Ref No. CE/2024/1709   Date 18/09/2024

Certificate

This is to certify that the scheme & syllabi of _Information Technology_

(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 _18th_ BOS held on

_18/3/2024_ and

Applicable for the students admitted in the Session/Batch

_2019 - 2020_ w.e.f. for the Semester (s)

3rd to 8th Sem [1st, 2nd Sem is common in all Engg. branches]

Date: _18/09/2024_

Signature & Stamp of Chairperson
Name: _Amar lahr_
Deptt. Name: _CE_
Professor and Chairman
Dept. of Computer Engineering
J.C. Bose University of Science and Technology
YMCA, Faridabad

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

Academic Branch

SCHEME

for

BACHELOR OF TECHNOLOGY PROGRAMME

in

INFORMATION TECHNOLOGY

(w.e.f Session 2019-2020)

DEPARTMENT OF COMPUTER ENGINEERING

FACULTY OF INFORMATICS & COMPUTING

J. C. Bose University of Science & Technology, YMCA

Faridabad, Haryana

DEPARTMENT OF COMPUTER ENGINEERING

B. TECH PROGRAMME

PROGRAMME EDUCATION OBJECTIVES

PEO1	To create knowledge about core areas related to the field of computer engineering.
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.

PROGRAMME OUTCOMES

PO1	**Engineering knowledge**: Apply the knowledge of mathematics, science, engineering fundamentals, and an engineering specialization to the solution of complex engineering problems.
PO2	**Problem analysis**: Identify, formulate, review research literature, and analyze complex engineering problems reaching substantiated conclusions using first principles of mathematics, natural sciences, and engineering sciences.
PO3	**Design/development of solutions**: 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	**Conduct investigations of complex problems**: 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	**Modern tool usage**: 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	**The engineer and society**: 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	**Environment and sustainability**: Understand the impact of the professional engineering solutions in societal and environmental contexts, and demonstrate the knowledge of, and need for sustainable development.
PO8	**Ethics**: Apply ethical principles and commit to professional ethics and responsibilities and norms of the engineering practice.
PO9	**Individual and team work**: Function effectively as an individual, and as a member or leader in diverse teams, and in multidisciplinary settings.
PO10	**Communication**: 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 | **Project management and finance**: 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 | **Life-long learning**: 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. |

PROGRAMME SPECIFIC OUTCOMES

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

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

STRUCTURE OF UNDERGRADUATE ENGINEERING PROGRAM

S.No.	Category	Breakup of Credits (Total 177)
1	Humanities and Social Sciences including Management courses	12
2	Basic Science courses	25
3	Engineering Science courses including workshop, drawing, basics of electrical/mechanical/computer etc	26
4	Professional core courses	52
5	Professional Elective courses relevant to chosen specialization/branch	18
6	Open subjects – Electives from other technical and /or emerging subjects	12*
7	Project work, seminar and internship in industry or elsewhere	20
8	MOOCs	12*
9	Audit Course (message of Bhagwat Gita)	3
10	Mandatory Courses [Environmental Sciences, Induction training, Constitution of India, Understanding Harmony, Message of Bhagwat Gita]	**Non-Credit**
11	Value Added Course [Universal Human Values]	**Non-Credit**
	Total	**180***

* 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.

CREDIT DISTRIBUTION IN THE FIRST YEAR OFUNDERGRADUATE ENGINEERING PROGRAM

Subject	Lecture (L)	Tutorial (T)	Laboratory/ Practical (P)	Total credits (C)
Chemistry -I	3	1	3	5.5
Physics	3	1	3	5.5
Maths-1	3	1	0	4
Maths -2	3	1	0	4
Programming for Problem solving	3	0	4	5
English	2	0	2	3
Engineering Graphics & Design	0	0	4	2
Workshop/Practicals	1	0	4	3
Basic Electrical Engg.	3	1	2	5
*Biology	2	1	0	3
*Engg. Mechanics	3	1	0	4
*Maths-3	3	0	0	3
MOOC	-	-	-	3

SEMESTER WISE SUMMARY OF THE PROGRAMME

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	35	850	27
5.	V	35	950	24
6.	VI	33	900	27
7.	VII	21	700	17
8.	VIII	One Semester	500	10
9.	MOOCs	-	-	12*
	Total	210+One Semester Training	5950	180*

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

COURSE CODE AND DEFINITION

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

MANDATORY INDUCTION PROGRAM (3-WEEKS DURATION)

