the demand, market, production, Indian economy and its characteristics.

#### **MODULE-1:**

Introduction to the subject: Micro and Macro Economics, Relationship between Science, Engineering, Technology and Economic Development. Production Possibility Curve, Nature of Economic Laws.

#### **MODULE-2:**

Time Value of Money: concepts and application. Capital budgeting; Traditional and modern methods, Payback period method, IRR, ARR, NPV, PI (with the help of case studies)

#### **MODULE-3:**

Meaning of Demand. Law of Demand, Elasticity of Demand; meaning, factors effecting it and its practical application and importance. Demand forecasting (a brief explanation)

#### **MODULE-4:**

Meaning of Production and factors of production, Law of variable proportions and returns to scale. Internal and external economies and diseconomies of scale. Concepts of cost of production, different types of costs; accounting cost, sunk cost, marginal cost, Opportunity cost. Break even analysis, Make or Buy decision (case study). Relevance of Depreciation towards industry.

#### **MODULE-5:**

Meaning of market, types of market, perfect competition, Monopoly, Monopolistic, Oligopoly. (main features). Supply and law of supply, Role of demand and supply in price determination.

#### **MODULE-6:**

Indian Economy, nature and characteristics. Basic concepts; fiscal and monetary policy, LPG, Inflation, Sensex, GATT, WTO and IMF. Difference between Central bank and Commercial banks

**Course Outcomes:**

On successful completion of this course, the students should be able to:

1. Use EXCEL spreadsheets and financial functions to model and solve engineering economic analysis problems.
2. Analyse the time value of money.
3. Analyze the effects of depreciation, income taxes, inflation, and price change in engineering economic analysis problems.
4. Understand the demand, market, production, Indian economy, and its characteristics

**REFERENCES:**

1. Jain T.R., Economics for Engineers, VK Publication
2. Chopra P. N., Principle of Economics, Kalyani Publishers
3. Dewett K. K., Modern economic theory, S. Chand
4. H. L. Ahuja., Modern economic theory, S. Chand
5. DuttRudar&Sundhram K. P. M., Indian Economy
6. Mishra S. K., Modern Micro Economics, Pragati Publications
7. Pandey I.M., Financial Management; Vikas Publishing House
8. Gupta Shashi K., Management Accounting, Kalyani Publication



**CODE: MC-03**

**SUBJECT NAME: ENVIRONMENTAL SCIENCES**

**NO OF CREDITS: 0**

**B.TECH4<sup>TH</sup> SEMESTER**

**L T P**

**2 0 0**

**SESSIONAL: 25**

**THEORY EXAM: 75**

**TOTAL : 100**

Pre-requisites: None

**Course Objectives:** The prime objective of the course is to

1. Provide the students a detailed knowledge on the threats and challenges to the environment due to developmental activities.
2. The students will be able to identify the natural resources and suitable methods for their conservation and sustainable development.
3. The focus will be on awareness of the students about the importance of ecosystem and biodiversity for maintaining ecological balance.
4. The students will learn about various attributes of pollution management and waste management practices.
5. The course will also describe the social issues both rural and urban environment and environmental legislation

### **MODULE-1: The Multidisciplinary Nature of Environmental Studies**

Definition, scope and importance. Need for public awareness.

### **MODULE-2: Natural Resources: Renewable and Non-Renewable Resources**

Natural resources and associated problems:

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



### **MODULE-3: Ecosystems**

- Concept of an ecosystem. Structure and function of an ecosystem. Producers, consumers and decomposers.
- Energy flow in the ecosystem. Ecological succession. Food chains, food webs and ecological pyramids.
- Introduction, types, characteristic features, structure and function of the following ecosystem: a) Forest ecosystem b) Grassland ecosystem c) Desert ecosystem d) Aquatic ecosystems (ponds, streams, lakes, rivers, oceans, estuaries).

### **MODULE-4: Biodiversity and its Conservation**

- Introduction – Definition: genetic, species and ecosystem diversity.
- Biogeographical classification of India. Value of biodiversity: consumptive use, productive use, social, ethical, aesthetic and option values. Biodiversity at global, National and local levels.
- India as a mega-diversity nation. Hot-spots of biodiversity. Threats to biodiversity: habitat loss, poaching of wildlife, man-wildlife conflicts. Endangered and endemic species of India. Conservation of biodiversity: in situ and ex-situ conservation of biodiversity

### **MODULE-5: Environmental Pollution Definition**

- Causes, effects and control measures of: a) Air pollution b) Water pollution c) Soil pollution d) Marine pollution e) Noise pollution f) Thermal pollution g) Nuclear hazards
- Solid waste Management: Causes, effects and control measures of urban and industrial wastes. Role of an individual in prevention of pollution. Pollution case studies. Disaster management: floods, earthquake, cyclone and landslides.

### **MODULE-6: Social Issues and the Environment**

- From Unsustainable to Sustainable development Urban problems related to energy. Water conservation, rain water harvesting, watershed management. Resettlement and rehabilitation of people; its problems and concerns. Case studies.
- Environmental ethics: Issues and possible solutions. Climate change, global warming, acid rain, ozone layer depletion, nuclear accidents and holocaust. Case studies. Wasteland reclamation. Consumerism and waste products.
- Environment Protection Act. Air (Prevention and Control of Pollution) Act. Water (Prevention and Control of Pollution) Act
- Wildlife Protection Act. Forest Conservation Act. Issues involved in enforcement of environmental legislation Public awareness.

### **MODULE-7: Human Population and the Environment**

Population growth, variation among nations. Population explosion – Family Welfare Programme. Environment and human health. Human Rights. Value Education. HIV/AIDS. Women and Child Welfare. Role of Information Technology in Environment and human health. Case Studies.

### **MODULE-8: Field Work**

- Visit to a local area to document environmental assets-river / forest / grassland / hill / mountain.
- Visit to a local polluted site – Urban / Rural / Industrial / Agricultural.
- Study of common plants, insects, birds.
- Study of simple ecosystems – pond, river, hill slopes, etc.



### **Course Outcomes:**

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

1. Understand environmental legislation and policies of national and international regime.
2. No regulations applicable to industries and other organizations which significant environmental aspects.
3. Get knowledge of the legal system operating in India and will be in a position to prepare compliance report for getting environmental clearance.
4. Prepare the environmental management system for an organization.

### **RERERENCES**

1. Environmental Science: towards a sustainable future by Richard T. Wright. 2008 PHL Learning Private Ltd. New Delhi.
2. Environmental Engineering and science by Gilbert M. Masters and Wendell P. Ela 2008 PHI Learning Pvt Ltd.
3. Environmental Science by Daniel B. Botkin& Edwards A. Keller, Wiley INDIA edition.
4. Fundamentals of Ecology by Odum, E.P., Barrick, M. and Barret, G.W. Thomson Brooks/Cole Publisher, California, 2005.



**CODE: PCC-CS-602**

**SUBJECT NAME: COMPUTER NETWORKS**

**NO OF CREDITS: 3**

**B.TECH 5<sup>th</sup> SEMESTER**

**SESSIONAL: 25**

**L T P**

**THEORY EXAM: 75**

**3 0 0**

**TOTAL : 100**

**Pre-requisites: Computer Organization & Architecture, Operating Systems**

**Course Objectives:**

1. To develop an understanding of modern network architectures from a design and performance perspective.
2. To introduce the student to the major concepts involved in wide-area networks (WANs), local area networks (LANs) and Wireless LANs (WLANs).
3. To provide an opportunity to do network programming
4. To provide a WLAN measurement ideas.

**MODULE-1:DATA COMMUNICATION COMPONENTS**

Representation of data and its flow Networks , Various Connection Topology, Protocols and Standards, OSI model, Transmission Media, LAN: Wired LAN, Wireless LANs, Connecting LAN and Virtual LAN, Techniques for Bandwidth utilization: Multiplexing - Frequency division, Time division and Wave division, Concepts on spread spectrum.

**MODULE-2: DATA LINK LAYER AND MEDIUM ACCESS SUB LAYER**

Error Detection and Error Correction - Fundamentals, Block coding, Hamming Distance, CRC; Flow Control and Error control protocols - Stop and Wait, Go back – N ARQ, Selective Repeat ARQ, Sliding Window, Piggybacking, Random Access, Multiple access protocols -Pure ALOHA, Slotted ALOHA, CSMA/CD,CDMA/CA

**MODULE-3: NETWORK LAYER**

Switching, Logical addressing – IPV4, IPV6; Address mapping – ARP, RARP, BOOTP and DHCP–Delivery, Forwarding and Unicast Routing protocols.

**MODULE-4: TRANSPORT LAYER**

Process to Process Communication, User Datagram Protocol (UDP), Transmission Control Protocol (TCP), SCTP Congestion Control; Quality of Service, QoS improving techniques: Leaky Bucket and Token Bucket algorithm.

**MODULE-5: APPLICATION LAYER**

Domain Name Space (DNS), DDNS, TELNET, EMAIL, File Transfer Protocol (FTP), WWW, HTTP, SNMP, Bluetooth, Firewalls, Basic concepts of Cryptography



## Course Outcomes

After taking the course, students will be able to:

1. Explain the functions of the different layer of the OSI Protocol.
2. Draw the functional block diagram of wide-area networks (WANs), local area networks (LANs) and Wireless LANs (WLANs) describe the function of each block.
3. For a given requirement (small scale) of wide-area networks (WANs), local area networks (LANs) and Wireless LANs (WLANs) design it based on the market available component
4. For a given problem related TCP/IP protocol developed the network programming.
5. Configure DNS DDNS, TELNET, EMAIL, File Transfer Protocol (FTP), WWW, HTTP, SNMP, Bluetooth, Firewalls using open source available software and tools.

## REFERENCES:

1. Data Communication and Networking, 4th Edition, Behrouz A. Forouzan, McGrawHill.
2. Data and Computer Communication, 8th Edition, William Stallings, Pearson Prentice Hall India.
3. Computer Networks, 8th Edition, Andrew S. Tanenbaum, Pearson New International Edition.
4. Internetworking with TCP/IP, Volume 1, 6th Edition Douglas Comer, Prentice Hall of India.
5. TCP/IP Illustrated, Volume 1, W. Richard Stevens, Addison-Wesley, United States of America





**CODE: PCC-CS-501**

**SUBJECT NAME: DATABASE MANAGEMENT SYSTEMS**

**NO OF CREDITS: 3**

B.TECH 5<sup>th</sup> SEMESTER

SESSIONAL: 25

L T P

THEORY EXAM: 75

3 0 0

TOTAL : 100

Pre-requisites: Operating Systems

**Course Objectives:**

1. To understand the different issues involved in the design and implementation of a database system.
2. To study the physical and logical database designs, database modeling, relational, hierarchical, and network models
3. To understand and use data manipulation language to query, update, and manage a Database
4. To develop an understanding of essential DBMS concepts such as: database security, integrity, concurrency, distributed database, and intelligent database, Client/Server (Database Server), Data Warehousing.
5. To design and build a simple database system and demonstrate competence with the fundamental tasks involved with modeling, designing, and implementing a DBMS.

**MODULE-1:**

**Database system architecture:** Data Abstraction, Data Independence, Data Definition Language (DDL), Data Manipulation Language (DML).

**Data models:** Entity-relationship model, network model, relational and object oriented data models, integrity constraints, data manipulation operations.

**MODULE-2:**

**Relational query languages:** Relational algebra, Tuple and domain relational calculus, SQL3, DDL and DML constructs, Open source and Commercial DBMS - MYSQL, ORACLE, DB2, SQL server.

**Relational database design:** Domain and data dependency, Armstrong's axiom, Normal forms, Dependency preservation, Lossless design.

**Query processing and optimization:** Evaluation of relational algebra expressions, Query equivalence, Join strategies, Query optimization algorithms.

**MODULE-3:**

**Storage strategies:** Indices, B-trees, hashing.

**MODULE-4:**

**Transaction processing:** Concurrency control, ACID property, Serializability of scheduling, Locking and timestamp based schedulers, Multi-version and optimistic Concurrency Control schemes, Database recovery.



### **MODULE-5:**

**Database Security:** Authentication, Authorization and access control, DAC, MAC and RBAC models, Intrusion detection, SQL injection.

### **MODULE-6:**

**Advanced topics:** Object oriented and object relational databases, Logical databases, Web databases, Distributed databases, Data warehousing and data mining.

### **Course Outcomes**

1. For a given query write relational algebra expressions for that query and optimize the developed expressions
2. For a given specification of the requirement design the databases using ER method and normalization.
3. For a given specification construct the SQL queries for Open source and Commercial DBMS -MYSQL, ORACLE, and DB2.
4. For a given query optimize its execution using Query optimization algorithms
5. For a given transaction-processing system, determine the transaction atomicity, consistency, isolation, and durability.
6. Implement the isolation property, including locking, time stamping based on concurrency control and Serializability of scheduling

### **REFERENCES:**

1. “Database System Concepts”, 6th Edition by Abraham Silberschatz, Henry F. Korth, S. Sudarshan, McGraw-Hill.
2. “Principles of Database and Knowledge – Base Systems”, Vol 1 by J. D. Ullman, Computer Science Press.
3. “Fundamentals of Database Systems”, 5th Edition by R. Elmasri and S. Navathe, Pearson Education
4. “Foundations of Databases”, Reprint by Serge Abiteboul, Richard Hull, Victor Vianu, Addison-Wesley



**CODE: PCC-AI-502**  
**SUBJECT NAME: DIGITAL IMAGE PROCESSING**  
**NO OF CREDITS: 3**

B.TECH 5<sup>th</sup> SEMESTER

SESSIONAL: 25

L T P

THEORY EXAM: 75

3 0 0

TOTAL : 100

Pre-requisites: Digital Signal Processing, Transform techniques.

Course Objectives: The purpose of the course is to :

1. Introduce the fundamentals of digital image processing, and various image Transforms
2. Introduce the Image Enhancement Techniques, Image restoration Techniques and methods
3. Familiarize the students with image compression and Segmentation used in digital image processing.

**MODULE 1: INTRODUCTION OF DIGITAL IMAGE PROCESSING (DIP)** Introduction to the DIP areas and applications; Components of Digital Image Processing; Elements of Visual Perception; Image Sensing and Acquisition; Image Sampling and Quantization; Relationships between pixels; color models.

**MODULE 2: IMAGE ENHANCEMENT COURSE CODE** Spatial Domain: Gray level transformations; Histogram processing; Basics of Spatial Filtering; Smoothing and Sharpening Spatial Filtering Frequency Domain: Introduction to Fourier Transform; Smoothing and Sharpening frequency domain filters; Ideal, Butterworth and Gaussian filters

**MODULE 3: COLOR IMAGE PROCESSING** Color models–RGB, YUV, HSI; Color transformations– formulation, color complements, color slicing, tone and color corrections; Color image smoothing and sharpening; Color Segmentation.

**MODULE 4: FEATURE EXTRACTION AND IMAGE SEGMENTATION** Feature Extraction: Contour and shape dependent feature extraction, Extraction of textural features Segmentation: Detection of Discontinuities; Morphological processing- erosion and dilation, point, line and edge detection, Thresholding, Regions Based segmentation, Edge linking and boundary detection, Hough transform

**MODULE 5: IMAGE COMPRESSION** Fundamentals of redundancies, Basic Compression Methods: Huffman coding, Arithmetic coding, LZW coding, JPEG Compression standard, Entropy-based schemes, Transform-based encoding, Predictive encoding and DPCM, Vector quantization, Huffman coding.

**Course Outcomes:** After undergoing this course, the students will be able to:

1. Understand the basic concepts of DIP.
2. Improve the quality of digital images.
3. Understand and De-noise Digital Images
4. Segment digital images and extract various features from digital images
5. Understand various image compression techniques and apply such techniques to compress digital images for reducing the sizes of digital images.



## REFERENCES:

1. Rafael C. Gonzales, Richard E. Woods, “Digital Image Processing”, Third Edition, Pearson Education, 2010.
2. Anil Jain K. “Fundamentals of Digital Image Processing”, PHI Learning Pvt. Ltd., 2011.
3. William K Pratt, “Digital Image Processing”, John Willey, 2002.
4. Nick Efford, “Digital Image Processing a practical introduction using Java”, Third Edition, Pearson Education, 2004.
5. R.C. Gonzalez, R.E. Woods, and S. L. Eddins “Digital Image Processing using MATLAB”, Pearson Prentice-Hall, 2004.
6. Sandipan Dey, “Hands-On Image Processing with Python”, Packt, 2018.



**CODE:PCC-CS-503**

**SUBJECT NAME: OBJECT ORIENTED PROGRAMMING**

**NO OF CREDITS: 3**

B.TECH 5<sup>th</sup> SEMESTER

SESSIONAL: 25

L T P

THEORY EXAM: 75

3 0 0

TOTAL : 100

Pre-requisites: Data Structures & Algorithms

Course Objectives:

The course will introduce standard tools and techniques for software development, using object oriented approach, use of a version control system, an automated build process, an appropriate framework for automated unit and integration tests.

### **MODULE-1: ABSTRACT DATA TYPES**

Decomposition & Abstraction, Abstraction Mechanisms – parameterization, specification, Kind of Abstractions – Procedural, Data, Type hierarchies, Iteration. ADT implementation - Concrete state space, concrete invariant, abstraction function. Implementing operations, illustrated by the Text example

### **MODULE-2: FEATURES OF OBJECT-ORIENTED PROGRAMMING**

Encapsulation, object identity, polymorphism – Inheritance in OO design. Implementing OO language features.- Classes, Objects and variables, Type Checking, Procedures - Commands as methods and as objects, Exceptions, Polymorphic procedures, Templates, Memory management

### **MODULE-3: DESIGN PATTERNS**

Introduction and classification. Creational Pattern – Abstract Factory Pattern, Factory Method, Singleton, Structural Pattern – Bridge, Flyweight, Behavioural Pattern - The iterator pattern, Observer pattern, Model-view-controller pattern

### **MODULE-4: GENERIC TYPES AND COLLECTIONS**

Simple Generics, Generics and Subtyping, Wildcards, Generic Methods, Set Interface, List Interface, Queue Interface, Deque Interface, Map Interface, Object Ordering, Sorted Set Interface, Sorted Map Interface

### **MODULE-5: GUI. GRAPHICAL PROGRAMMING WITH SCALA AND SWING**

Swing components, Laying out components in a container, Panels, Look & Feel, Event listener, concurrency in swing.

### **MODULE-6: THE SOFTWARE DEVELOPMENT PROCESS**

Requirement specification and analysis, Data Model, Design, Implementation, Testing.