When new students enter an institution, they come with diverse thoughts, backgrounds and preparations. It is important to help them adjust to the new environment and inculcate in them the ethos of the institution with a sense of larger purpose. A 3-week long induction program for the UG students entering the institution, right at the start, has to be planned. Normal classes will start only after the induction program is over. Its purpose is to make the students feel comfortable in their new environment, open them up, set a healthy daily routine, create bonding in the batch as well as between faculty and students, develop awareness, sensitivity and understanding of the self, people around them, society at large, and nature. Tentative activities which can be planned in this Induction Programme are as follows:

- **Physical activity**

- **Creative Arts**

- **Universal Human Values**

- **Literary**

- **Proficiency Modules**

- **Lectures by Eminent People**

- **Visits to local Areas**

- **Familiarization to Dept./Branch & Innovation.**

HUMANITIES & SOCIAL SCIENCES INCLUDING MANAGEMENT

S.N	Code No.	Course Title	Hours Per week			Total Credits	Semeste
			L	T	P		
1	HSMC-101	English	2	0	2	3	2
2	HSMC-02	Economics for Engineers	3	0	0	3	3
3	HSMC-03/ HSMC-04	Management-I (Organizational Behaviour/ Finance & Accounting)	3	0	0	3	4
4	HSMC-01	Humanities –I (Effective Technical Communication)	3	0	0	3	5
Total Credits						12	

BASIC SCIENCE COURSES [BSC]

S.N	Code No.	Course	Hours Per Week			Total Credits	Semester
			L	T	P		
1	BSC101D	Physics(SemiConductor Physics)	3	1	3	5.5	1/2
2	BSC103E	Mathematics –I (Calculus & Linear Algebra)	3	1	0	4	1
3	BSC106E	Mathematics –II (Probability & Statistics)	3	1	0	4	2
4	BSC102	Chemistry	3	1	3	5.5	1/2
5	BSC -01	Biology	2	1	0	3	4
6	BSC-301	Mathematics –III (Calculus and Ordinary Differential Equations)	3	0	0	3	3
Total Credits						25	

ENGINEERING SCIENCE COURSE [ESC]

S.No	Code No.	Course Title	Hours Per Week			Tota	Semeste
			L	T	P		
1	ESC 101	Basic Electrical Engineering	3	1	2	5	½
2	ESC102	Engineering Graphics & Design	0	0	4	2	½
3	ESC103	Programming for Problem Solving	3	0	4	5	½
4	ESC104	Workshop-I	0	0	4	2	1
5	ESC106	Workshop-II	0	0	4	2	2
6	ESC-301, ESC-303	Analog Electronic Circuits	3	0	4	5	3
7	ESC-302, ESC-304	Digital Electronics	3	0	4	5	3
					Total Credits	**26**	

PROFESSIONAL CORE COURSES [PCC]

S.No	Code No.	Course Title	Hours Per Week			Total Credits	Semester
			L	T	P		
1	PCC-CS-301	Data Structures & Algorithms	3	0	4	5	3
2	PCC-CS-302	IT Workshop-(Sci-lab/MATLAB)	0	0	4	2	3
3	PCC-CS- 401	Discrete Mathematics	3	1	0	4	4
4	PCC-CS- 402, PCC-CS-405	Computer Organization & Architecture	3	0	4	5	4
5	PCC-CS- 403, PCC-CS-406	Operating System	3	0	4	5	4
6	PCC-CS- 404, PCC-CS-407	Design & Analysis of Algorithms	3	0	4	5	4
7	PCC-CS- 501, PCC-CS-504	Database Management System	3	0	4	5	5
8	PCC-CS- 502	Formal Languages, Automata and Compiler Design	3	0	0	3	5
9	PCC-CS- 503, PCC-CS-505	Object Oriented Programming	3	0	4	5	5

S.No	Code No.	Course Title	Hours Per Week			Total Credits	Semester
			L	T	P		
10.		Computer NetwoPCC-CS-602, PCC-CS-604rks	3	0	0	3	5
10	PCC-CS- 601, PCC-CS-603	Intelligent Systems	3	0	4	5	6
11	PCC-IT- 601-A-2024	Data Analytics using Python	3	0	4	5	6
Total Credits						52	

PROFESSIONAL ELECTIVE COURSES [PEC]

S.No.	Code No.	Course Title	Hours Per Week			Total Credits	Semester
			L	T	P		
1	PEC *	Elective-I	3	0	0	3	5
2	PEC *	Elective-II	3	0	0	3	6
3	PEC *	Elective-III	3	0	0	3	6
4	PEC *	Elective-IV	3	0	0	3	7
5	PEC *	Elective-V	3	0	0	3	7
6	PEC *	Elective-VI	3	0	0	3	7
Total Credits						18	

* refer to table of streams for Program Elective Courses (PEC) for codes

OPEN ELECTIVE COURSES [OEC]

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

* refer to table of Open Elective Course (OEC) for codes

VALUE ADDED COURSE [VAC]*

S. No.	Code	Course Title	Hours Per Week			Semester	Credits	Marks for Sessional	Marks for End Term Examination	Total
			L	T	P					
1.	HSMC (H-102)	Universal Human Values 2: Understanding Harmony	0	0	2	V	0	15	35	50
Total							**0**	**0**	**0**	**0**

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
Total							**3**	**25**	**75**	**100**

*As approved during the 20th Meeting of Academic Council, the above subjects are to be included in the curriculum

J C BOSE UNIVERSITY OF SCIENCE & TECHNOLOGY, YMCA, FARIDABAD
B.Tech (INFORMATION TECHNOLOGY)
Scheme of Studies/Examination
Semester -I Course Structure

S.No.	Course Notation	Category	Course Code	Course Title	Hours per week			Credits	Sessional Marks	External Marks	Total
					L	T	P				
1	B	BSC	BSC101D	Physics(SemiConductor Physics)	3	1	-	4	25	75	100
2	C	BSC	BSC103E	Mathematics-I (Calculus & Linear Algebra)	3	1	-	4	25	75	100
3	A	ESC	ESC101	Basic Electrical Engineering	3	1	-	4	25	75	100
4	B	ESC	ESC102	Engineering Graphics & Design	-	-	4	2	30	70	100
5	A	BSC	BSC 102	Chemistry	3	1	-	4	25	75	100
6	B	ESC	ESC103	Programming for Problem solving	3	-	-	3	25	75	100
7	C	ESC	ESC104	Workshop- I	-	-	4	2	30	70	100
8	A	HSMC	HSMC101	English	2	-	-	2	25	75	100
9	B	BSC	BSC104D	Physics lab	-	-	3	1.5	15	35	50
10	A	ESC	ESC107	Basic Electrical Engineering Lab	-	-	2	1	15	35	50
11	A	BSC	BSC 105	Chemistry Lab	-	-	3	1.5	15	35	50
12	B	ESC	ESC105	Programming for Problem solving Lab	-	-	4	2	15	35	50
13	A	HSMC	HSMC102	English Lab	-	-	2	1	15	35	50

Note: Exams duration will be as under

a. Theory exams will be of 03 hours duration.

b. Practical exams will be of 02 hours duration

c. Workshop exam will be of 03 hours duration

Significance of the Course Notations used in scheme: -

C = These courses are common to both the groups Group-A and Group-B.

A = Other compulsory courses for Group-A.

B = Other compulsory courses for Group-B.

Students will study either Group A (BSC103,ESC101,BSC102,HSMC101,ESC107,BSC105,HSMC102)   **OR** Group B (BSC101..,BSC103A/B,ESC102,ESC103,BSC104, ESC105) (* Branch specific scheme and syllabus for Maths-I, Math-II and Physics on next page)

J C BOSE UNIVERSITY OF SCIENCE & TECHNOLOGY, YMCA, FARIDABAD
B.Tech (INFORMATION TECHNOLOGY)
Scheme of Studies/Examination
Semester -II (All Branches) Course Structure

S.No.	Course Notation	Category Code	Course Code	Course Title	Hours per week			Credits	Sessional Marks	External Marks	Total
					L	T	P				
1	A	BSC	BSC101D	Physics(SemiConductor Physics)	3	1	-	4	25	75	100
2	C	BSC	BSC106E	Mathematics-II (Probability and Statistics)	3	1	-	4	25	75	100
3	B	ESC	ESC101	Basic Electrical Engineering	3	1	-	4	25	75	100
4	A	ESC	ESC102	Engineering Graphics & Design	-	-	4	2	30	70	100
5	B	BSC	BSC 102	Chemistry	3	1	-	4	25	75	100
6	A	ESC	ESC103	Programming for Problem solving	3	-	-	3	25	75	100
7	C	ESC	ESC106	Workshop- II	-	-	4	2	30	70	100
8	B	HSMC	HSMC101	English	2	-	-	2	25	75	100
9	A	BSC	BSC104D	Physics lab	-	-	3	1.5	15	35	50
10	B	ESC	ESC107	Basic Electrical Engineering Lab	-	-	2	1	15	35	50
11	B	BSC	BSC 105	Chemistry Lab	-	-	3	1.5	15	35	50
12	A	ESC	ESC105	Programming for Problem solving Lab	-	-	4	2	15	35	50
13	B	HSMC	HSMC102	English Lab	-	-	2	1	15	35	50

Note: Exams duration will be as under

a. Theory exams will be of 03 hours duration.
b. Practical exams will be of 02 hours duration
c. Workshop exam will be of 03 hours duration

Note: Workshop I and Workshop II can be decided for specific branch by the respective Dean/Principal of respective UTD/Institutions.