### Course Outcomes:

After taking the course, students will be able to:

1. Specify simple abstract data types and design implementations, using abstraction functions to document them.
2. Recognize features of object-oriented design such as encapsulation, polymorphism, inheritance, and composition of systems based on object identity.
3. Name and apply some common object-oriented design patterns and give examples of their use.
4. Design applications with an event-driven graphical user interface.

### REFERENCES

1. Barbara Liskov, *Program Development in Java*, Addison-Wesley, 2001



**CODE: BSC-01**

**SUBJECT NAME: BIOLOGY**

**NO OF CREDITS: 3**

B.TECH 5<sup>th</sup> SEMESTER

SESSIONAL: 25

L T P

THEORY EXAM: 75

2 1 0

TOTAL : 100

Pre-requisites: None

**Course Objectives:** The purpose of the course is to:

1. Acquaint the students with the concept “Genetics is to biology what Newton’s laws are to Physical Sciences”,
2. Familiarize the students with the concept that all forms of life have the same building blocks and yet the manifestations are as diverse as one can imagine without catalysis life would not have existed on earth, molecular basis of coding and decoding (genetic information) is universal.
3. Acquaint the students with the fundamental principles of chemical and physical energy transactions are the same in physical/chemical and biological world.

## MODULE 1: INTRODUCTION

**Purpose:** To convey that Biology is as important a scientific discipline as Mathematics, Physics and Chemistry.

Bring out the fundamental differences between science and engineering by drawing a comparison between eye and camera, Bird flying and aircraft. Mention the most exciting aspect of biology as an independent scientific discipline. Why we need to study biology? Discuss how biological observations of 18th Century that lead to major discoveries. Examples from Brownian motion and the origin of thermodynamics by referring to the original observation of Robert Brown and Julius Mayor. These examples will highlight the fundamental importance of observations in any scientific inquiry.

## MODULE 2: CLASSIFICATION

**Purpose:** To convey that classification *per se* is not what biology is all about. The underlying criterion, such as morphological, biochemical or ecological be highlighted.

Hierarchy of life forms at phenomenological level. A common thread weaves this hierarchy Classification. Discuss classification based on (a) cellularity- Unicellular or multicellular (b) ultrastructure- prokaryotes or eucaryotes. (c) energy and Carbon utilisation -Autotrophs, heterotrophs, lithotropes (d) Ammonia excretion – aminotelic, uricotelic, ureotelic (e) Habitata- aquatic or terrestrial (e) Molecular taxonomy- three major kingdoms of life. A given organism can come under different category based on classification. Model organisms for the study of biology come from different groups. E.coli, S.cerevisiae, D. Melanogaster, C. elegance, A. Thaliana, M. Musculus.



### MODULE 3: Genetics

**Purpose:** To convey that “Genetics is to biology what Newton’s laws are to Physical Sciences”

Mendel’s laws, Concept of segregation and independent assortment. Concept of allele. Gene mapping, Gene interaction, Epistasis. Meiosis and Mitosis be taught as a part of genetics. Emphasis to be give not to the mechanics of cell division nor the phases but how genetic material passes from parent to offspring. Concepts of recessiveness and dominance. Concept of mapping of phenotype to genes. Discuss about the single gene disorders in humans. Discuss the concept of complementation using human genetics.

### MODULE 4: BIOMOLECULES

**Purpose:** To convey that all forms of life has the same building blocks and yet the manifestations are as diverse as one can imagine

Molecules of life. In this context discuss monomeric units and polymeric structures. Discuss about sugars, starch and cellulose. Amino acids and proteins. Nucleotides and DNA/RNA. Two carbon units and lipids.

### MODULE 5: ENZYMES

**Purpose:** To convey that without catalysis life would not have existed on earth.

*Enzymology:* How to monitor enzyme catalysed reactions. How does an enzyme catalyse reactions? Enzyme classification. Mechanism of enzyme action. Discuss at least two examples. Enzyme kinetics and kinetic parameters. Why should we know these parameters to understand biology? RNA catalysis.

### MODULE 6: INFORMATION TRANSFER

**Purpose:** The molecular basis of coding and decoding genetic information is universal

Molecular basis of information transfer. DNA as a genetic material. Hierarchy of DNA structure- from single stranded to double helix to nucleosomes. Concept of genetic code. Universality and degeneracy of genetic code. Define gene in terms of complementation and recombination.

### MODULE 7: MACROMOLECULAR ANALYSIS

**Purpose:** How to analyse biological processes at the reductionist level

*Proteins-* structure and function. Hierarch in protein structure. Primary secondary, tertiary and quaternary structure. Proteins as enzymes, transporters, receptors and structural elements.

### MODULE 8: METABOLISM

**Purpose:** The fundamental principles of energy transactions are the same in physical and biological world.

Thermodynamics as applied to biological systems. Exothermic and endothermic versus endergonic and exergoinc reactions. Concept of  $K_{eq}$  and its relation to standard free energy. Spontaneity. ATP as an energy currency. This should include the breakdown of glucose to  $CO_2 + H_2O$  (Glycolysis and Krebs cycle) and synthesis of glucose from  $CO_2$  and  $H_2O$  (Photosynthesis). Energy yielding and energy consuming reactions. Concept of Energy Charge.

### MODULE 9: MICROBIOLOGY

Concept of single celled organisms. Concept of species and strains. Identification and classification of microorganisms. Microscopy. Ecological aspects of single celled organisms. Sterilization and media compositions. Growth kinetics.





## Course Outcomes:

After studying the course, the student will be able to:

1. Describe how biological observations of 18th Century that lead to major discoveries.
2. Convey that classification *per se* is not what biology is all about but highlight the underlying criteria, such as morphological, biochemical and ecological
3. Highlight the concepts of recessiveness and dominance during the passage of genetic material from parent to offspring
4. Convey that all forms of life have the same building blocks and yet the manifestations are as diverse as one can imagine
5. Classify enzymes and distinguish between different mechanisms of enzyme action.
6. Identify DNA as a genetic material in the molecular basis of information transfer.
7. Analyse biological processes at the reductionistic level
8. Apply thermodynamic principles to biological systems.
9. Identify and classify microorganisms.

## REFERENCES

1. ***“Biology: A global approach”*** Campbell, N. A.; Reece, J. B.; Urry, Lisa; Cain, M, L.; Wasserman, S. A.; Minorsky, P. V.; Jackson, R. B. Pearson Education Ltd
2. ***“Outlines of Biochemistry”*** , Conn, E.E; Stumpf, P.K; Bruening, G; Doi, R.H. John Wiley and Sons
3. ***“Principles of Biochemistry(V Edition)”***, By Nelson, D. L.; and Cox, M. M.W.H. Freeman and Company
4. ***“Molecular Genetics (Second edition)”***, Stent, G. S.; and Calender, R. W.H. Freeman and company, Distributed by Satish Kumar Jain for CBS Publisher
5. ***“Microbiology”*** , Prescott, L.M J.P. Harley and C.A. Klein 1995. 2nd edition Wm, C.Brown Publishers



**CODE: MC-01**

**SUBJECT NAME: CONSTITUTION OF INDIA**

**NO OF CREDITS: 0**

**B.TECH 5<sup>th</sup> SEMESTER**

**SESSIONAL: 25**

**L T P**

**THEORY EXAM: 75**

**2 0 0**

**TOTAL : 100**

**Course Objectives:** The purpose of the course is to:

1. Acquaint the students with the Historical perspectives, Salient Features and Characteristics of Constitution of India.
2. Acquaint the students with the various schemes of Fundamental Rights, Fundamental Duties, Article-19, Article-21 and D.P.S.P
3. Familiarize the students with the basic structure of the Government of India.
4. Acquaint the students with the Constitutional Amendments • & Emergency Provisions.
5. Acquaint the students with the Local Government of India and its Three Tier Structure •

### **CONSTITUTION OF INDIA– BASIC FEATURES AND FUNDAMENTAL PRINCIPLES**

The Constitution of India is the supreme law of India. Parliament of India can not make any law which violates the Fundamental Rights enumerated under the Part III of the Constitution. The Parliament of India has been empowered to amend the Constitution under Article 368, however, it cannot use this power to change the “basic structure” of the constitution, which has been ruled and explained by the Supreme Court of India in its historical judgments. The Constitution of India reflects the idea of “Constitutionalism” – a modern and progressive concept historically developed by the thinkers of “liberalism” – an ideology which has been recognized as one of the most popular political ideology and result of historical struggles against arbitrary use of sovereign power by state. The historic revolutions in France, England, America and particularly European Renaissance and Reformation movement have resulted into progressive legal reforms in the form of “constitutionalism” in many countries. The Constitution of India was made by borrowing models and principles from many countries including United Kingdom and America.

The Constitution of India is not only a legal document but it also reflects social, political and economic perspectives of the Indian Society. It reflects India’s legacy of “diversity”. It has been said that Indian constitution reflects ideals of its freedom movement, however, few critics have argued that it does not truly incorporate our own ancient legal heritage and cultural values. No law can be “static” and therefore the Constitution of India has also been amended more than one hundred times. These amendments reflect political, social and economic developments since the year 1950.

The Indian judiciary and particularly the Supreme Court of India has played an historic role as the guardian of people. It has been protecting not only basic ideals of the Constitution but also strengthened the same through progressive interpretations of the text of the Constitution. The judicial activism of the Supreme Court of India and its historic contributions has been recognized throughout the world and it gradually made it “as one of the strongest court in the world”.

### **COURSE CONTENT**

1. Meaning of the constitution law and constitutionalism.



2. Historical perspective of the Constitution of India.
3. Salient features and characteristics of the Constitution of India.
4. Scheme of the fundamental rights.
5. The scheme of the Fundamental Duties and its legal status.
6. The Directive Principles of State Policy – Its importance and implementation.
7. Federal structure and distribution of legislative and financial powers between the Union and the States.
8. Parliamentary Form of Government in India – The constitution powers and status of the President of India
9. Amendment of the Constitutional Powers and Procedure
10. The historical perspectives of the constitutional amendments in India
11. Emergency Provisions : National Emergency, President Rule, Financial Emergency
12. Local Self Government – Constitutional Scheme in India
13. Scheme of the Fundamental Right to Equality
14. Scheme of the Fundamental Right to certain Freedom under Article 19
15. Scope of the Right to Life and Personal Liberty under Article 21

**Course Outcomes:** On successful completion of this course the student should be able to:

1. Understand the Historical Perspective of Constitution of India.
2. Understand various schemes and scope of Fundamental Rights, Fundamental Duties and D.P.S.P
3. Understand the Type of Government in India and its Federal Structure.
4. Understand Constitutional Amendments, Emergency Provisions in India, Local Self Government, and its Three Tier Structure.

#### REFERENCES:

1. The Constitutional Law Of India 9<sup>th</sup> Edition, by Pandey. J. N.
2. The Constitution of India by P.M.Bakshi
3. Constitution Law of India by Narender Kumar
4. Bare Act by P. M. Bakshi



**CODE: PEC-CS-S-703**

**SUBJECT NAME: INTERNET OF THINGS**

**NO OF CREDITS: 3**

B.TECH 7<sup>th</sup> SEMESTER

SESSIONAL: 25

L T P

THEORY EXAM: 75

3 0 0

TOTAL : 100

Pre-requisites: Internet and web Technology, Computer Networks

Course Objectives:

1. Student will be able to learn the basics of IOT.
2. Student will be able to analyse basic protocols of wireless and MAC.
3. Students will get familiar with web of things.
4. Students will get basic knowledge of resource management.

#### **MODULE-1: INTRODUCTION TO IoT**

Introduction to IoT, Characteristics of IoT, Physical design of IoT, Logical design of IoT, Functional blocks of IoT, Communication models & APIs, IoT & M2M Machine to Machine, Difference between IoT and M2M, Software define Network, Challenges in IoT(Design, Development, Security).

#### **MODULE-2: NETWORK AND COMMUNICATION ASPECTS**

Wireless medium access issues, MAC protocol survey, Survey routing protocols, Sensor deployment & Node discovery, Data aggregation & dissemination.

#### **MODULE-3: WEB OF THINGS**

Web of Things vs Internet of things, two pillars of web, Architecture and standardization of IoT, Unified multitier-WoT architecture, WoT portals and Business intelligence, Cloud of things: Grid/SOA and cloud computing, Cloud middleware, cloud standards

#### **MODULE-4: RESOURCE MANAGEMENT IN IOT**

Domain specific applications of IoT, Home automation, Industry applications, Surveillance applications, Other IoT applications Clustering, Synchronization, Software agents.

#### **Course Outcomes:**

On successful completion of the course, the student will:

1. Understand the concepts of Internet of Things
2. Analyze basic protocols network
3. Understand the concepts of Web of Things along with its architecture and will be able to differentiate WoT from IoT.
4. Design IoT applications in different domain and be able to analyze their performance



## REFERENCES:

1. Vijay Madiseti, ArshdeepBahga, "Internet of Things: A Hands-On Approach"
2. WaltenegusDargie,ChristianPoellabauer, "Fundamentals of Wireless Sensor Networks: Theory and Practice"



**CODE: PCC-AI-601**

**SUBJECT NAME: BIG DATA ANALYTICS**

**NO OF CREDITS: 3**

B.TECH 5<sup>th</sup> SEMESTER

SESSIONAL: 25

L T P

THEORY EXAM: 75

3 0 0

TOTAL : 100

Pre-requisites: Some prior knowledge about Java programming, Basics of SQL queries, exposure to Linux environment, concept of data mining and machine learning methods will be beneficial.

### **Course Objectives:**

1. To provide an overview of an emerging field of big data analytics.
2. To make students familiar with the tools required to manage and analyze big data like Hadoop, No SQL, Map-Reduce.
3. To teach the fundamental techniques and principles in achieving analytics with scalability and streaming capability on both structured and unstructured data.
4. To enable students to have skills that will help them to solve complex real-world problems in for decision support.

**MODULE I: INTRODUCTION TO BIG DATA** Types of Digital Data, Characteristics of Data, Evolution of Big Data, Definition of Big Data, Challenges with Big Data, 3Vs of Big Data, Non-Definitional traits of Big Data - Business Intelligence vs. Big Data, Coexistence. Big Data Analytics: Classification of analytics, Terminologies in Big Data. Big Data Processing Architectures, Data Warehouse, ReEngineering the Data Warehouse, Big data learning approaches.

**MODULE II: NTRODUCTION TO HADOOP** Features of Hadoop, Advantages, Versions, Physical Architecture of Hadoop, Analyzing Data with Hadoop, Overview of Hadoop Eco systems, Hadoop distributions, Hadoop vs. SQL, RDBMS vs. Hadoop, Components of Hadoop, Concept of HDFS, Hadoop Streaming

**MODULE III: HDFS (HADOOP DISTRIBUTED FILE SYSTEM) AND MAP REDUCE** Distributed File Systems: Physical Organization of Compute Nodes, Large-Scale FileSystem Organization. The Design of HDFS, HDFS Concepts, Command Line Interface, Hadoop file system interfaces, Data flow, Data Ingest with Flume and Scoop and Hadoop archives MapReduce: The Map Tasks, Grouping by Key, The Reduce Tasks, Combiners, Details of MapReduce Execution, Coping with Node Failures. Algorithms Using MapReduce: Matrix-Vector Multiplication by MapReduce, RelationalAlgebra Operations, Computing Selections by MapReduce, Computing Projections by MapReduce, Union, Intersection, and Difference by MapReduce, Computing Natural Join by MapReduce, Grouping and Aggregation by MapReduce, Matrix Multiplication, Matrix Multiplication with One MapReduce Step.

**MODULE IV: NO SQL DATABASE** Introduction to NoSQL, NoSQL Business Drivers, NoSQL Data Architecture Patterns: Keyvalue stores, Graph stores, Column family (Bigtable)stores, Document stores, Variations of NoSQL architectural patterns, NoSQL Case Study, NoSQL solution for big data, Understanding the types of big data problems; Analyzing big data with a shared-nothing architecture; Choosing distribution models: master-slave versus peer-to-peer; NoSQL systems to handle big data problems.



**MODULE V: HADOOP ECO SYSTEM** 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. Big SQL: Introduction

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

1. Understand the key issues in big data management and its associated applications for business decisions and strategy.
2. Develop problem solving and critical thinking skills in fundamental enabling techniques like Hadoop, MapReduce and NoSQL in big data analytics.
3. Collect, manage, store, query and analyze various forms of Big Data.
4. Interpret business models and scientific computing paradigms and apply software tools for big data analytics.
5. Adapt adequate perspectives of big data analytics in various applications like recommender systems, social media applications etc.

#### **TEXT BOOKS:**

1. Anand Rajaraman and Jeff Ullman “Mining of Massive Datasets”, Cambridge University Press,
2. Alex Holmes “Hadoop in Practice”, Manning Press, Dreamtech Press.
3. Dan McCreary and Ann Kelly “Making Sense of NoSQL” – A guide for managers and the rest of us, Manning Press.

#### **REFERENCES:**

1. Chuck Lam, “Hadoop in Action”, Dreamtech Press
2. Judith Hurwitz, Alan Nugent, Dr. Fern Halper, Marcia Kaufman, “Big Data for Dummies”, Wiley India 2. Michael Minelli, Michele Chambers, Ambiga Dhiraj, “Big Data Big Analytics: Emerging Business Intelligence And Analytic Trends For Today's Businesses”, Wiley India
3. Paul Zikopoulos, Chris Eaton, “Understanding Big Data: Analytics for Enterprise Class Hadoop and Streaming Data’, McGraw Hill Education.



**CODE:HSMC-03**

**SUBJECT NAME: MANAGEMENT-I (ORGANIZATIONAL BEHAVIOUR)**

**NO OF CREDITS: 3**

B.TECH 7<sup>TH</sup> SEMESTER

L T P

3 0 0

SESSIONAL: 25

THEORY EXAM: 75

TOTAL : 100

**Course Objectives:** The purpose of this course is to:

1. Familiarize the students the students with basic concepts of management
2. Acquaint the students with fundamentals of Organizational Behaviour.
3. Impart knowledge about behavioural processes at individual, team and organizational level.

### **MODULE-1**

Introduction to management: concept, nature; evolution of management thoughts –traditional, behavioural, system, contingency and quality viewpoints; Managerial levels, skills and roles in an organization; Functions of Management: Planning, Organizing, Directing, Controlling, Problem solving and Decision making; Management control; managerial ethics and social responsibility; Management Information System (MIS).

### **MODULE-2**

Fundamentals of Organizational Behavior: Concept, evolution, importance and relationship with other Fields; Contemporary challenges of OB; Individual Processes and Behavior – differences, Personality concept, determinant, theories and applications; Values, Attitudes and Emotions, Perception- concept, process and applications, Learning and Reinforcement; Motivation: concept, theories and applications; Stress management.

### **MODULE-3**

Interpersonal Processes- Work teams and groups- Definition of Group, Stages of group development, Group cohesiveness, Types of groups, Group processes and Decision Making; Team Building; Conflict- concept, sources, types, management of conflict; Power and Political Behavior; Leadership: concept, function and styles.

### **MODULE-4**

Organizational Processes and structure: organizational design: various organizational structures and their effect on human behavior; Organizational climate; Organizational culture; Organizational change: Concept, Nature, Resistance to Change, Change Management, Implementing Change and Organizational Development

**Course Outcomes:**

1. The students learn how to influence the human behaviour.
2. Students will be able to understand behavioural dynamics in organizations.
3. Students will be able to apply managerial concepts in practical life.
4. Students will be able to understand organizational culture and change.





## REFERENCES:

1. Robbins, S.P. and Decenzo, D.A. Fundamentals of Management, Pearson Education Asia, New Delhi.
2. Stoner, J et. al, Management, New Delhi, PHI, New Delhi
3. Satya Raju, Management – Text & Cases, PHI, New Delhi
4. Kavita Singh, Organisational Behaviour: Text and cases. New Delhi: Pearson Education.
5. Pareek, Udai, Understanding Organisational Behaviour, Oxford University Press, New Delhi
6. Robbins, S.P. & Judge, T.A., Organisational Behaviour, Prentice Hall of India, New Delhi



**CODE:HSMC-04**

**SUBJECT NAME: MANAGEMENT-I (FINANCE & ACCOUNTING)**

**NO OF CREDITS: 3**

B.TECH 7<sup>TH</sup> SEMESTER

SESSIONAL: 25

L T P

THEORY EXAM: 75

3 0 0

TOTAL : 100

**Course Objectives:** The purpose of this course is to:

1. Understand the basic nature of accounting and its interaction with other accounting and their comparison.
2. Impart knowledge about the kind of information the manager need and information sources
3. Familiarize the students about how information can be used to carry out important managerial decision.

#### **MODULE-1:**

Meaning nature and scope of different types of accounting and their comparison. Accounting principles and Indian accounting standards, IFRS, Preparation of final accounts of company with basic adjustments. Reading and understanding of Annual report.

#### **MODULE-2:**

Analysis and interpretation of financial statements – meaning, importance and techniques, ratio analysis; fund flow analysis; cash flow analysis (AS-3)

#### **MODULE-3:**

Classification of costs, preparation of cost sheet, inventory valuation, overview of standard costing and variance analysis; material variance and labour variance.

#### **MODULE-4:**

Budgetary control- meaning, need, objectives, essentials of budgeting, different types of budgets cash budget, flexible budget zero base budget; marginal costing, BEP analysis, decision making for optimum sales mix, exploring new markets, make/Buy decisions, expand/ contract, accepting and rejecting decisions

#### **Course Outcomes:**

1. This course will impart knowledge to the students regarding preparation of financial statements their analysis.
2. The students will be able to understand applications of cost accounting and cost control techniques like standard costing etc.
3. The course will help them to take better managerial decisions.
4. Students will be able to know about budget control techniques.

#### **REFERENCES:**

1. Singhal, A.K. and Ghosh Roy, H.J., Accounting for Managers, JBC Publishers and Distributors, New Delhi
2. Pandey, I.M., Management Accounting, Vikas Publishing House, New Delhi
3. Horngren, Sundem and Stratton, Introduction to Management Accounting, Pearson Education, New Delhi.



4. Jain, S.P and Narang, K.L., Advanced Cost Accounting, Kalyani Publishers, Ludhiana.
5. Khan, M.Y. and Jain, P.K., Management Accounting, TMH, New Delhi



## **DETAILED 4-YEAR CURRICULUM CONTENTS**

**Undergraduate Degree in Engineering & Technology**

**Branch/Course: COMPUTER ENGINEERING**

<h3><b>ELECTIVE COURSES</b></h3>
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**CODE: PCC-CS-601**

**SUBJECT NAME: INTELLIGENT SYSTEMS**

**NO OF CREDITS: 3**

B.TECH 6<sup>th</sup> SEMESTER

SESSIONAL: 25

L T P

THEORY EXAM: 75

3 0 0

TOTAL : 100

Pre-requisites: Basics of Data Structures and Mathematics

**Course Objectives:**

The purpose of the course is to:

1. Introduce the basic concepts of Artificial Intelligence (AI).
2. Familiarize the students with the use of AI to solve real world problems for which solutions are difficult to express using the traditional algorithmic approach.
3. Explore the essential theory behind methodologies for developing systems that demonstrate intelligent behaviour including dealing with uncertainty, learning from experience and following problem solving strategies found in nature.

**MODULE-1:**

Biological foundations to intelligent systems I: Artificial neural networks, Backpropagation networks, Radial basis function networks, and recurrent networks.

**MODULE-2:**

Biological foundations to intelligent systems II: Fuzzy logic, knowledge Representation and inference mechanism, genetic algorithm, and fuzzy neural networks.

**MODULE-3:**

Search Methods Basic concepts of graph and tree search. Three simple search methods: breadth- first search, depth-first search, iterative deepening search. Heuristic search methods: best-first search, admissible evaluation functions, hill climbing search. Optimisation and search such as stochastic annealing and genetic algorithm.

**MODULE-4:**

Knowledge representation and logical inference Issues in knowledge representation. Structured representation, such as frames, and scripts, semantic networks and conceptual graphs. Formal logic and logical inference, Knowledge-based systems structures, its basic components. Ideas of Blackboard architectures.



## **MODULE-5:**

Reasoning under uncertainty and Learning Techniques on uncertainty reasoning such as Bayesian reasoning, Certainty factors and Dempster-Shafer Theory of Evidential reasoning, A study of different learning and evolutionary algorithms, such as statistical learning and induction learning.

Course Outcomes:

On the completion of the course the student will be able to:

1. Demonstrate knowledge of the fundamental principles of intelligent systems
2. Analyse and compare the relative merits of a variety of AI problem solving techniques
3. Apply their knowledge to design solutions to different problems
4. Design and develop an intelligent system for a selected application.

## **REFERENCES:**

1. Luger G.F. and Stubblefield W.A. (2008). Artificial Intelligence: Structures and strategies for Complex Problem Solving. Addison Wesley, 6th edition.
2. Russell S. and Norvig P. (2009). Artificial Intelligence: A Modern Approach. Prentice-Hall, 3<sup>rd</sup> edition.

**CODE: PEC-CS-D-501**

**SUBJECT NAME: BASICS OF MACHINE LEARNING**

**NO OF CREDITS: 3**

B.TECH 5<sup>th</sup> SEMESTER

SESSIONAL: 25

L T P

THEORY EXAM: 75

3 0 0

TOTAL : 100

Pre-requisites: Internet and web Technology, Computer Networks

**Course objectives:**

1. To learn the concept of how to learn patterns and concepts from data without being explicitly programmed in various IOT nodes.
2. To design and analyse various machine learning algorithms and techniques with a modern outlook focusing on recent advances.
3. Explore supervised and unsupervised learning paradigms of machine learning.
4. To explore Deep learning technique and various feature extraction strategies.

**MODULE-1: SUPERVISED LEARNING (REGRESSION/CLASSIFICATION)**

Basic methods: Distance-based methods, Nearest-Neighbours, Decision Trees, Naive Bayes      Linear models: Linear Regression, Logistic Regression, Generalized Linear Models

Support Vector Machines, Nonlinearity and Kernel Methods

Beyond Binary Classification: Multi-class/Structured Outputs, Ranking

**MODULE-2: UNSUPERVISED LEARNING**

Clustering: K-means/Kernel K-means

Dimensionality Reduction: PCA and kernel PCA

Matrix Factorization and Matrix Completion

Generative Models (mixture models and latent factor models)

**MODULE-3:**

Evaluating Machine Learning algorithms and Model Selection, Introduction to Statistical Learning Theory, Ensemble Methods (Boosting, Bagging, Random Forests)

**MODULE-4:**

Sparse Modeling and Estimation, Modeling Sequence/Time-Series Data, Deep Learning and Feature Representation Learning

**MODULE-5:**

Scalable Machine Learning (Online and Distributed Learning), Introduction to Bayesian Learning and Inference, Recent trends in various learning techniques of machine learning and classification methods.

**Course outcomes:**

After completion of course, students would be able to:

1. Extract features that can be used for a particular machine learning approach in various IOT applications.
2. To compare and contrast pros and cons of various machine learning techniques and to get an insight of when to apply a particular machine learning approach.
3. To mathematically analyse various machine learning approaches and paradigms.

**REFERENCES:**

1. Kevin Murphy, Machine Learning: A Probabilistic Perspective, MIT Press, 2012
2. Trevor Hastie, Robert Tibshirani, Jerome Friedman, The Elements of Statistical Learning, Springer 2009 (freely available online)
3. Christopher Bishop, Pattern Recognition and Machine Learning, Springer, 2007



**CODE: PEC-CS-S-601**

**SUBJECT NAME: SOFTWARE ENGINEERING**

**NO OF CREDITS: 3**

B.TECH 6<sup>th</sup> SEMESTER

SESSIONAL: 25

L T P

THEORY EXAM: 75

3 0 0

TOTAL : 100

Pre-requisites:

**Course Objectives:**

1. To enable the students to apply a systematic application of scientific knowledge in creating and building cost effective software solutions to business and other types of problems.
2. To make the students understand project management concepts & their metrics.
3. To make the students understand requirement engineering and its models (Information, functional, behavioral).
4. Making the students understand to develop quality software, its maintenance & introduce about software reliability.

**MODULE-1: INTRODUCTION**

Evolving role of software, Software Characteristics, Software crisis, Silver bullet, Software myths, Software process, Personal Software Process (PSP), Team Software Process (TSP), emergence of software engineering, Software process, project and product, Software Process Models: Waterfall Model, Prototype Model, Spiral, Model ,RAD Model, Iterative Model, Incremental Model, Aspect-oriented Model, Agile Model.

**MODULE-2: SOFTWARE PROJECT MANAGEMENT**

Project management concepts, Planning the software project, Estimation—LOC based, FP based, Use-case based, empirical estimation COCOMO- A Heuristic estimation techniques, staffing level estimation, team structures, staffing, risk analysis and management.

**MODULE-3: REQUIREMENTS, ANALYSIS AND SPECIFICATION**

Software Requirements engineering, Requirement engineering process, Requirement Engineering Tasks, Types of requirements, SRS. System modeling: Data Modeling, Functional modeling and information flow: Data flow diagrams, Behavioral Modeling, The mechanics of structured analysis: Creating entity/relationship diagram, data flow model, control flow model, the data dictionary.

**MODULE-4: SYSTEM DESIGN**

Design principles, the design process; Design concepts: Abstraction, refinement, modularity, software architecture, control hierarchy, structural partitioning, data structure, software procedure, information hiding; Effective modular design: Functional independence, Cohesion, Coupling;

## **MODULE-5: SOFTWARE TESTING AND MAINTENANCE**

Testing terminology- error, bug/defect/fault, failure, Verification and validation, Test case design, Static testing ,Dynamic testing--- Black box testing—Boundary value analysis, White box testing-- basis path testing, Unit testing, Integration testing, Acceptance Testing

## **MODULE-6: SOFTWARE QUALITY MODELS AND STANDARDS**

Quality concepts, Software quality assurance, SQA activities, Formal approaches to SQA; Statistical software quality assurance; CMM, The ISO 9126 Standard

### **Course Outcomes:**

The student will be able to

1. Implement Software life cycle models and have a knowledge of different phases of Software life cycle
2. Identify, formulate, review, estimate and schedule complex software projects using principles of mathematics.
3. Create a bug free software with good design and quality by using appropriate techniques and modern engineering and IT tools.
4. Analyze verification, validation activities, static, dynamic testing, debugging tools and techniques and importance of working in teams.

### **REFERENCES:**

1. Software Engineering – A Practitioner’s Approach, Roger S. Pressman, 1996, MGH.
2. Fundamentals of software Engineering,Rajib Mall, PHI
3. Software Engineering by Ian Sommerville, Pearson Edu, 5th edition, 1999, AW,
4. Software Engineering – David Gustafson, 2002, T.M.H
5. Software Engineering Fundamentals Oxford University, Ali Behforooz and Frederick J. Hudson 1995,JW&S,
6. An Integrated Approach to software engineering by Pankaj jalote , 1991 Narosa

**CODE: PEC-CS-D-601**

**SUBJECT NAME: DATA MINING**

**NO OF CREDITS: 3**

B.TECH 6<sup>th</sup> SEMESTER

SESSIONAL: 25

L T P

THEORY EXAM: 75

3 0 0

TOTAL : 100

Pre-requisites: Database Management System

**Course Objectives:**

1. To familiarize the students with the basic roadmap of data mining and various data mining techniques.
2. To introduce the techniques of frequent pattern mining and Clustering
3. To acquaint students with classification and prediction techniques in data mining.
4. To introduce students with time series data and data streams
5. To introduce various advance mining applications areas like web mining, social network analysis etc.

**MODULE-1: INTRODUCTION**

Introduction to Data Warehousing, Architecture, Data warehouse schemas, OLAP operations, KDD process, Data Mining: Predictive and Descriptive models, Data Mining primitives and Applications

**MODULE-2: FREQUENT PATTERN MINING AND CLUSTERING**

Mining frequent patterns, association and correlations; Association Rule Mining, Sequential Pattern Mining concepts, Cluster Analysis – Types of Data in Cluster Analysis, Partitioning methods, Hierarchical Methods; Transactional Patterns and other temporal based frequent patterns,

**MODULE-3: CLASSIFICATION AND PREDICTION**

Classification by Decision tree induction, Bayesian classification, Rule based classification, backpropagation through Neural Networks, Genetic Algorithm, Support Vector Machines, Prediction: linear and non-linear regression techniques.

**MODULE-4: MINING TIME SERIES DATA AND DATA STREAMS**

Mining Time series Data, Periodicity Analysis for time related sequence data, Similarity search in Time-series analysis; Mining Data Streams, Methodologies for stream data processing and stream data systems, Frequent pattern mining in stream data, Classification of dynamic data streams.

## **MODULE-5: ADVANCED MINING APPLICATIONS**

Web Mining, Web page layout structure; mining web link structure, content and usage patterns; Recent trends in Distributed Warehousing and Data Mining, Class Imbalance Problem; Graph Mining; Social Network Analysis

### **Course Outcomes:**

1. The students will be able to understand basic concepts of data warehouse and data mining, techniques and applications
2. The students will be able to understand the techniques to extract patterns from transactional database using Association and Apriori algorithms
3. The students will be able to understand different clustering techniques and will be able to cluster data sets
4. The students will be able to classify data set into different classes and acquire the knowledge to make predications based on classified data
5. The students will be able to understand and analyze time series data
6. The students will be able to understand types of web mining viz. content, structure and usage mining. Web content mining in detail.
7. The students can extend the Graph mining algorithms to Web mining
8. Students will understand advance applications of data mining

### **REFERENCES**

1. Jiawei Han and M Kamber, Data Mining Concepts and Techniques,, Second Edition, Elsevier Publication, 2011.
2. Introduction to Data Mining - Pang-Ning Tan, Michael Steinbach, Vipin Kumar, Addison Wesley, 2006.
3. G Dong and J Pei, Sequence Data Mining, Springer, 2007.

**CODE:PEC-CS-S-602(I)**

**SUBJECT NAME: DISTRIBUTED SYSTEMS**

**NO OF CREDITS: 3**

B.TECH 6<sup>th</sup> SEMESTER

SESSIONAL: 25

L T P

THEORY EXAM: 75

3 0 0

TOTAL : 100

Pre-requisites: Database Management Systems

**Course Objectives:**

1. To introduce the fundamental concepts and issues of managing large volume of shared data in a parallel and distributed environment
2. To provide insight into related research problems.

**MODULE-1: INTRODUCTION**

Distributed data processing; What is a DDBS; Advantages and disadvantages of DDBS; Problem areas; Overview of database and computer network concepts. Distributed Database Management System Architecture Transparencies in a distributed DBMS; Distributed DBMS architecture; Global directory issues/

**MODULE-2: DISTRIBUTED DATABASE DESIGN**

Alternative design strategies; Distributed design issues; Fragmentation; Data allocation Semantics Data Control : View management; Data security; Semantic Integrity Control

Query Processing Issues: Objectives of query processing; Characterization of query processors; Layers of query processing; Query decomposition; Localization of distributed data

**MODULE-3: DISTRIBUTED QUERY OPTIMIZATION**

Factors governing query optimization; Centralized query optimization; Ordering of fragment queries; Distributed query optimization algorithms

**Transaction Management:** The transaction concept; Goals of transaction management; Characteristics of transactions; Taxonomy of transaction models

**Concurrency Control:** Concurrency control in centralized database systems; Concurrency control in DDBSs; Distributed concurrency control algorithms; Deadlock management

**MODULE-4: RELIABILITY**

Reliability issues in DDBSs; Types of failures; Reliability techniques; Commit protocols; Recovery protocols

**Course Outcomes:**

After completion of course, students would be:

1. Design trends in distributed systems.
2. Apply network virtualization.
3. Apply remote method invocation and objects.

**REFERENCES**

1. Principles of Distributed Database Systems, M.T. Ozu and P. Valduriez, Prentice-Hall, 1991.
2. Distributed Database Systems, D. Bell and J. Grimson, Addison-Wesley, 1992.

**CODE: PEC-CS-D-602**

**SUBJECT NAME: SOFT COMPUTING**

**NO OF CREDITS: 3**

B.TECH 6<sup>th</sup> SEMESTER

L T P

3 0 0

SESSIONAL: 25

THEORY EXAM: 75

TOTAL : 100

Pre-requisites: Basics knowledge of Mathematics and Computer Science.

**Course Objectives:**

1. To introduce soft computing concepts and techniques and foster their abilities in designing appropriate technique for a given scenario.
2. To implement soft computing based solutions for real-world problems.
3. To give students knowledge of non-traditional technologies and fundamentals of artificial neural networks, fuzzy sets, fuzzy logic, genetic algorithms.
4. To provide students a hand-on experience on MATLAB to implement various strategies.

**MODULE-1: INTRODUCTION TO SOFT COMPUTING**

Evolution of Computing: Soft Computing Constituents, From Conventional AI to Computational Intelligence: Machine Learning Basics

**MODULE-2: FUZZY LOGIC:** Fuzzy Sets, Operations on Fuzzy Sets, Fuzzy Relations, Membership Functions: Fuzzy Rules and Fuzzy Reasoning, Fuzzy Inference Systems, Fuzzy Expert Systems, Fuzzy Decision Making.