J C BOSE UNIVERSITY OF SCIENCE & TECHNOLOGY, YMCA, FARIDABAD
B.Tech (INFORMATION TECHNOLOGY)
Scheme of Studies/Examination
Semester III

S. No.	Category	Course Code	Course Title	Hours per week			Credits	Sessional Marks	Final Marks	Total
				L	T	P				
1	ESC	ESC-301	Analog Electronic Circuits	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	PCC	PCC-CS-302	IT Workshop-(Sci-lab/MATLAB)	0	0	4	2	15	35	50
5	BSC	BSC-301	Mathematics- III (Calculus and Ordinary Differential Equations)	3	0	0	3	25	75	100
6	HSMC	HSMC-02	Economics For Engineers	3	0	0	3	25	75	100
7	ESC	ESC-303	Analog Electronic Circuits LAB	0	0	4	2	15	35	50
8	ESC	ESC-304	Digital Electronics LAB	0	0	4	2	15	35	50
9	PCC	PCC-CS-303	Data Structure & Algorithms Lab	0	0	4	2	15	35	50
10	Capstone Project	PROJ-CS-301	Project-I	0	0	4	2	25	75	100
	Total			15	0	20	25	210	590	800

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 & TECHNOLOGY, YMCA, FARIDABAD
B.Tech (INFORMATION TECHNOLOGY)
Scheme of Studies/Examination
Semester IV

S. No	Category	Course Code	Course Title	Hours per week			Credits	Sessional Marks	Final Marks	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-03/HSMC-04	Management – I (Organizational Behaviour/Finance and Accounting)	3	0	0	3	25	75	100
6	BSC	BSC-01	Biology	2	1	0	3	25	75	100
7	PCC	PCC-CS-405	Computer Organization & Architecture Lab	0	0	4	2	15	35	50
8	PCC	PCC-CS-406	Operating System Lab	0	0	4	2	15	35	50
9	PCC	PCC-CS-407	Design & Analysis of Algorithms Lab	0	0	4	2	15	35	50
10	Capstone Project	PROJ-CS-401	Project-II	0	0	4	2	25	75	100
	Total			**17**	**2**	**16**	**27**	**220**	**630**	**850**

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 & TECHNOLOGY, YMCA, FARIDABAD

B.Tech (INFORMATION TECHNOLOGY)

Scheme of Studies/Examination

Semester V

S. No	Category	Course Code	Course Title	Hours Per week			Credits	Sessional Marks	Final Marks	Total
				L	T	P				
1	PCC	PCC-CS-501	Database Management Systems	3	0	0	3	25	75	100
2	PCC	PCC-CS-502	Formal Languages , Automata and Compiler Design	3	0	0	3	25	75	100
3	PCC	PCC-CS-503	Object Oriented Programming	3	0	0	3	25	75	100
4	PCC	PCC-CS-602	Computer Networks	3	0	0	3	25	75	100
5	HSMC	HSMC-01	Humanities- I (Effective Technical Communication)	3	0	0	3	25	75	100
6	PEC	PEC*	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	HSMC (H-102)	Universal Human Values 2: Understanding Harmony	0	0	2	0	15	35	50
9	PCC	PCC-CS-504	Database Management Systems Lab	0	0	4	2	15	35	50
10	PCC	PCC-CS-505	Object Oriented Programming Lab	0	0	4	2	15	35	50

11	Capstone Project	PROJ-CS-501	Project-III	0	0	4	2	25	75	100
Total				**22**	**1**	**12**	**24**	**245**	**705**	**950**

* refer to table of streams for Program Elective Courses (PEC) for codes

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 & TECHNOLOGY, YMCA, FARIDABAD