**MODULE-3: NEURAL NETWORKS:** Machine Learning Using Neural Network, Adaptive Networks, Feed forward Networks, Supervised Learning Neural Networks, Radial Basis Function Networks : Reinforcement Learning, Unsupervised Learning Neural Networks, Adaptive Resonance architectures, Advances in Neural networks

**MODULE-4: GENETIC ALGORITHMS:** Introduction to Genetic Algorithms (GA), Applications of GA in Machine Learning : Machine Learning Approach to Knowledge Acquisition.

**MODULE-5: MATLAB**

Study of neural network toolbox and fuzzy logic toolbox, Simple implementation of Artificial Neural Network and Fuzzy Logic

**Course Outcomes:**

After completion of course, students would be able to:

1. Identify and describe soft computing techniques and their roles in building intelligent Machines.
2. Apply fuzzy logic and reasoning to handle uncertainty and solve various engineering problems.

3. Apply genetic algorithms to combinatorial optimization problems.
4. Evaluate and compare solutions by various soft computing approaches for a given problem.

## **REFERENCES**

1. George J. Klir and Bo Yuan, "Fuzzy Sets and Fuzzy Logic: Theory and Applications", PHI
2. Satish Kumar, "Neural Networks: A classroom approach" Tata McGraw Hill.
3. Haykin S., "Neural Networks-A Comprehensive Foundations", PHI
4. Anderson J.A., "An Introduction to Neural Networks", PHI
5. M.Ganesh, "Introduction to Fuzzy sets and Fuzzy Logic" PHI.
6. N P Padhy and S P Simon, " Soft Computing with MATLAB Programming", Oxford University Press



**CODE: PEC-CS-S-701(I)**

**SUBJECT NAME: ADVANCED OPERATING SYSTEMS**

**NO OF CREDITS: 3**

B.TECH 7<sup>th</sup> SEMESTER

SESSIONAL: 25

L T P

THEORY EXAM: 75

3 0 0

TOTAL : 100

Pre-requisites:

**Course Objectives:**

1. To learn the fundamentals of different types of Operating Systems.
2. To learn the mechanisms to handle processes scheduling, synchronization and memory management in Distributed OS.
3. To understand the system architecture of Multiprocessor OS and learn the mechanisms to handle processes scheduling, synchronization, memory management and fault tolerance in Multiprocessor OS.
4. To understand the characteristics and system architecture of Real-Time OS and learn the mechanisms of processes scheduling, real-time OS protocols and Case studies.
5. To learn the mechanisms to design fast OS with proper resource utilization.

**MODULE-1: INTRODUCTION**

Introduction of Operating Systems, Evolution of OS, Types of OS: Batch OS, single user & Multi-user OS, Multiprogramming and Multi-tasking, Multi-threading, Time-sharing, Embedded OS, Distributed Operating Systems, Multi-processor Operating Systems, Real-time Operating Systems, Mobile Operating Systems

**MODULE-2: DISTRIBUTED OPERATING SYSTEMS**

Introduction, Characteristics, Network OS & Distributed OS, Various issues, Communication in Distributed Systems, Clock Synchronization, Mutual Exclusion Algorithms, Deadlock Detection and Prevention, Distributed Process Scheduling Algorithms, Distributed File Systems.

**MODULE-3: MULTI-PROCESSOR OPERATING SYSTEMS**

Introduction, System Architecture, Structure of Multi-processor OS, Process Synchronization, Processor Scheduling Algorithms, Memory Sharing, Process Migration, Fault Tolerance

**MODULE-4: REAL-TIME OPERATING SYSTEMS**

Introduction, Characteristics, Structure of a Real-time System, Scheduling Algorithms, Mutual Exclusion, Priority Inheritance Protocol, Priority Ceiling Protocol, Case Studies

## **MODULE-5: MOBILE OPERATING SYSTEMS**

Introduction, Mobile Devices, Characteristics of Mobile Devices, Resource management in Mobile OS: Power Management, Battery Management, Thermal Management, Memory Management, Scheduling, File System, Security, Android OS.

### **Course Outcomes:**

After the successful completion of the course students will be able to:

1. Understand the characteristics of different OS.
2. Develop algorithms for process scheduling, synchronization for different OS.
3. For a given specification of memory organization develop the techniques for optimally allocating memory to processes by increasing memory utilization and for improving the access time for different OS.
4. Design and implement file management system for different OS.
5. Design and implement security policies in OS.

### **REFERENCES**

1. Mukesh Singhal, Niranjana G. Shivaratri, "*Advanced Concepts In Operating Systems*", Tata McGraw-Hill Education; 2nd edition, [ISBN: 007057572X], 2001.
2. Andrew S. Tanenbaum, Herbert Bos, "*Modern Operating Systems*", Pearson Prentice Hall™; 4th edition, [ISBN: 9781292061429], 2014.
3. D. M. Dhamdhere, "*Operating Systems*", Tata McGraw Hill; 1st edition, [ISBN: 9781282187245], 2006.

**CODE: PEC-CS-D-701**

**SUBJECT NAME: SPEECH AND NATURAL LANGUAGE PROCESSING**

**NO OF CREDITS: 3**

B.TECH 7<sup>th</sup> SEMESTER

SESSIONAL: 25

L T P

THEORY EXAM: 75

3 0 0

TOTAL : 100

Pre-requisites:

**Course Objectives:**

1. To make the students familiar with difference levels/stages of natural language processing and to introduce concept of Formal languages and grammars: Chomsky hierarchy and problems associated (like Left-Associative grammars, ambiguous grammars) with them.
2. To introduce the students with Morphology and Part of Speech Tagging by taking examples from Hindi, English.
3. To introduce the top down and the bottom up parsing approaches and their respective types of parsers.
4. To make the students familiar with grammar types like ATN & RTN.
5. To make the students familiar with the basic techniques of parsing like CKY, Earley & Tomita's algorithms and role Hidden Markov Model in NLP
6. To make the students familiar with Semantics-knowledge and its utilization.

**MODULE-1: AUTOMATIC SPEECH RECOGNITION**

Introduction to Automatic Speech Recognition (ASR), Components in ASR, Challenges in ASR, Issues in ASR based Application development.

**MODULE-2: COMPONENTS OF NATURAL LANGUAGE PROCESSING**

Lexicography, syntax, semantics, pragmatics: word level representation of natural languages prosody & natural languages.

**MODULE-3 FORMAL LANGUAGES AND GRAMMARS**

Chomsky hierarchy, Left-Associative grammars, ambiguous grammars, resolution of ambiguities. Introduction of top down and bottom up parsers.

**MODULE-4: COMPUTATION LINGUISTICS:**

Morphology of natural languages like Hindi, English etc., Part of Speech Tagging (POS), recognition and parsing of natural language structures: ATN & RTN, General techniques of parsing: CKY, Earley & Tomita's algorithms. Introduction to Hidden Markov Model (HMM)

## **MODULE-5: SEMANTICS-KNOWLEDGE REPRESENTATION**

Semantic networks logic and inference pragmatics, graph models and optimization, Prolog for natural language semantic (e.g. DCG).

## **MODULE-6: APPLICATION OF NLP: INTELLIGENT WORK PROCESSORS**

Machine translation, user interfaces, Man-Machine interfaces, natural language querying, tutoring and authoring systems, speech recognition, commercial use of NLP.

### **Course outcomes:**

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

1. Difference levels/stages of natural language processing and the concept of Formal languages and grammars: Chomsky hierarchy and problems associated (like Left Associative grammars, ambiguous grammars) with them.
2. The top down and the bottom up parsing approaches and their respective types of parsers like CKY, Earley & Tomita's.
3. The Hidden Markov Model and its application in NLP.
4. The student will be able to write small ATN & RTN grammars for simple English sentences.
5. The student will be able to do Morphology of words from natural languages like Hindi, English and Semantics-knowledge and its important to understand the documents.

## **REFERENCES**

1. "Natural Language Understanding" James Allen, -1995 Benjamin/cummings Pub. Comp. Ltd
2. "Language as a cognitive process", Terry Winograd 1983, AW
3. "Natural Language processing in prolog", G. Gazder, 1989, Addison Wesley.
4. "Introduction of Formal Language Theory", MdljArbib&Kfaury, 1988, Springer Verlag.

**CODE: PEC-CS-D-702(II)**

**SUBJECT NAME: INFORMATION RETRIEVAL**

**NO OF CREDITS:3**

B.TECH 7<sup>th</sup> SEMESTER

SESSIONAL: 25

L T P

THEORY EXAM: 75

3 0 0

TOTAL : 100

Pre-requisites:

**Course Objectives:**

1. To build an understanding of the fundamental concepts of Information Retrieval
2. To understand the elements of Web Search Engines and Crawlers
3. To familiarize students with the basic taxonomy and terminology of Indices and to understand Heap's Law for estimation and Zipf's law for modeling distribution of terms
4. To understand dictionary compression and posting list compression and to introduce the scoring ,tf-idf weighting and vector space model for scoring

**MODULE-1: INTRODUCTION TO INFORMATION RETRIEVAL**

Information retrieval problem, an inverted index, Processing Boolean queries, The extended Boolean model versus ranked retrieval, an inverted index, Bi-word indexes, Positional indexes, Combination schemes

**MODULE-2: SEARCH ENGINES**

Basic Building Blocks and Architecture, Text Acquisition, Text Transformation, Index Creation, User Interaction, Ranking, Evaluation.

**MODULE-3: CRAWL SAND FEEDS**

Crawling the Web, Retrieving Web Pages, The Web Crawler, Freshness, Focused Crawling, Deep Web, Crawling Documents and Email, Storing the Documents, Detecting Duplicates

**MODULE-4: INDEX CONSTRUCTION AND COMPRESSION**

Hardware basics, Blocked sort-based indexing, Single-pass in-memory indexing, Distributed indexing, Dynamic indexing

Index compression: Statistical properties of terms in information retrieval, Heaps' law: Estimating the number of terms, Zipf's law: Modeling the distribution of terms, Dictionary compression, Dictionary as a string, Blocked storage, Postings file compression

## **MODULE-5: SCORING, TERM WEIGHTING AND THE VECTOR SPACE MODEL**

Parametric and zone indexes, Weighted zone scoring, Learning weights, The optimal weight, Term frequency and weighting, Inverse document frequency, Tf-idf weighting, The vector space model for scoring, Computing scores in a complete search system.

### **Course Outcomes:**

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

1. Understand basic Information Retrieval Systems and learn how Boolean queries are processed.
2. understand the basic concept of Search Engines their architecture and its various functional components and understand the basic concept of Web crawlers and their architecture
3. identify the different types of indices: inverted index, positional index, bi-word index and be able make estimations and model distribution of terms and compressions
4. enumerate various types of indices and also understand the concept of efficient storage of indices and learn tf-idf scoring and vector space model scoring for ranking

### **REFERENCES**

1. C.D.Manning, P. Raghavan and H.Schutze Introduction to Information Retrieval, Cambridge University Press, 2008 (available at <http://nlp.stanford.edu/IR-book/>).
2. B.Croft, D.Metzler, T.Strohman, Search Engines : Information Retrieval in Practice, AddisonWesley, 2009 (available at <http://ciir.cs.umass.edu/irbook/>).

**CODE: PEC-CS-D-702(I)**

**SUBJECT NAME: DATA ANALYTICS**

**NO OF CREDITS: 3**

B.TECH 7<sup>th</sup> SEMESTER

SESSIONAL: 25

L T P

THEORY EXAM: 75

3 0 0

TOTAL : 100

Pre-requisites: High-school level linear algebra, and calculus, Knowledge of probability theory, statistics, and programming

**Course Objectives:**

1. to get the students familiar about the Concepts of Descriptive and Inferential Statics through tests
2. to study the concepts of ANOVA and Machine learning
3. to study in detail Supervised Learning and Classification techniques
4. to study the basic and advanced concepts of Unsupervised Learning and Challenges for Big Data Analytics

**MODULE-1: DESCRIPTIVE STATISTICS & INFERENCE STATISTICS**

Introduction to the course Descriptive Statistics Probability Distributions Inferential Statistics through hypothesis tests Permutation & Randomization Test

**MODULE-2: REGRESSION & MACHINE LEARNING**

Regression and ANOVA Regression ANOVA (Analysis of Variance)

Machine Learning: Introduction and Concepts Differentiating algorithmic and model based frameworks  
Regression: Ordinary Least Squares, Ridge Regression, Lasso Regression, K Nearest Neighbours, Regression & Classification

**MODULE-3: SUPERVISED LEARNING WITH REGRESSION AND CLASSIFICATION TECHNIQUES**

Bias-Variance Dichotomy, Model Validation Approaches Logistic Regression, Linear Discriminant Analysis Quadratic Discriminant Analysis Regression and Classification Trees Support Vector Machines, Ensemble Methods: Random Forest, Neural Networks Deep learning

**MODULE-4: UNSUPERVISED LEARNING AND CHALLENGES FOR BIG DATA ANALYTICS**

Clustering Associative Rule Mining Challenges for big data analytics, Creating data for analytics through designed experiments Creating data for analytics through Active learning Creating data for analytics through Reinforcement learning

**Course Outcomes:**

After completion of the course:

1. Students will be able to understand the statistical analysis methods.
2. Students will be able to understand the concepts of Regression and Machine Learning
3. Students will be able to Compare and contrast Supervised and Unsupervised learning
4. Students will be able to understand the major challenges related to Big Data Analytics

**REFERENCES**

1. Hastie, Trevor, et al. The elements of statistical learning. Vol. 2. No. 1. New York: springer, 2009.
2. Montgomery, Douglas C., and George C. Runger. Applied statistics and probability for engineers. John Wiley & Sons, 2010.
3. Michael Berthold, David J. Hand, Intelligent Data Analysis, Springer, 2007.
4. Anand Rajaraman and Jeffrey David Ullman, Mining of Massive Datasets, Cambridge University Press, 2012.



**CODE: PEC-CS-A-703**

**SUBJECT NAME: CRYPTOGRAPHY AND NETWORK SECURITY**

**NO OF CREDITS: 3**

B.TECH 7<sup>th</sup> SEMESTER

SESSIONAL: 25

L T P

THEORY EXAM: 75

3 0 0

TOTAL : 100

Pre-requisites: Computer Networks

**Course Objectives:**

1. Understand the basic concept of Cryptography and Network Security, their mathematical models.
2. To impart knowledge of major issues in network and computer system security, focusing mainly on threats from malicious software and To understand common attacks on computer networks and methods to detect and remediate such attacks.
3. To study various issues in security of MANETS and study various attacks.
4. To provide the students with the competences required for understanding various issues in security of Wireless Security Networks and also various attacks against security mechanism and routing.

**MODULE-1:**

Introduction What is security?, Need of security, Why is security so hard?, various goals of security, Difference between Vulnerability, Threats, Attacks and control, Security goals, aspects of security, security services, security attacks Encryption Techniques Terminology of encryption, Requirement of encryption, cryptography, cryptanalysis, cryptanalytic attacks, symmetric ciphers: Substitution ciphers, Transposition ciphers, Data Encryption Standard (DES, Advanced Encryption Standard (AES), location of encryption devices, key distribution, Public Key Cryptography and RSA, Diffie-Hellman Key Exchange, Message Authentication and Hash Functions, MD5, SHA

**MODULE-2:**

Network Security Security services, Message confidentiality, Message integrity, message authentication, digital signature, entity authentication. Authentication applications: Kerberos95, X.509 Authentication service, Public key infrastructure. Electronic mail Security: Pretty Good Privacy (PGP), IP Security: IP security overview, IP security architecture, Authentication header, Encapsulating security Payload, Combining security associations, Key management.

**MODULE-3:**

Security Attacks in MANET Security issues in MANET, Attacks in MANET: External Attack, Internal attack, Black hole attack, warm hole attack, grey hole attack, Byzantine attack, Sleep Deprivation attack, Flooding attack: RREQ flooding attack, Data flooding Attack.

**MODULE-4:**

Security Attacks in Wireless Sensor Networks Security issues in WSN, Attacks in WSN : Attack against Security mechanism, Attack against basic mechanism like routing: Spoofed, altered, replayed routing, Information, Selective forwarding , Sinkhole attacks , Sybil attacks, Wormholes, HELLO flood attacks

**Course Outcomes:**

After the completion of this course the student will able to:

1. Understand theory of fundamental cryptography, encryption and decryption algorithms,
2. Build secure systems by use of block ciphers like AES, DES.
3. To be familiar with network security designs using available secure solutions and advanced security issues and technologies.
4. To develop basic security enhancements in MANETS.
5. To know how authentication is implemented in wireless systems and understand authentication protocols and processes.

**REFERENCES:**

1. P. Pfleeger, Shari Lawrence Pfleeger Charles: Security in Computing, PHI.
2. William Stalling, Cryptography and Network Security, 3rd Edition. PHI New Delhi
3. William Stalling, Network Security Essentials, 2nd Edition. PHI New Delhi
4. Bruce Schneier, Niels Ferguson : Practical Cryptography, Wiley Dreamtech India Pvt. Ltd.

**CODE: PEC-CS-D-703**

**SUBJECT NAME: NEURAL NETWORKS AND DEEP LEARNING**

**NO OF CREDITS: 3**

B.TECH 7<sup>th</sup> SEMESTER

SESSIONAL: 25

L T P

THEORY EXAM: 75

3 0 0

TOTAL : 100

Pre-requisites: Basics knowledge of Mathematics and Algorithms.

**Course Objectives:**

1. To introduce neural networks concepts and associated techniques
2. To design appropriate neural network based technique for a given scenario.
3. To introduce the concept of associative memories and their capabilities in pattern completion and repair.
4. To introduce the unsupervised learning self organizing maps

**MODULE-1: INTRODUCTION TO NEURAL NETWORKS**

Artificial neurons, Neural networks and architectures, Feedforward and feedback architectures, Learning types-supervised, unsupervised and reinforced, learning mechanisms-Gradient Descent, Boltzmann, and Hebbian, Single Perceptron as classifier, Multi-layer perceptron model. .

**MODULE-2: RECURRENT NETWORKS**

Attractor Neural Networks, Associative learning and Memory Model, Discrete Hopfield Network, Condition for Perfect Recall in Associative Memory, Bi-direction Associative memories (BAM)-Auto and Hetro-association, Boltzmann machine, Introduction to Adaptive Resonance Networks.

**MODULE-3: FEED FORWARD NETWORKS**

Gradient Descent and Least Mean Squares Algorithm, Back Propagation Algorithms, Multi-Class Classification Using Multi-layered Perceptrons., Support Vector Machine (SVM), Radial Basis Function Networks: Cover's Theorem, Learning Mechanisms in RBF.

**MODULE-4: PRINCIPAL COMPONENTS AND ANALYSIS**

Introduction to PCA, Dimensionality reduction Using PCA, Hebbian-Based Principal Component Analysis, Introduction to Self Organizing Maps : Cooperative and Adaptive Processes in SOM, and Vector-Quantization Using SOM.

**Course Outcomes:**

After successful completion of the course, the students will be able to:

1. Use neural networks concepts and associated techniques for solving classification and regression problems.
2. Design and Use neural networks for pattern recall, completion and repair.
3. Design and Use neural networks for self learning and unsupervised classifications.
4. Choose the appropriate classifier.

**REFERENCES:**

1. Haykin S., "*Neural Networks-A Comprehensive Foundations*", Prentice-Hall International, New Jersey, 1999.
2. Anderson J.A., "*An Introduction to Neural Networks*", PHI, 1999.
3. Satish Kumar, "*Neural Networks: A Classroom Approach*"
4. Hertz J, Krogh A, R.G. Palmer, "*Introduction to the Theory of Neural Computation*", Addison-Wesley, California, 1991.

**DETAILED 4-YEAR CURRICULUM CONTENTS**

**Undergraduate Degree in Engineering & Technology**

**Branch/Course: COMPUTER ENGINEERING**

<p><b>OPEN ELECTIVE COURSES</b></p>
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**CODE: OEC-CS-601(I)**

**SUBJECT NAME: SOFT SKILLS AND INTERPERSONAL COMMUNICATION**

**NO OF CREDITS: 3**

B.TECH 6<sup>th</sup> SEMESTER

SESSIONAL: 25

L T P

THEORY EXAM: 75

3 0 0

TOTAL : 100

Pre-requisites: Basic knowledge of reading and writing English.

**Course Objectives:** The purpose of this course is to:

1. Create awareness among the stock holders of the corporate world in which the role of individuals as team players and as responsible leaders materializes to a great extent.
2. Address various challenges of communication as well as behavioral skills faced by individuals at workplace and organizations in bridging the gaps through effective skills.
3. Impart knowledge about interviews, group discussions, meeting management, presentations, and nuances of drafting various business documents for sustainability in today's global world.

### **MODULE-1: INTRODUCTION**

Introduction to Soft Skills, Aspects of Soft Skills, Effective Communication Skills, Classification of Communication, Personality Development

Positive Thinking, Telephonic Communication Skills, Telephonic Communication Skills, Communicating Without Words, Paralanguage, Proxemics, Haptics: The Language of Touch, Meta-communication, Listening Skills, Types of Listening, Negotiation Skills , Culture as Communication, Communicating across Cultures , Organizational Communication.

### **MODULE-2: COMMUNICATION BREAKDOWN**

Advanced Writing Skills, Principles of Business Writing, Types of Business Writing, Business Letters, Business Letters: Format and Style, Types of Business Letter.

### **MODULE-3: SKILL DEVELOPMENT**

Writing Reports, Types of Report, Strategies for Report Writing, Strategies for Report Writing, Evaluation and Organization of Data, Structure of Report, Report Style, Group Communication Skills, Leadership Skills, Group Discussion, Meeting Management, Adaptability & Work Ethics. Advanced Speaking Skills, Oral Presentation, Speeches & Debates, Combating Nervousness, Patterns & Methods of Presentation, Oral Presentation: Planning & Preparation

## MODULE-4: PRESENTATION AND INTERVIEWS

Making Effective Presentations, Speeches for Various Occasions, Interviews, Planning & Preparing, Effective Résumé, Drafting an Effective Résumé, Facing Job Interviews, Emotional Intelligence & Critical Thinking, Applied Grammar

### Course Outcomes:

After completion of the course student will be able to :

1. Understand the concept of soft skills including communication skills, listening skills, positive thinking and also will be able to enhance own personality.
2. Able to write business letters.
3. Able to write reports.
4. Able to make effective resume and will also be able to present himself/herself in interview, speeches, presentations, talks etc.

### REFERENCES:

1. Butterfield, Jeff. *Soft Skills for Everyone*. New Delhi: Cengage Learning. 2010.
2. Chauhan, G.S. and Sangeeta Sharma. *Soft Skills*. New Delhi: Wiley. 2016.
3. Goleman, Daniel. *Working with Emotional Intelligence*. London: Banton Books. 1998.
4. Hall, Calvin S. et al. *Theories of Personality*. New Delhi: Wiley. rpt. 2011.
5. Holtz, Shel. *Corporate Conversations*. New Delhi: PHI. 2007.
6. Kumar, Sanajy and Pushp Lata. *Communication Skills*. New Delhi: OUP. 2011.
7. Lucas, Stephen E. *The Art of Public Speaking*. McGraw-Hill Book Co. International Edition, 11th Ed. 2014.
8. Penrose, John M., et al. *Business Communication for Managers*. New Delhi: Thomson South Western. 2007.
9. Sharma, R.C. and Krishna Mohan. *Business Correspondence and Report Writing*. New Delhi: TMH. 2016.
10. Sharma, Sangeeta and Binod Mishra. *Communication Skills for Engineers and Scientists*. New Delhi: PHI Learning. 2009, 6th Reprint 2015.
11. Thorpe, Edgar and Showick Thorpe. *Winning at Interviews*. Pearson Education. 2004.
12. Turk, Christopher. *Effective Speaking*. South Asia Division: Taylor & Francis. 1985.

**CODE: OEC-CS-601(II)**

**SUBJECT NAME: CYBER LAW AND ETHICS**

**NO OF CREDITS: 3**

B.TECH 6<sup>th</sup> SEMESTER

SESSIONAL: 25

L T P

THEORY EXAM: 75

3 0 0

TOTAL : 100

Pre-requisites: Basics of Data Structures and Mathematics

**Course objectives:** The purpose of this course is to:

1. Introduce a basic understanding of cyber law.
2. Impart knowledge about developing Competencies for dealing with frauds and deceptions (confidence tricks, scams)
3. Acquire knowledge on other Cyber Crimes that are taking place via the internet.

### **MODULE- 1: INTRODUCTION**

Computers and its Impact in Society, Overview of Computer and Web Technology, Need for Cyber Law, Cyber Jurisprudence at International and Indian Level

### **MODULE- 2: CYBER LAW- INTERNATIONAL PERSPECTIVES**

UN & International Telecommunication Union (ITU) Initiatives Council of Europe - Budapest Convention on Cybercrime, Asia-Pacific Economic Cooperation (APEC), Organization for Economic Co-operation and Development (OECD), World Bank, Commonwealth of Nations

### **MODULE- 3: CONSTITUTIONAL & HUMAN RIGHTS ISSUES IN CYBERSPACE**

Freedom of Speech and Expression in Cyberspace, Right to Access Cyberspace – Access to Internet, Right to Privacy, Right to Data Protection

### **MODULE- 4: CYBER CRIMES & LEGAL FRAMEWORK**

Cyber Crimes against Individuals, Institution and State, Hacking, Digital Forgery, Cyber Stalking/Harassment, Cyber Pornography, Identity Theft & Fraud, Cyber terrorism, Cyber Defamation, Different offences under IT Act, 2000

### **MODULE- 5: CYBER TORTS**

Cyber Defamation, Different Types of Civil Wrongs under the IT Act, 2000

### **MODULE- 6: INTELLECTUAL PROPERTY ISSUES IN CYBER SPACE**

Interface with Copyright Law, Interface with Patent Law, Trademarks & Domain Names Related issues



## **MODULE- 7: E-COMMERCE CONCEPT**

E-commerce-Salient Features, Online approaches like B2B, B2C & C2C Online contracts, Click Wrap Contracts, Applicability of Indian Contract Act, 1872

## **MODULE- 8: DISPUTE RESOLUTION IN CYBERSPACE**

Concept of Jurisdiction, Indian Context of Jurisdiction and IT Act, 2000, International Law and Jurisdictional Issues in Cyberspace, Dispute Resolutions, Information warfare policy and ethical Issues.

### **Course Outcomes : On successful completion of the course the student will be able to:**

1. Identify and analyze statutory, regulatory, constitutional, and organizational laws that affect the information technology professional.
2. Locate and apply case law and common law to current legal dilemmas in the technology field.
3. Apply diverse viewpoints to ethical dilemmas in the information technology field and Recommend appropriate actions.
4. Distinguish enforceable contracts from non-enforceable contracts

### **References:**

- Chris Reed & John Angel, Computer Law, OUP, New York, (2007).
- Justice Yatindra Singh, Cyber Laws, Universal Law Publishing Co, New Delhi, (2012)
- Verma S, K, Mittal Raman, Legal Dimensions of Cyber Space, Indian Law Institute, New Delhi, (2004)
- JonthanRosenoer, Cyber Law, Springer, New York, (1997).
- Sudhir Naib, The Information Technology Act, 2005: A Handbook, OUP, New York, (2011)
- S. R. Bhansali, Information Technology Act, 2000, University Book House Pvt. Ltd., Jaipur (2003).
- Vasu Deva, Cyber Crimes and Law Enforcement, Commonwealth Publishers, New Delhi, (2003).

**CODE: PCC-IT- 601**

**SUBJECT NAME: DATA ANALYTICS USING PYTHON**

**NO OF CREDITS: 3**

B.TECH 6<sup>th</sup> SEMESTER

SESSIONAL: 25

L T P

THEORY EXAM: 75

3 0 0

TOTAL : 100

Pre-requisites: Basics of Data Structures and Mathematics

**Course objectives:** The student will learn how to apply

1. Understand the fundamentals of data analytics and its importance in various domains.
2. Learn about the role of Python programming language in data analytics.
3. Understand descriptive statistics, data visualization, and summarization techniques to gain insights into datasets.
4. Learn how to conduct hypothesis testing and regression analysis using Python.

### **MODULE-1**

**Python Fundamentals and Objects in Python:** Lists, dictionaries, Functions, Files, class and instance attributes, inheritance, multiple inheritance, methods resolution order, magic methods and operator overloading, meta classes, abstract and inner classes, exception handling, modular programs and packages.

### **MODULE-2**

**Numerical Analysis in Python:** Introduction to NumPy, NumPy array object, Creating a multidimensional array, NumPy numerical types - Data type objects, Character codes, dtype constructors. dtype attributes. One-dimensional slicing and indexing. Manipulating array shapes - Stacking arrays, Splitting NumPy arrays, NumPy array attributes, Converting arrays, Creating array views and copies. Indexing with a list of locations. Indexing NumPy arrays with Booleans. Broadcasting NumPy arrays.

### **MODULE-3**

**Introduction to Data Analytics :** Descriptive Statistics Probability Distributions Inferential Statistics through hypothesis tests, two sample testing and Introduction to ANOVA, Two-way ANOVA Permutation & Randomization Test, Chi square test

## **MODULE-4**

**Data Manipulation:** Dataframes in panda, Creating dataframes from .csv and excel files, Lists of tuples, Dataframes aggregation and concatenation

## **MODULE -5**

**Data Analysis & Visualization:** Introduction to various analysis techniques like classification, regression, clustering, Estimation and prediction of Regression model. and Visualization: subplots, markers, labels, legends, saving plots to file

### **Course Outcomes:**

After completion of course, students will be able to:

1. The students will be able to understand the fundamental concepts and principles of data analytics, including data manipulation, exploration, and visualization.
2. The students will be able to Write Python scripts to manipulate, analyze, and visualize data.
3. The students will be able to Conduct hypothesis testing and perform regression analysis using Python libraries.
4. The students will be able to Identify and define data analytics problems, formulate solutions, and interpret results in the context of real-world applications.

### **Reference Books:**

1. McKinney, W. (2012). Python for data analysis: Data wrangling with Pandas, NumPy, and IPython. " O'Reilly Media, Inc."
2. Swaroop, C. H. (2003). A Byte of Python. Python Tutorial.
3. Ken Black, sixth Editing. Business Statistics for Contemporary Decision Making. "John Wiley & Sons, Inc".
4. Anderson Sweeney Williams (2011). Statistics for Business and Economics. "Cengage Learning".
5. Douglas C. Montgomery, George C. Runger (2002). Applied Statistics & Probability for Engineering. "John Wiley & Sons, Inc"

**CODE: OEC-CS-601(IV)**

**SUBJECT NAME: ELECTRONIC DEVICES**

**NO OF CREDITS: 3**

B.TECH 6<sup>th</sup> SEMESTER

L T P

3 0 0

SESSIONAL: 25

THEORY EXAM: 75

TOTAL: 100

Pre-requisites: Computer Organization & Architecture, Digital Electronics

**Course objectives:**

1. To give exposure to students about Semiconductor Physics.
2. To give the exposure about characteristics of Semiconductor devices
3. To introduce the working of difficult Semiconductor Electronic devices.
4. To introduce the concept of fabrication terminologies semiconductor electronic devices.

**MODULE-1: INTRODUCTION TO SEMICONDUCTOR PHYSICS**

Review of Quantum Mechanics, Electrons in periodic Lattices, E-k diagrams. Energy bands in intrinsic and extrinsic silicon;

**MODULE-2: CARRIER TRANSPORT**

Diffusion current, drift current, mobility and resistivity; sheet resistance, design of resistors Generation and recombination of carriers; Poisson and continuity equation P-N junction characteristics, I-V characteristics, and small signal switching models; Avalanche breakdown, Zener diode, Schottky diode

**MODULE-3: BIPOLAR JUNCTION TRANSISTOR**

I-V characteristics, Ebers-Moll Model, MOS capacitor, C-V characteristics, MOSFET, I-V characteristics, and small signal models of MOS transistor, LED, photodiode and solar cell;

**MODULE-4: INTEGRATED CIRCUIT FABRICATION PROCESS**

Oxidation, diffusion, ion implantation, photolithography, etching, chemical vapor deposition, sputtering, twin-tub CMOS process.

**Course Outcomes:**

At the end of this course students will demonstrate the ability to

1. Understand the principles of semiconductor Physics
2. Understand and utilize the mathematical models of Semiconductor junctions and 1. MOS transistors for circuits and systems.
3. Understand various Semiconductor, fabrication process.
4. Understand the design & characteristics of Semiconductor devices.

## REFERENCES:

1. G. Streetman, and S. K. Banerjee, "*Solid State Electronic Devices*," 7th edition, Pearson, 2014.
2. D. Neamen, D. Biswas "*Semiconductor Physics and Devices*," McGraw-Hill Education
3. S. M. Sze and K. N. Kwok, "*Physics of Semiconductor Devices*," 3rd edition, John Wiley & Sons, 2006.
4. C.T. Sah, "*Fundamentals of Solid State Electronics*," World Scientific Publishing Co. Inc, 1991.
5. Y. Tsvetkov and M. Colin, "*Operation and Modeling of the MOS Transistor*," Oxford Univ. Press, 2011.

**CODE: OEC-CS-601(V)**

**SUBJECT NAME: DIGITAL SYSTEM DESIGN**

**NO OF CREDITS: 3**

B.TECH 6<sup>th</sup> SEMESTER

SESSIONAL: 25

L T P

THEORY EXAM: 75

3 0 0

TOTAL: 100

Pre-requisites:

Course objectives:

1. To study the concept of combinational logic circuits
2. To make the student aware about modular combinational circuits with MUX/DEMUX, Decoder, Encoder
3. To understand the synchronous sequential logic circuits
4. To study Logic families and semiconductor memories.
5. To study VLSI design flow.

#### **MODULE-1: 1 LOGIC SIMPLIFICATION AND COMBINATIONAL LOGIC DESIGN**

Review of Boolean Algebra and De Morgan's Theorem, SOP & POS forms, Canonical forms, Karnaugh maps up to 6 variables, Binary codes, Code Conversion.

#### **MODULE-2: COMBINATIONAL CIRCUITS**

Comparators, Multiplexers, Encoder, Decoder, Driver & Multiplexed Display, Half and Full Adders, Subtractors, Serial and Parallel Adders, BCD Adder, Barrel shifter and ALU

#### **MODULE-3: SEQUENTIAL LOGIC DESIGN**

Building blocks like S-R, JK and Master-Slave JK FF, Edge triggered FF, Ripple and Synchronous counters, Shift registers, Finite state machines, Design of synchronous FSM, Algorithmic State Machines charts. Designing synchronous circuits like Pulse train generator, Pseudo Random Binary Sequence generator, Clock generation

#### **MODULE-4: LOGIC FAMILIES AND SEMICONDUCTOR MEMORIES**

TTL NAND gate, Specifications, Noise margin, Propagation delay, fan-in, fan-out, Tristate TTL, ECL, CMOS families and their interfacing, Memory elements, Concept of Programmable logic devices like FPGA. Logic implementation using Programmable Devices.

## **MODULE-5: VLSI DESIGN FLOW**

Design entry: Schematic, FSM & HDL, different modeling styles in VHDL, Data types and objects, Dataflow, Behavioral and Structural Modeling, Synthesis and Simulation VHDL constructs and codes for combinational and sequential circuits.

### **Course Outcomes:**

At the end of this course students will demonstrate the ability to

1. Design and analyze combinational logic circuits
2. Design & analyze modular combinational circuits with MUX/DEMUX, Decoder, Encoder
3. Design & analyze synchronous sequential logic circuits
4. Use HDL & appropriate EDA tools for digital logic design and simulation

### **REFERENCES:**

1. R.P. Jain, “*Modern digital Electronics*”, Tata McGraw Hill, 4th edition, 2009. Douglas Perry, “*VHDL*”, Tata McGraw Hill, 4th edition, 2002.
2. W.H. Gothmann, “*Digital Electronics- An introduction to Theory and Practice*”, PHI, 2<sup>nd</sup> edition, 2006.
3. D.V. Hall, “*Digital Circuits and Systems*”, Tata McGraw Hill, 1989
4. Charles Roth, “*Digital System Design using VHDL*”, Tata McGraw Hill 2nd edition 2012.

**CODE: OEC-CS-602(I)**

**SUBJECT NAME: HUMAN RESOURCE MANAGEMENT**

**NO OF CREDITS: 3**

B.TECH 6<sup>th</sup> SEMESTER

SESSIONAL: 25

L T P

THEORY EXAM: 75

3 0 0

TOTAL: 100

**Course objectives:** The purpose of this course is to:

1. Sensitize students to the various facts of managing people
2. Create an understanding of the various policies and practices of human resource management.
3. Impart Knowledge about Industrial Relations and Grievance Handling

**MODULE-1:**

Human Resource Management: concept, evolution and scope; Strategic objectives of HR management; Roles, responsibilities and competencies of HR manager; Challenges to HR professionals; Human Resource Planning & Forecasting: significance and process; Human Resource Information System.

**MODULE-2:**

HR Sourcing and Recruitment; Selection: process, Placement; Induction and Socialization.

Job Analysis: job Description and job Specification; Job Design: approaches and methods; Job Evaluation-concept & methods; Performance Management System: appraisal and counselling.

**MODULE-3:**

Training: training process, training need analysis (TNA); training methods and techniques; Designing Training programs; Training evaluation; Career planning and Development; Potential Appraisal and Succession planning; Employee Compensation: basic concepts & determinants; New trends in compensation management.

**MODULE-4:**

Industrial Relations and Grievance Handling; Employee welfare; Dispute Resolution; International Human Resource Management; Contemporary Issues in HRM: knowledge Management, HR Audit & Accounting, HR in virtual organizations, ethics & corporate social responsibility.

**Course Outcomes:**

1. The course will help to understand the basics of HRM with roles and responsibilities of a HR manager.
2. This course enables the students to meet HR challenges in present scenario
3. It will facilitate them in employing, maintaining and promoting a motivated force in an organization.
4. Students will be aware about contemporary issues of human resource management.



## **RERERENCES:**

1. K. Aswathapa Human resource Management: Text and cases, 6<sup>th</sup> edition, Tata McGraw Hill, New Delhi.
2. Uday Kumar Halder&JuthikaSarkarHuman resource Management New Delhi, Oxford University Press.
3. De Cenvo, Da & Robbins S.P. Fundamentals of Human Resource Management, 9<sup>th</sup> edition, New York, John Wiley & Sons.
4. Gary Dessler, Human Resource Management, 11<sup>th</sup> edition New Delhi: Pearson Prentice Hall.
5. TanujaAgarwala, Strategic Human resource Management, Oxford University Press

**CODE: OEC-CS-602(II)**

**SUBJECT NAME: ICT FOR DEVELOPMENT**

**NO. OF CREDITS: 3**

B.TECH 6<sup>th</sup> SEMESTER

SESSIONAL: 25

L T P

THEORY EXAM: 75

3 0 0

TOTAL : 100

**Course objectives: The purpose of this course is to:**

1. Impart knowledge about Information and Communication technologies and their applications in the development field
2. Discuss how ICTs can be best used to overcome sustainability challenges
3. Impart training of basic set of competencies that integrate cross-disciplinary knowledge for practical problem solving with the use of information and communication technologies.

#### **MODULE-1: INTRODUCTION**

Introduction to ICTs for sustainable Development Introduction to Information and Communication Technology (ICT); Role of ICTs in Sustainable Development; Current Status of ICTs in Sustainable Development- Global and India Scenario. Potential of ICTs in various fields, impact of information Technologies on GDP growth

#### **MODULE-2: BUILDING KNOWLEDGE SOCIETIES**

The concept of Knowledge Society; identifying stakeholders and target communities; Understanding information needs, Traditional vs. contemporary knowledge systems, information processing and retrieval; Understanding means of communication in different areas, developing an effective communication strategy Case: Wana Unwired

#### **MODULE-3: INFORMATION AND COMMUNICATION TECHNOLOGIES**

The hardware and software, the physical infrastructure, satellite, wireless solutions, telecommunication technologies, mobiles, fixed line, internet and world wide web, community radio, technology-user interface, design of relevant ICT products and services.

#### **MODULE-4: ICT APPLICATIONS**

Applications of ICT in education, Health (telehealth, telemedicine and health informatics), Gender Equality, Agriculture (e Governance, telecentres, Mobiles for development, climate change and disaster management, ICT Networks for water management (This module will be dealt with the help of country case studies in all the sectors and inputs from ICT4D practitioners Case Studies: eCME, Apollo Telemedicine Network Foundation, Bhoomi, eSewa, Gyandoot, eAgriculture. M-PESA, CYCLETEL)

## **MODULE-5: ICT FOR DEVELOPMENT IN INDIA**

Policy and Institutional Framework in India, e governance, ICT Models in health, education, agriculture, finance, gender equality, Mobiles for Development Experience sharing by ICT for Development practitioners Case Studies: Reuters Market Light, IffcoKisaan Sanchar Ltd.

## **MODULE-6: ICT4D IMPLEMENTATION**

Developing an ICT4D Project, Critical Success factors for technology diffusion and use, Constraints in adoption, The role of national policies, Institutional Policy framework, Multi-stakeholder partnerships, Role of Private Sector Case Studies: echaupal , Lifelines India.

### **Course Outcomes:**

After completion of the course:

1. Students will be familiarized with main theories and conceptual frameworks in the field of ICT for development
2. Students will learn potential of both information and communication technologies in different areas such as health, education, agriculture, finance, gender equality and climate change.
3. Students will be able to understand the existing innovative business models and other applications in the above mentioned areas with reference to India and other developing countries
4. Students will be able to compare and contrast various business models (public, private sector, PPP, civil society) with respect to technology, infrastructure, capacity building, human resource etc.
5. Students will be able to learn how ICT models can be successfully implemented at the field and understand critical success factors and constraints in adoption.

**CODE: OEC-CS-602(III)**

**SUBJECT NAME: INTELLECTUAL PROPERTY RIGHTS**

**NO OF CREDITS: 3**

B.TECH 6<sup>th</sup> SEMESTER

SESSIONAL: 25

L T P

THEORY EXAM: 75

3 0 0

TOTAL : 100

**Course Objectives:**

1. To make the student aware about Intellectual Property and why it is important
2. To study the concept of Patents, history of patent and its categorization.
3. To learn the procedure of obtaining Patents.
4. To make the student learn Assignment and Revocation of Patent
5. To study the concept of infringement and its defence.

**MODULE-1: INTRODUCTION TO INTELLECTUAL PROPERTY**

Concept of Intellectual Property, Kinds of Intellectual Property, Economic Importance of Intellectual Property, Indian Theory on Private Property: Constitutional Aspects of Property, Constitutional Protection of Property and Intellectual Property, Economic Development and Intellectual Property Rights Protection

**MODULE-2: INTRODUCTION TO PATENTS**

Overview, Historical Development, Concepts: Novelty, Utility, Patentable Subject-matter: Patent Act, 1970- Amendments of 1999, 2000, 2002 and 2005, Pharmaceutical Products and Process and Patent , Protection, Software Patents, Business Method, Protection of Plant Varieties and Farmers' Rights Act, 2001, Patenting of Micro-organism

**MODULE-3: PROCEDURE OF OBTAINING OF PATENTS**

Concepts of a Patent Application,, Specification: Provisional, Complete, Disclosure Aspects, Claims: Principal, Dependant, Omnibus, Examination of Application, Opposition of Application, Sealing of Patents

**MODULE-4: WORKING OF PATENTS – COMPULSORY LICENSE**

Commercialization of Inventions: License- Terms of License Agreement, Assignments of Patents, Revocation of Patents

**MODULE-5: INFRINGEMENT**

What is Infringement?, How is Infringement determined? Who is an Infringer?, Direct, Contributory and Induced, Defences of Infringement: Research Exemption, Invalidity, Misuse, Failure to mark, Laches and Estoppel and first sale doctrine

**Course Outcomes:**

After completion of the course student will be able to:

1. Understand the concept of Intellectual Property and its importance.
2. Understand Patents, categorization and procedure for obtaining patents.
3. Understand the commercialization of invention
4. Understand the concept of infringement and its defence.

**REFERENCES:**

1. W.R. Cornish, Intellectual Property, Sweet & Maxwell, London (2000)
2. P. Narayana, Patent Law, Wadhwa Publication
3. Merges, Patent Law and Policy: Cases and Materials, 1996
4. Brian C. Reid, A Practical Guide to Patent Law, 2nd Edition, 1993
5. Brinkhof (Edited), Patent Cases, Wolters Kluwer.
6. Prof. Willem Hoyng & Frank Eijsvogels, Global Patent Litigation, Strategy and Practice, Wolters Kluwer.
7. Gregory Stobbs, Software Patents Worldwide, Wolters Kluwer.
8. Feroz Ali Khader, The Law of Patents- With a special focus on Pharmaceuticals in India, Lexis Nexis Butterworths Wadhwa, Nagpur.
9. Sookman, Computer Law, 1996
10. N.S. Gopalakrishnan & T.G. Agitha, Principles of Intellectual Property (2009). Eastern Book Company, Lucknow

**CODE: OEC-CS-602(IV)**

**SUBJECT NAME: INTERNATIONAL BUSINESS ENVIRONMENT**

**NO OF CREDITS: 3**

B.TECH 6<sup>th</sup> SEMESTER

SESSIONAL: 25

L T P

THEORY EXAM: 75

3 0 0

TOTAL : 100

**Course Objectives:** The purpose of this course is to:

1. Impart knowledge about International Business Environment.
2. Familiarize the students about the framework on basis of which business can be run smoothly.
3. Introduce the basics of Free Trade Zones and Regional Economic Integrations

**MODULE-1:**

International business environment; Concept of international business; domestic vs international business, stages of internationalization, tariff and non-tariff barriers, Risks involved in international business

**MODULE-2:**

Theories of international trade: Adam Smith, Ricardo and Ohlin & Heckler theory, Leontief paradox, PLC

**MODULE-3:**

International Monetary Systems: Historical background and structure. International Financial institutions; IMF, World Bank, Euro Currency. International financial markets and instruments.

**MODULE-4:**

Free trade zones. Bilateral and Multilateral Trade Laws – General Agreement on Trade and Tariffs, (GATT), World Trade Organization – IPR, TRIPS, TRIMS, GATS. Regional Economic Integrations: NAFTA, EU. Trade Blocks; ASEAN, SAAARC, BRICS

**Course Outcomes:**

1. The student will be aware of the international organizations in which India is a member or otherwise.
2. The students may take opportunity to take their business from domestic to international.
3. International organizations and their links to India will be understood by students in an easy manner.
4. The students will be aware business environment at international level

**REFERENCES:**

1. Lasserre, Philippe Global Strategic Management, Palgrave MacMillan.
2. John D Daniels, Lee H Radebaugh Daniel P Sullivan ,PrashantSalwan. International Business Environments and Operations, Pearson Education

3. Tamer Cavusgil, Gary Knight International Business: Strategy, Management and the New Realities, 1st Edition, Pearson Education.
4. K Aswathappa, International Business, Tata Mcgraw Hill.
5. Richard Hodgetts, Fred Luthans, Jonathan Doh. International Management: Culture, Strategy And Behaviour, Pearson Education.
6. Deresky, International Management: Managing across borders and culture. Pearson Education.
7. Nandi : “International Business Environment” McGraw Hill Education.

**CODE: OEC-CS-602(V)**

**SUBJECT NAME: BASICS OF OPERATIONS RESEARCH**

**NO OF CREDITS: 3**

B.TECH 6<sup>th</sup> SEMESTER

SESSIONAL: 25

L T P

THEORY EXAM: 75

3 0 0

TOTAL : 100

**Course Objectives:**

1. To introduce the student with Different types of OR Models and Linear Programming Model
2. To introduce the students about Dual Sensitive Method and Sensitive Analysis.
3. To introduce the concept of Assignment Problem.
4. To introduce the students with Network Model
5. To introduce the concept of Dynamic Programming and Queuing Model.

**MODULE-1:**

The origin of OR, Phases of an O.R. study, Impact of OR, Formulation of Linear-programming model, Graphical solution. Converting the linear programming problem to standard form, Simplex method.

**MODULE-2:**

Big-M method, Two-phase method, Degeneracy, Alternate optima, unbounded and infeasible solution.

**MODULE-3:**

Definition of the dual problem, prima-dual relationship, Dual Simplex method, Post optimal and sensitivity analysis.

**MODULE-4:**

Assignment problem and its mathematical formulation, solution of assignment problem (Hungarian method), Transportation problem and its mathematical formulation. Initial basic feasible solution of transportation problem by North-West corner rule. Lowest-Cost Entry method and Vogel's Approximation method, Optimal solution of transportation problem.

**MODULE-5:**

Network models, Minimal spanning tree algorithm, Shortest-route problem (Floyd's Algorithm and Dijkstras algorithm), Maximal flow problem, Introduction to CPM & PERT.

**MODULE-6:**

Introduction to Dynamic Programming, General inventory Model, Static Economic Order Quantity (EOQ) Models.



**MODULE-7:**

Elements of a Queuing model, Pure Birth & Death model, Generalized Poisson Queuing, Specialized Poisson Queues.

**Course Outcomes:**

After completion of the course student will be able to:

1. Understand different types of OR Model and solve Linear programming problems.
2. Understand dual simplex problem and sensitive analysis.
3. Solve Assignment problem.
4. Understand Dynamic Programming and Queuing Model.

**REFERENCES:**

1. Operations Research by HamdyA Taha
2. Introduction to Operations Research by Hiller and Dieherman, TMH
3. Optimization Theory and Application: SS Rao, John Wiley.

**CODE: OEC-CS-701(I)**

**SUBJECT NAME: FINANCIAL MANAGEMENT**

**NO OF CREDITS: 3**

B.TECH 7<sup>th</sup> SEMESTER

SESSIONAL: 25

L T P

THEORY EXAM: 75

3 0 0

TOTAL : 100

**Course Objectives:** The purpose of this course is to:

1. Develop understanding among the students regarding nature of finance
2. Impart knowledge about its interaction with other Management functions
3. Familiarize the students with the objectives of Financial Management.

**MODULE-1:**

Financial management-scope finance functions and its organisation, objectives of financial management; time value of money; sources of long term finance.

**MODULE-2:**

Investment decisions importance, difficulties, determining cash flows, methods of capital budgeting with excel; risk analysis (risk adjusted discount rate method and certainty equivalent method); cost of different sources of raising capital; weighted average cost of capital.

**MODULE-3:**

Capital structure decisions-financial and operating leverage; EBIT/EPS Analysis, capital structure theories- NI, NOI, traditional and M-M theories; determinants of dividend policy and dividend models -Walter, Gordon & M.M. models.

**MODULE-4:**

Working Capital- meaning, need, determinants; estimation of working capital need; management of cash, inventory and receivables.

**Course Outcomes:**

1. It creates understanding among the students regarding the key decisions like Investment, Financing and dividend Decisions of financial Management.
2. They are able to understand the usage and applications of leverages in financial decisions.
3. The students are able to use their best knowledge in finance towards the value creation for the organization.
4. The students will be made aware of working capital management concept.

## **RERERENCES:**

1. Pandey, I.M., "*Financial Management*", Vikas Publishing House, New Delhi
2. Khan M.Y, and Jain P.K., "*Financial Management*", Tata McGraw Hill, New Delhi
3. Keown, Arthur J., Martin, John D., Petty, J. William and Scott, David F, "*Financial Management*", Pearson Education
4. Chandra, Prasanna, "*Financial Management*", TMH, New Delhi
5. Van Horne, James C., "*Financial Management and Policy*", Prentice Hall of India
6. Brigham & Houston, "*Fundamentals of Financial Management*", Thomson Learning, Bombay.
7. Kishore, R., "*Financial Management*", Taxman's Publishing House, New Delhi

**CODE: OEC-CS-701(II)**

**SUBJECT NAME: E-COMMERCE AND ENTREPRENEURSHIP**

**NO OF CREDITS: 3**

**B.TECH 7<sup>th</sup> SEMESTER**

**SESSIONAL: 25**

**L T P**

**THEORY EXAM: 75**

**3 0 0**

**TOTAL : 100**

**Course Objectives:**

1. To understand the basic concept of electronic transactions, types of business models and about customer relationship management.
2. To study about various legal and ethical issues related to electronic transactions and also understating the concepts of IPR.
3. To understand the skills of Entrepreneurship, to identify the projects and the analysis and report making.

**MODULE-1: INTRODUCTION TO E-COMMERCE**

Need, importance, Business models, revenue models and business processes, economic forces & e-commerce, identifying e-commerce opportunities, international nature of e-commerce, technology infrastructure-internet & WWW; Business strategies for ecommerce: Revenue models in transaction, revenue strategic issues, customer behavior and relationship intensity, advertising on the web, e-mail marketing, technology enabled CRM

**MODULE-2: BUSINESS TO BUSINESS STRATEGIES**

(Overview strategic methods for Developing E-Commerce) Purchasing, logistics and supply activities, electronic data interchange (EDI), electronic data interchange on the internet, supply chain management using internet technologies, electronic market place & portals (Home shopping, E-marketing, Tele marketing), auctions, online auctions, virtual communicative & web portals; legal, and ethical issues in e-commerce — use and protection of intellectual property in online business, online crime, terrorism & warfare, ethical issues.

**MODULE-3: ENTREPRENEURSHIP**

Definition, Concept, Growth and role. The Entrepreneur: types, Characteristics, theories of Entrepreneurial class, Urges and importance of Entrepreneurship Stimulants; Seed-Beds of Entrepreneurship, Influencing Factors; Problems (Operational and Non-Operational) and Obstacles. Entrepreneurial Management. Role of socio-economic environment

**MODULE-4:**

Skills for a New Class of Entrepreneurs, The Ideal Entrepreneurs, The Entrepreneurship Audit, Identification of opportunities by an Entrepreneur, The steps to identify the project /ventures, Process of

converting business opportunities into reality. Feasibility Report and analysis, Process of setting up a small scale industry / unit

### **MODULE-5:**

Promotion of a venture, External Environment Analysis: Economic, Social, Technological and competition, Legal Framework for establishing and fund raising Venture Capital: Sources and Documents required.

### **Course Outcomes:**

After completion of course, students would be able to:

1. The students will be able to understand the basic concepts of electronic transactions.
2. Study of various types of business models and customer relationship management.
3. Students will be able to understand about various business strategies and marketing strategies.
4. Study of various legal and ethical issues related to electronic transactions.
5. Study of intellectual property rights and its importance.
6. Study of Entrepreneurship management
7. Study of analyzing the external environment, the competition and designing the framework for establishing a venture capital.
8. Study of business intelligence and knowledge management tools.

### **REFERENCES:**

1. Gary P. Schneider, "Electronic Commerce", Seventh Edition, CENGAGE Learning India Pvt. Ltd., New Delhi.
2. K.K.Bajaj, D. Nag "E-Commerce", 2nd Edition, McGraw Hill Education, New Delhi
3. P.T. Joseph, "E-Commerce An Indian Perspective", PHI Publication, NewDelhi.
4. Bhaskar Bharat, "Electronic Commerce-Technology and Application", McGraw Hill Education, New Delhi
5. Mary Sumner, "Enterprise Resource Planning", 2005, PHI Learning India Pvt. Ltd. / Pearson Education, Inc. New Delhi. 6. Chan, " E-Commerce fundamentals and Applications", Wiley India, New Delhi

**CODE: OEC-CS-701(III)**

**SUBJECT NAME: R PROGRAMMING**

**NO OF CREDITS: 3**

B.TECH 7<sup>th</sup> SEMESTER

SESSIONAL: 25

L T P

THEORY EXAM: 75

3 0 0

TOTAL : 100

Pre-requisites: Basic Programming

**Course Objectives:**

1. Understand what R is and what it can be used for
2. Why would you choose R over another tool
3. Troubleshoot software installs (keep your fingers crossed)
4. Gain familiarity with using R from within the RStudio IDE
5. Get to know the basic syntax of R functions
6. Be able to install and load a package into your R library

**MODULE-1: INTRODUCTION**

Getting **R**, R Version, 32-bit versus 64-bit, The **R** Environment, Command Line Interface, RStudio, Revolution Analytics RPE

**R** Packages: Installing Packages, Loading Packages, Building a Package

R Basics: Basic Math, Variables, Data Types, Vectors, Calling Functions, Function Documentation, Missing Data

Advanced Data Structures: data frames, Lists, Matrices, Arrays

**MODULE-2: R DATA**

Reading Data into **R**: Reading CSVs, Excel Data, Reading from Databases, Data from Other Statistical Tools, R Binary Files, Data Included with R, Extract Data from Web Sites

Statistical Graphics: Base Graphics, ggplot2

**MODULE-3: R FUNCTIONS & STATEMENTS**

Writing **R** Functions: Hello, World!, Function Arguments, Return Values, do.call

Control Statements: if and else, switch, ifelse, Compound Tests

Loops: for Loops, while Loops, Controlling Loops

**MODULE-4: DATA MANIPULATION**

Group Manipulation: Apply Family, aggregate, plyr, data.table

Data Reshaping: cbind and rbind, Joins, reshape2

Manipulating Strings: paste, sprint, Extracting Text, Regular

## **MODULE-5: R STATISTICS & LINEAR MODELING**

Probability Distributions: Normal Distribution, Binomial Distribution, Poisson

Basic Statistics: Summary Statistics, Correlation and Covariance, T-Tests 200, ANOVA

Linear Models: Simple Linear Regression, Multiple Regression

Generalized Linear Models: Logistic Regression, Poisson

Model Diagnostics: Residuals, Comparing Models, Cross-Validation, Bootstrap, Stepwise Variable Selection

## **MODULE-6: NON-LINEAR MODELING**

Nonlinear Models: Nonlinear Least Squares, Splines, Generalized Additive Models, Decision Trees, Random Forests

Clustering: K-means, PAM, Hierarchical Clustering

### **Course Outcomes:**

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

1. Familiarize themselves with R and the RStudio IDE
2. Understand and use R functions
3. Install and load a package into your R library
4. Get insight into the capabilities of the language as a productivity tool for data manipulation and statistical analyses.

### **REFERENCES:**

1. Jared P. Lander, R for Everyone: Advanced Analytics and Graphics, Pearson Edu. Inc.
2. Christian Heumann, Michael Schomaker and Shalabh, Introduction to Statistics and Data Analysis - With Exercises, Solutions and Applications in R , Springer, 2016
3. Pierre Lafaye de Micheaux, Rémy Drouilhet, Benoit Lique, The R Software-Fundamentals of Programming and Statistical Analysis, Springer 2013
4. By Alain F. Zuur, Elena N. Ieno, Erik H.W.G. Meesters, A Beginner's Guide to R (Use R) Springer 2009

**CODE: OEC-CS-701(IV)**

**SUBJECT NAME: NON-CONVENTIONAL ENERGY SOURCES**

**NO OF CREDITS: 3**

**B.TECH 7<sup>th</sup> SEMESTER**

**SESSIONAL: 25**

**L T P**

**THEORY EXAM: 75**

**3 0 0**

**TOTAL : 100**

**Course Objectives:**

1. To learn various renewable energy sources
2. To gain understanding of integrated operation of renewable energy sources
3. To understand Power Electronics Interface with the Grid

**MODULE-1:**

Introduction, Distributed vs Central Station Generation Sources of Energy such as Micro-turbines Internal Combustion Engines.

**MODULE-2:**

Introduction to Solar Energy, Wind Energy, Combined Heat and Power Hydro Energy, Tidal Energy, Wave Energy Geothermal Energy, Biomass and Fuel Cells.

**MODULE-3:**

Power Electronic Interface with the Grid

**MODULE-4:**

Impact of Distributed Generation on the Power System Power Quality Disturbances

**MODULE-5:**

Transmission System Operation Protection of Distributed Generators Economics of Distributed Generation

**Course Outcomes:**

After completion of the course, Students will be able to:

1. Gain knowledge about renewable energy
2. Understand the working of distributed generation system in autonomous/grid connected modes
3. Know the Impact of Distributed Generation on Power System

**REDERENCES:**

1. Ranjan Rakesh, Kothari D.P, Singal K.C, “Renewable Energy Sources and Emerging Technologies”, 2nd Ed. Prentice Hall of India ,2011
2. Math H. Bollen, Fainan Hassan, “Integration of Distributed Generation in the Power System”, July 2011,Wiley –IEEE Press



3. Loi Lei Lai, Tze Fun Chan, "Distributed Generation: Induction and Permanent Magnet Generators", October 2007, Wiley-IEEE Press.
4. Roger A. Messenger, Jerry Ventre, "Photovoltaic System Engineering", 3rd Ed, 2010
5. James F. Manwell, Jon G. McGowan, Anthony L Rogers, "Wind energy explained: Theory Design and Application", John Wiley and Sons 2nd Ed, 2010

**CODE: OEC-CS-702(I)**

**SUBJECT NAME: ECONOMIC POLICIES IN INDIA**

**NO OF CREDITS: 3**

B.TECH 7<sup>th</sup> SEMESTER

SESSIONAL: 25

L T P

THEORY EXAM: 75

3 0 0

TOTAL : 100

**Course Objectives:** The purpose of this course is to:

1. Introduce various issues pertaining to India's economic development.
2. Familiarize the students about Framework of Indian Economy.
3. Acquaint the students with development strategies in India
4. Impart knowledge about Economic policy, industrial Sector and infrastructure development

#### **MODULE-1: FRAMEWORK OF INDIAN ECONOMY**

- National Income: Trends and Structure of National Income
- Demographic Features and Indicators of Economic Growth and Development Rural-Urban Migration and issues related to Urbanization
- Poverty debate and Inequality, Nature, Policy and Implications
- Unemployment-Nature, Central and State Government's policies, policy implications, Employment trends in Organized and Unorganized Sector

#### **MODULE-2: DEVELOPMENT STRATEGIES IN INDIA**

- Agricultural- Pricing, Marketing and Financing of Primary Sector
- Economic Reforms- Rationale of Economic Reforms, Liberalization, Privatization and Globalization of the Economy,
- Changing structure of India's Foreign Trade
- Role of Public Sector- Redefining the role of Public Sector, Government Policy towards Public Sector, problems associated with Privatization, issues regarding Deregulation-Disinvestment and future of Economic Reforms

#### **MODULE-3: THE ECONOMIC POLICY AND INFRASTRUCTURE DEVELOPMENT**

- Energy and Transport
- Social Infrastructure- Education, Health and Gender related issues, Social Inclusion
- Issues and policies in Financing Infrastructure Development
- Indian Financial System- issues of Financial Inclusion, Financial Sector Reforms-review of Monetary Policy of R.B.I. Capital Market in India.

#### **MODULE-4: THE ECONOMIC POLICY AND INDUSTRIAL SECTOR**

- Industrial Sector in Pre-reforms period, Growth and Pattern of Industrialization
- Industrial Sector in Post-reform period- growth and pattern of Micro, Small, Medium Enterprises, problems of India's Industrial Exports
- Labour Market- issues in Labour Market Reforms and approaches to Employment Generation Basic

##### **Course Outcomes:**

On successful completion of the course the student will be able to:

1. Understand various issues pertaining to India's economic development.
2. Understand about Framework of Indian Economy.
3. Create understanding of development strategies in India
4. Understand about Economic policy, industrial Sector and infrastructure development

#### **REFERENCES**

1. Brahmananda, P.R. and V.A. Panchmukhi.[2001], Ed. 'Development Experience in Indian Economy, Inter-state Perspective,' Bookwell, New Delhi.
2. Gupta,S.P.[1989], 'Planning and Development in India: A Critique,' Allied Publishers Private Limited, New Delhi.
3. Bhagwati, Jagdish.[2004], 'In Defense of Globalization,' Oxford University
4. Dhingra, Ishwar //C.[2006], 'Indian Economy,' Sultan Chand and Sons, New Delhi.
5. Datt, Ruddar and Sundaram, K.P.M.[Latest edition] , 'Indian Economy,' S. Chand and Co, New Delhi.

**CODE: PEC-IT-I-703**

**SUBJECT NAME: BASICS OF CLOUD COMPUTING**

**NO OF CREDITS: 3**

B.TECH 7<sup>th</sup> SEMESTER

SESSIONAL: 25

L T P

THEORY EXAM: 75

3 0 0

TOTAL : 100

**Course objectives:** The student will learn how to apply

1. Trust-based security model to real-world security problems.
2. An overview of the concepts, processes, and best practices needed to successfully secure information within Cloud infrastructures.
3. Students will learn the basic Cloud types and delivery models and develop an understanding of the risk and compliance responsibilities and Challenges for each Cloud type and service delivery model.

#### **MODULE-1: INTRODUCTION TO CLOUD COMPUTING**

Online Social Networks and Applications, Cloud introduction and overview, Different clouds, Risks, Novel applications of cloud computing .

#### **MODULE-2: CLOUD COMPUTING ARCHITECTURE**

Requirements, Introduction Cloud computing architecture, On Demand Computing Virtualization at the infrastructure level, Security in Cloud computing environments, CPU Virtualization, A discussion on Hypervisors Storage Virtualization Cloud Computing Defined, The SPI Framework for Cloud Computing, The Traditional Software Model, The Cloud Services Delivery Model Cloud Deployment Models Key Drivers to Adopting the Cloud, The Impact of Cloud Computing on Users, Governance in the Cloud, Barriers to Cloud Computing Adoption in the Enterprise .

#### **MODULE-3: SECURITY ISSUES IN CLOUD COMPUTING**

Infrastructure Security, Infrastructure Security: The Network Level, The Host Level, The Application Level, Data Security and Storage, Aspects of Data Security, Data Security Mitigation Provider Data and Its Security Identity and Access Management Trust Boundaries and IAM, IAM Challenges, Relevant IAM Standards and Protocols for Cloud Services, IAM Practices in the Cloud, Cloud Authorization Management

#### **MODULE-4: SECURITY MANAGEMENT IN THE CLOUD**

Security Management Standards, Security Management in the Cloud, Availability Management: SaaS, PaaS, IaaS Privacy Issues Privacy Issues, Data Life Cycle, Key Privacy Concerns in the Cloud, Protecting Privacy, Changes to Privacy Risk Management and Compliance in Relation to Cloud Computing, Legal and Regulatory Implications, U.S. Laws and Regulations, International Laws and Regulations

## **MODULE-5: AUDIT AND COMPLIANCE**

Internal Policy Compliance, Governance, Risk, and Compliance (GRC), Regulatory/External Compliance, Cloud Security Alliance, Auditing the Cloud for Compliance, Security-as-a-Cloud.

## **MODULE-6: DATA INTENSIVE COMPUTING**

Map-Reduce Programming Characterizing Data-Intensive Computations, Technologies for Data-Intensive Computing, Storage Systems, Programming Platforms, MapReduce Programming, MapReduce Programming Model, Example Application

### **Course Outcomes:**

After completion of course, students would be able to:

1. Identify security aspects of each cloud model
2. Develop a risk-management strategy for moving to the Cloud
3. Implement a public cloud instance using a public cloud service provider

### **REFERENCES:**

1. Gautam Shroff, “Enterprise Cloud Computing Technology Architecture Applications”, Cambridge University Press; 1 edition, [ISBN: 978-0521137355], 2010.
2. Kai Hwang, Geoffrey C. Fox, Jack J. Dongarra, “Distributed and Cloud Computing: From parallel processing to IOT” Morgan Kaufmann Publishers; 1 edition [ISBN: 978-0-12-385880], 2012.

**CODE: OEC-CS-702 (III)**

**SUBJECT NAME: OPTICAL NETWORK DESIGN**

**NO OF CREDITS: 3**

**B.TECH 7<sup>th</sup> SEMESTER**

**SESSIONAL: 25**

**L T P**

**THEORY EXAM: 75**

**3 0 0**

**TOTAL : 100**

**Course Objectives:**

1. To make students familiar with SONET and SDH Architecture and add Drop Multiplexer.
2. To make students aware of wavelength division multiplexing techniques.
3. To introduce T-Carrier multiplexed hierarchy.
4. To introduce features of SONET and SDH.
4. To study about LDP protocol in detail

**MODULE-1: INTRODUCTION TO OPTICAL NETWORKING**

Introduction SONET/SDH and dense wavelength-division multiplexing (DWDM) , Add/drop multiplexers (ADMs), DWDM, CWDM, Time-Division Multiplexing, Synchronous TDMs, Statistical TDMs, Circuit Switched Networks, T-Carrier multiplexed Hierarchy, DS framing, DS multiframing formats, D4 Superframe, D5 extended superframe, E-Carrier multiplexed Hierarchy, TDM network elements, and Ethernet switching.

**MODULE-2:SONET ARCHITECTURES**

SONET integration of TDM signals, SONET electrical and optical signals, SONET Layers, SONET framing, SONET transport overhead, SONET alarms, multiplexing, virtual tributaries, SONET network elements, SONET topologies, SONET protection mechanisms, APS, two-fiber UPSR, DRI, and two-fiber and four-fiber BLSR rings. SPR,RPR

**MODULE-3:SDH ARCHITECTURES**

SDH integration of TDM signals, SDH electrical and optical signals, SDH Layers, SDH framing, SDH higher layer framing, SDH transport overhead, SDH alarms, multiplexing, virtual containers, SDH network elements, SDH topologies, SDH protection mechanisms, APS, 1+1 protection, 1:1 protection, 1:N protection, Unidirectional v/s bidirectional rings, Path and multiplex section switching, Subnetwork Connection protection rings, DRI, and two-fiber and four-fiber Multiplex section-shared protection rings,

**MODULE-4:WAVELENGTH-DIVISION MULTIPLEXING**

Wavelength-division multiplexing principles, coarse wavelength-division multiplexing, dense wavelength-division multiplexing, WDM systems, WDM characteristics, impairments to transmission, and dispersion and compensation in WDM systems. Optical link design, factors affecting system design, point-to-point link based on Q-factor and OSNR, OSNR calculations for fiber amplifiers.

## **MODULE-5:LABEL DISTRIBUTION PROTOCOLS**

The Label Distribution Protocol (LDP), Label Spaces, LDP Sessions, and Hello Adjacencies , The LDP PDU Format, The LDP Message Format, The LDP Messages, The Multi-Protocol Label Switching (MPLS) Architecture, Label Allocation Schemes, The Next Hop Label Forwarding Entry (NHLFE), Explicit Routing, An Example of the Use of the Label Stack, Schemes for Setting up an LSP

### **Course Outcomes:**

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

1. SONET and SDH Architecture.
2. wavelength and time division multiplexing techniques.
3. SONET and SDH frames and their architectures
4. LDP protocol in detail.

### **REFERENCES**

1. “Optical Network Design and Implementation (Networking Technology)”, by Vivek Alwayn, Cisco press
2. “Handbook of Fiber Optic Data Communication”, Third Edition: A Practical Guide to Optical Networking by Casimer De Cusatis

**CODE: OEC-CS-702(IV)**

**SUBJECT NAME: HIGH SPEED NETWORK**

**NO OF CREDITS: 3**

B.TECH 7<sup>th</sup> SEMESTER

SESSIONAL: 25

L T P

THEORY EXAM: 75

3 0 0

TOTAL : 100

**Course Objectives:**

1. To make the students familiar with High Speed Network technologies.
2. To make students aware of advantages and disadvantages of high speed technologies.
3. Study of techniques available for congestion control traffic management.
4. How to make congestion control in TCP and ATM.
5. To study integrated and differentiated services architecture.
6. Protocols for high speed communication

**MODULE-1: HIGH SPEED NETWORKS**

Frame Relay Networks – Asynchronous transfer mode – ATM Protocol Architecture, ATM logical Connection, ATM Cell – ATM Service Categories – AAL.High Speed LANs: Fast Ethernet, Gigabit Ethernet, Fiber Channel – Wireless LANs: applications, requirements – Architecture of 802.11

**MODULE-2: CONGESTION AND TRAFFIC MANAGEMENT**

Queuing Analysis- Queuing Models – Single Server Queues – Effects of Congestion – Congestion Control – Traffic management – Congestion Control in Packet Switching Networks – Frame Relay Congestion Control.

**MODULE-3: TCP AND ATM CONGESTION CONTROL**

TCP Flow control – TCP Congestion Control – Retransmission – Timer Management – Exponential RTO backoff – KARN's Algorithm – Window management – Performance of TCP over ATM. Traffic and Congestion control in ATM – Requirements – Attributes – Traffic Management Frame work, Traffic Control – ABR traffic Management – ABR rate control, RM cell formats, ABR Capacity allocations – GFR traffic management.

**MODULE-4: INTEGRATED AND DIFFERENTIATED SERVICES**

Integrated Services Architecture – Approach, Components, Services- Queuing Discipline, FQ, PS, BRFQ, GPS, WFQ – Random Early Detection, Differentiated Services



## **MODULE-5: PROTOCOLS FOR QOS SUPPORT**

RSVP – Goals & Characteristics, Data Flow, RSVP operations, Protocol Mechanisms – Multiprotocol Label Switching – Operations, Label Stacking, Protocol details – RTP – Protocol Architecture, Data Transfer Protocol, RTCP.

### **Course outcomes:**

1. Students will be able to understand basic high speed networks like Frame relay and ATM.
2. Students will be familiar with advantages and disadvantages of high speed network.
3. Students will be aware of congestion control traffic management techniques.
4. Students will be aware of TCP and ATM congestion control techniques.
5. To learn the functionality of integrated and differentiated services architecture.
6. Familiarity with various high speed protocols currently available.

### **REFERENCES**

1. William Stallings, “HIGH SPEED NETWORKS AND INTERNET”, Pearson Education, Second Edition, 2002.
2. Warland & Pravin Varaiya, “HIGH PERFORMANCE COMMUNICATION NETWORKS”, Jean Harcourt Asia Pvt. Ltd., II Edition, 2001.
3. Irvan Pepelnjk, Jim Guichard and Jeff Apcar, “MLS and VPN architecture”, Cisco Press, Volume 1 and 2, 2003.

**DETAILED 4-YEAR CURRICULUM CONTENTS**

**Undergraduate Degree in Engineering & Technology**

**Branch/Course: COMPUTER ENGINEERING**

<p><b>VALUE ADDED COURSES</b></p>
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**CODE:HSMC (H-102)**

**SUBJECT NAME: UNIVERSAL HUMAN VALUES 2: UNDERSTANDING HARMONY**

**NO OF CREDITS: 0**

**B.TECH 5<sup>th</sup> SEMESTER**

**L T P**

**2 1 0**

The value-added courses is for UG/PG students. It may be taught through digital aided learning/class room teaching. Its duration is 35 hours. Minimum 75% attendance is compulsory for students and its evaluation will be done by concerned Dept. through Viva-Voce examination/internal examination.

Pre-requisites: None. Universal Human Values 1 (desirable)

Course Objectives:

1. Development of a holistic perspective based on self-exploration about themselves (human being), family, society and nature/existence.
2. Understanding (or developing clarity) of the harmony in the human being, family, society and nature/existence
3. Strengthening of self-reflection.
4. Development of commitment and courage to act

### **Human Values Course**

This course also discusses their role in their family. It, very briefly, touches issues related to their role in the society and the nature, which needs to be discussed at length in one more semester for which the foundation course named as “ H-102 Universal Human Values 2: Understanding Harmony” is designed which may be covered in their III or IV semester. During the Induction Program, students would get and initial exposure to human values through Universal Human Values –I. This exposure is to be augmented by this compulsory full semester foundation course.

### **Universal Human Values 2: Understanding Harmony**

#### **MODULE-1: COURSE INTRODUCTION - NEED, BASIC GUIDELINES, CONTENT AND PROCESS FOR VALUE EDUCATION**

1. Purpose and motivation for the course, recapitulation from Universal Human Values-I
2. Self-Exploration–what is it? - Its content and process; ‘Natural Acceptance’ and Experiential Validation- as the process for self-exploration
3. Continuous Happiness and Prosperity- A look at basic Human Aspirations
4. Right understanding, Relationship and Physical Facility- the basic requirements for fulfilment of aspirations of every human being with their correct priority
5. Understanding Happiness and Prosperity correctly- A critical appraisal of the current scenario

6. Method to fulfil the above human aspirations: understanding and living in harmony at various levels.

Include practice sessions to discuss natural acceptance in human being as the innate acceptance for living with responsibility (living in relationship, harmony and co-existence) rather than as arbitrariness in choice based on liking-disliking.

## **MODULE-2:UNDERSTANDING HARMONY IN THE HUMAN BEING - HARMONY IN MYSELF!**

1. Understanding human being as a co-existence of the sentient 'I' and the material 'Body'
2. Understanding the needs of Self ('I') and 'Body' - happiness and physical facility
3. Understanding the Body as an instrument of 'I' (I being the doer, seer and enjoyer)
4. Understanding the characteristics and activities of 'I' and harmony in 'I'
5. Understanding the harmony of I with the Body: Sanyam and Health; correct appraisal of Physical needs, meaning of Prosperity in detail
6. Programs to ensure Sanyam and Health.

Include practice sessions to discuss the role others have played in making material goods available to me. Identifying from one's own life. Differentiate between prosperity and accumulation. Discuss program for ensuring health vs dealing with disease

## **MODULE-3:UNDERSTANDING HARMONY IN THE FAMILY AND SOCIETY- HARMONY IN HUMAN – HUMAN RELATIONSHIP**

1. Understanding values in human-human relationship; meaning of Justice (nine universal values in relationships) and program for its fulfilment to ensure mutual happiness; Trust and Respect as the foundational values of relationship
2. Understanding the meaning of Trust; Difference between intention and competence
3. Understanding the meaning of Respect, Difference between respect and differentiation; the other salient values in relationship
4. Understanding the harmony in the society (society being an extension of family): Resolution, Prosperity, fearlessness (trust) and co-existence as comprehensive Human Goals
5. Visualizing a universal harmonious order in society- Undivided Society, Universal Order- from family to world family.

Include practice sessions to reflect on relationships in family, hostel and institute as extended family, real life examples, teacher-student relationship, goal of education etc. Gratitude as a universal value in relationships. Discuss with scenarios. Elicit examples from students' lives

## **MODULE-4:UNDERSTANDING HARMONY IN THE NATURE AND EXISTENCE - WHOLE EXISTENCE AS COEXISTENCE**

1. Understanding the harmony in the Nature
2. Interconnectedness and mutual fulfilment among the four orders of nature-recyclability and self-regulation in nature

3. Understanding Existence as Co-existence of mutually interacting units in all pervasive space
4. Holistic perception of harmony at all levels of existence.

Include practice sessions to discuss human being as cause of imbalance in nature (film “Home” can be used), pollution, depletion of resources and role of technology etc.

## **MODULE-:5 IMPLICATIONS OF THE ABOVE HOLISTIC UNDERSTANDING OF HARMONY ON PROFESSIONAL ETHICS**

1. Natural acceptance of human values
2. Definitiveness of Ethical Human Conduct
3. Basis for Humanistic Education, Humanistic Constitution and Humanistic Universal Order
4. Competence in professional ethics: a. Ability to utilize the professional competence for augmenting universal human order b. Ability to identify the scope and characteristics of people friendly and eco-friendly production systems, c. Ability to identify and develop appropriate technologies and management patterns for above production systems.
5. Case studies of typical holistic technologies, management models and production systems
6. Strategy for transition from the present state to Universal Human Order: a. At the level of individual: as socially and ecologically responsible engineers, technologists and managers b. At the level of society: as mutually enriching institutions and organizations
7. Sum up.

Include practice Exercises and Case Studies will be taken up in Practice (tutorial) Sessions eg. To discuss the conduct as an engineer or scientist etc.

**Course Outcomes:** On successful completion of the course the students are expected to

1. Become more aware of themselves, and their surroundings (family, society, nature)
2. Become more responsible in life, and in handling problems with sustainable solutions, while keeping human relationships and human nature in mind.
3. Become sensitive to their commitment towards what they have understood (human values, human relationship and human society).
4. Apply what they have learnt to their own self in different day-to-day settings in real life, at least a beginning would be made in this direction. This is only an introductory foundational input. It would be desirable to follow it up by
  - (a) faculty-student or mentor-mentee programs throughout their time with the institution
  - (b) Higher level courses on human values in every aspect of living. E.g. as a professional

## **READINGS:**

### **Text Books:**

1. Human Values and Professional Ethics by R R Gaur, R Sangal, G P Bagaria, Excel Books, New Delhi, 2010

## REFERENCE BOOKS

1. Jeevan Vidya: EkParichaya, A Nagaraj, Jeevan Vidya Prakashan, Amarkantak, 1999.
2. Human Values, A.N. Tripathi, New Age Intl. Publishers, New Delhi, 2004.
3. The Story of Stuff (Book).
4. The Story of My Experiments with Truth - by Mohandas Karamchand Gandhi
5. Small is Beautiful - E. F Schumacher.
6. Slow is Beautiful - Cecile Andrews
7. Economy of Permanence - J C Kumarappa
8. Bharat Mein Angreji Raj - PanditSunderlal
9. Rediscovering India - by Dharampal
10. Hind Swaraj or Indian Home Rule - by Mohandas K. Gandhi
11. India Wins Freedom - Maulana Abdul Kalam Azad
12. Vivekananda - Romain Rolland (English)
13. Gandhi - Romain Rolland (English)

## ASSESSMENT

This is a compulsory non-credit course. The assessment is to provide a fair state of development of the student, so participation in classroom discussions, self-assessment, peer assessment etc. will be used in evaluation.

Example:

Assessment by faculty mentor : 10 marks

Self –assessment : 10 marks

Assessment by peers : 10 marks

Socially relevant project/Group Activities/Assignments :20 marks

Semester End Examination : 50 marks

The overall pass percentage is 40%. In case the student fails, he/she must repeat the course.

**DETAILED 4-YEAR CURRICULUM CONTENTS**

**Undergraduate Degree in Engineering & Technology**

**Branch/Course: COMPUTER ENGINEERING**

<p><b>AUDIT COURSES</b></p>
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**CODE:AC-02-23**

**SUBJECT NAME:MESSAGE OF BHAGWAT GITA**

**NO OF CREDITS: 3**

**B.TECH 6<sup>th</sup> SEMESTER**

**L T P**

**2 1 0**

**SESSIONAL: 25**

**THEORY EXAM: 75**

**TOTAL : 100**

The value-added courses is for UG/PG students. It may be taught through digital aided learning/class room teaching. Its duration is 35 hours. Minimum 75% attendance is compulsory for students and its evaluation will be done by concerned Dept. through Viva-Voce examination.

**Course Objectives:** The purpose of this course is to:

1. Enable the students to create awareness on Message of Bhagwat Gita to instill Moral,Social Values
2. Familiarize the students with Karma Yoga and discuss its importance
3. Acquaint the students with Bhakti Yoga and discuss its significance

**MODULE-1:** Introduction: Relevance of Bhagavad Gita today- Background of Mahabharatha. Arjuna Vishada Yoda: Arjuna's Anguish and Confusion- Symbolism of Arjuna's Chariot. Sankhya Yoga: Imporance of Self-Knowledge- Deathlessness : Indestructibility of Consiousness- Being Established in Wisdom – Qualities of a Sthita-prajna.

**MODULE-2:** Karma Yoga: Yoga of Action – Living in the present- Dedicated Action without Anxiety over Results – Concept of Swadhrma, Dhyana Yoga: Tuning the Mind- Quantity, Quality and Direction of Thoughts- Reaching Inner Silence.

**MODULE-3:** Bhakti Yoga: Yoga of Devotion – Form and Formless Aspects of the Divine- Inner Qualities of a True Devotee, GanatrayaVibhaga Yoga: Dynamics of the Three Gunas: Tamas, Rajas, Sattva- Going Beyond the Three Gunas- Description of A Gunatheetha.

**Course Outcomes:** Upon completion of the course, the student should be able to

1. Realize the Relevance of Bhagavad Gita
2. Realize the significance of Karma Yoga and Bhakti Yoga
3. Learn the responsibilities and duty in the society.

## **REFERENCES**

1. **Swami Chinmayananda, : The Holy Geeta”, Central Chinmaya Mission Trust 2002.**
2. **Swami Chinmayananda, “ A Manual of Self Unfordment”, Central Chinmaya Mission Trust, 2001.**



# NGF College of Engineering & Technology

## Career Scope of B.Tech CSE (AI & ML))

### B.Tech in AI & ML at NGFCET: An Overview

The **B.Tech in Artificial Intelligence and Machine Learning (AI & ML)** program at NGFCET (New Green Field College of Engineering and Technology) under the **Department of Computer Science** is designed to meet the growing demand for **AI and ML specialists** in the global tech industry.

This program focuses on **machine learning algorithms, neural networks, natural language processing (NLP), deep learning, big data analytics, and cloud computing**, making graduates highly employable in **cutting-edge tech roles**.

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### 1. Job Opportunities for B.Tech in AI & ML Graduates

The AI & ML field offers **diverse and lucrative job opportunities** across industries such as **IT, healthcare, finance, e-commerce, and manufacturing**.

### Top Job Roles for AI & ML Graduates

- **AI Engineer:** Develop and implement AI models for automation and decision-making.
  - **Machine Learning Engineer:** Design, train, and deploy ML models.
  - **Data Scientist:** Analyze large datasets and derive meaningful insights.
  - **AI Research Scientist:** Conduct advanced research on AI algorithms.
  - **Computer Vision Engineer:** Develop AI solutions for image and video analysis.
  - **Natural Language Processing (NLP) Engineer:** Build models for speech and language processing.
  - **Robotics Engineer:** Work on AI-driven automation and robotics projects.
  - **Business Intelligence Developer:** Use AI to create data-driven reports and insights.
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### 2. Average Salary Packages for AI & ML Graduates

#### In India IN

The **demand for AI and ML professionals** in India is skyrocketing, with companies offering **high salary packages** even at the entry level.

- **Entry-Level (0–2 years):** ₹6 – ₹12 LPA
- **Mid-Level (3–5 years):** ₹15 – ₹25 LPA
- **Experienced Professionals (5+ years):** ₹30 – ₹50+ LPA

#### High-Paying Specializations:

- **Deep Learning & Neural Networks:** ₹18 – ₹35 LPA
  - **Data Science & AI:** ₹20 – ₹40 LPA
  - **Cloud AI Engineer:** ₹22 – ₹45 LPA
- 

#### ✅ In Delhi-NCR Region (Gurugram, Noida, and Delhi)

Being located in **NCR** gives NGFCET students a significant advantage, as the region is a **major tech hub** with companies actively seeking AI and ML professionals.

- **Entry-Level (0–2 years):** ₹7 – ₹12 LPA
- **Mid-Level (3–5 years):** ₹18 – ₹30 LPA
- **Experienced Professionals (5+ years):** ₹35 – ₹60 LPA

#### ✅ Top Companies in NCR Hiring AI & ML Professionals:

- **Gurugram:** Google, Accenture, Nagarro, MakeMyTrip, and OYO.
  - **Noida:** HCL Technologies, Infosys, TCS, Adobe, and EXL Service.
  - **Delhi:** Zomato, Paytm, Deloitte, and Tech Mahindra.
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#### 🌐 Global Salary and Job Opportunities

B.Tech in AI & ML graduates have **excellent global prospects**, as AI is a **high-demand skill** across various industries, especially in countries like the **USA, Canada, Germany, UK, and Australia**.

- **USA:** \$100,000 – \$180,000 per year (~₹80L – ₹1.5Cr)
- **Canada:** CAD 90,000 – 150,000 per year (~₹55L – ₹90L)
- **Germany:** €60,000 – €120,000 per year (~₹55L – ₹1Cr)
- **UK:** £50,000 – £120,000 per year (~₹50L – ₹1.2Cr)
- **Australia:** AUD 110,000 – 180,000 per year (~₹60L – ₹1Cr)

#### ✅ Top Global Companies Hiring AI & ML Graduates:

- **USA:** Google, Amazon, Tesla, Meta, and Apple.
  - **Canada:** Shopify, IBM, Amazon Canada, and RBC.
  - **Germany:** Siemens, SAP, Mercedes-Benz, and Bosch.
  - **UK:** Barclays, Deloitte, HSBC, and Revolut.
  - **Australia:** Atlassian, Canva, and Commonwealth Bank.
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### 🚀 3. Career Advancement through Certifications

To **enhance employability**, B.Tech AI & ML students at NGFCET should pursue **industry-recognized certifications**, including:

- **AI and ML Certifications:**
    - AWS Certified Machine Learning – Specialty
    - Microsoft Certified: Azure AI Engineer Associate
    - Google TensorFlow Developer Certification
    - IBM AI Engineering Professional Certificate
  - **Data Science & Big Data Certifications:**
    - Data Science and Machine Learning Specialization (Coursera)
    - Google Cloud Professional Data Engineer
    - Big Data on AWS
  - **Programming and Tools:**
    - Python, R, and SQL Certifications
    - Tableau and Power BI (for data visualization)
    - TensorFlow and PyTorch (for ML models)
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#### 4. Remote Work and Freelancing Opportunities

AI and ML graduates can **explore remote and freelance work**, providing flexibility and access to **global clients**.

- **Freelancing Platforms:** Upwork, Fiverr, Freelancer, and Toptal.
  - **Remote Companies:** GitLab, Automattic, and Zapier regularly hire remote AI and ML experts.
  - **Freelance Income:** Skilled AI freelancers can earn **₹2,00,000 – ₹5,00,000/month** based on their expertise.
  - **Work From Home (WFH)** offers the flexibility to perform job duties remotely, allowing employees to maintain productivity and balance personal responsibilities from the comfort of their own space
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#### 5. Higher Education Opportunities

B.Tech AI & ML graduates aiming for **higher studies** can pursue:

- **M.Tech in Artificial Intelligence:** Specialized master's program to deepen technical expertise.
- **MBA in Business Analytics:** Combining AI skills with business strategies.
- **PG Diploma in Data Science and ML:** Short-term courses to enhance specialization.

- **MS in AI & ML (Abroad):** Higher education options in the **USA, Canada, and Germany** offer excellent job prospects.
  - **PhD in AI/ML:** For research and academic careers.
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## 6. Opportunities in Civil Services, Government, and Public Sectors

- **Government & Public Sector:** Graduates often get career opportunities in civil services through UPSC, IES, and state exams. Graduates can secure PSU jobs in BHEL, ONGC, and ISRO via GATE. Government sectors like NIC, DRDO, and defense recruit for IT roles, ensuring stable and rewarding public sector careers.
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## 7. Key Takeaways: Why B.Tech in AI & ML at NGFCET is a Great Career Choice

- ✓ **Proximity to NCR Tech Hub:** Access to **Delhi, Gurgaon, and Noida**, offering extensive job opportunities.
  - ✓ **Campus Placement Support:** NGFCET organizes placement drives, job fairs, and internship programs with **top MNCs and startups**.
  - ✓ **Industry-Aligned Curriculum:** Includes **hands-on learning, projects, and certifications** in AI & ML.
  - ✓ **Internships and Live Projects:** Collaboration with **tech companies** for real-world exposure.
  - ✓ **Higher Education and Certifications:** Guidance for **M.Tech, MS, and industry certifications** to boost career prospects.
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## 8. Tips to Maximize Career Prospects During B.Tech in AI & ML

-  To enhance employability and salary potential, students should:
  - ✓ **Build a strong GitHub profile:** Showcase AI and ML projects.
  - ✓ **Participate in hackathons:** Join Kaggle and other platforms to demonstrate skills.
  - ✓ **Pursue internships:** Gain practical experience with tech companies.
  - ✓ **Get certified:** Enhance your resume with **industry-recognized certifications**.
  - ✓ **Develop communication skills:** Crucial for client-facing roles in data science and AI.
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## 9. Conclusion: B.Tech in AI & ML at NGFCET – A Gateway to High-Paying Global Careers

Pursuing a B.Tech in Artificial Intelligence and Machine Learning (AI & ML) at NGFCET under the expert guidance of Prof. (Dr.) Kuldeep Tomar and the learned faculty members empowers students with cutting-edge skills in AI, machine learning, and data science. With state-of-the-art infrastructure, industry-focused curriculum, and hands-on learning, students are equipped to thrive in the booming tech industry.

NGFCET's strategic location in the Delhi-NCR region offers access to top-tier companies and abundant job opportunities with competitive salary packages in India and abroad. Graduates are well-prepared for high-demand roles in IT, finance, healthcare, and emerging tech sectors, making B.Tech in AI & ML at NGFCET a gateway to a successful and rewarding global career.