B.Tech (INFORMATION TECHNOLOGY)
Scheme of Studies/Examination
Semester VI

Sl. No.	Category	Course Code	Course Title	Hours per week			Credits	Sessional	Final	Total
				L	T	P				
1	PCC	PCC-CS-601	Intelligent Systems	3	0	0	3	25	75	100
2	PCC	PCC-IT-601-A-2024	Data Analytics using Python	3	0	0	3	25	75	100
3	PEC	PEC*	Elective-II	3	0	0	3	25	75	100
4	PEC	OEC*	Elective-III	3	0	0	3	25	75	100
5	OEC	OEC*	Open Elective-I (Humanities)	3	0	0	3	25	75	100
6.	OEC	OEC*	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-CS-603	Intelligent Systems lab	0	0	4	2	15	35	50
10.	PCC	PCC-IT-602	Data Analysis Using python Lab	0	0	4	2	15	35	50
Total				**20**	**1**	**12**	**27**	**230**	**670**	**900**

* refer to table of streams for Program Elective Courses (PEC) and Open Elective Course (OEC)

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 MOOC

J C BOSE UNIVERSITY OF SCIENCE & TECHNOLOGY, YMCA, FARIDABAD
B.Tech (INFORMATION TECHNOLOGY)
Scheme of Studies/Examination
Semester VII (May be carried out in VIIIth Semester*)

Sl. No.	Category	Course Code	Course Title	Hours per week			Credits	Sessional Marks	Final Marks	Total
				L	T	P				
1	PEC	OEC*	Elective-IV	3	0	0	3	25	75	100
2	PEC	PEC*	Elective-V	3	0	0	3	25	75	100
3	PEC	PEC*	Elective-VI	3	0	0	3	25	75	100
4	OEC	OEC*	Open Elective-III	3	0	0	3	25	75	100
5	OEC	OEC*	Open Elective-IV	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-701	Project-V	0	0	4	2	25	75	100
Total				**17**	**0**	**4**	**17**	**175**	**525**	**700**

* refer to table of streams for Program Elective Courses (PEC) and Open Elective Course (OEC)

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

J C BOSE UNIVERSITY OF SCIENCE & TECHNOLOGY, YMCA, FARIDABAD
B.TECH (INFORMATION TECHNOLOGY)
SCHEME OF STUDIES/EXAMINATION

Semester VIII (May be carried out in VII th Semester*)

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

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

arned 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 7th or 8th semester. In the case of pursuance of internship in 7th semester, the course contents of 7th semester will be taught in 8th semester and vice-versa. The approval of such interchangeability should be requested from the authority before the commencement of 7th semester.

STREAMS for Program Elective Courses (PEC) (IT)

	STREAM-1 INFORMATION AND COMMUNICATIONS TECHNOLOGY	STREAM-2: DATA INFORMATIC SCIENCES
S.NO	Subjects	Subjects
Elective-1	Signals and Systems	Information Retrieval
	Web and Internet Technology	
Elective-2	Routing in Communication Networks	Soft Computing
Elective-3	Optical Network Design	Data Mining
Elective-4	Wireless communications and Ad-hoc Networks	Speech and Natural language Processing
	High Speed Network	DFS and Big Data Analysis
Elective-5	Basics of Cloud Computing	Basics of Machine Learning
Elective-6	Internet of Things	Neural Network and Deep learning

Semester-wise distribution of Program Elective Courses (PEC) (IT)

Elective-1 Semester 5th

Signals and Systems-S1	ESC-501
Web and Internet Technology-S1	PEC-CS-A-702
Information Retrieval-S2	PEC-CS-D-702(II)

Elective-2   Semester 6th

Routing in Communication Networks-S1	PEC-IT-I-601
Soft Computing-S2	PEC-CS-D-602

Elective-3   Semester 6th

Optical Network Design-S1	OEC-CS-702(III)
Data Mining-S2	PEC-CS-D-601

Elective-4 Semester 7th

Wireless Communications and Ad-hoc Networks - S1	PEC-IT-I-701
High Speed Network-S1	OEC-CS-702(IV)
Speech and Natural language Processing-S2	PEC-CS-D-701
DFS and Big Data Analysis-S2	PEC-IT-D-701

Elective-5- Semester 7th

Basics of Cloud Computing-S1	PEC-IT-I-703
Basics of Machine Learning - S2	PEC-CS-D-501

Elective-6- Semester 7th

Internet of Things-S1	PEC-CS-S-703
Neural Network and Deep learning-S2	PEC-CS-D-703

OPEN ELECTIVE COURSES (OEC 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))	Entrepreneurship and E-commerce (OEC-CS-701(II))	Advanced Operating System (PEC-CS-S-701(I))
Computer Graphics (PEC-CS-A-602)	Intellectual Property Rights (OEC-CS-602(III))	R programming (OEC-CS-701(III))	Game Theory (PEC-CS-T-702)
Electronic Devices (ELOE-101)	International Business Environment (OEC-CS-602(IV))	Non-Conventional Energy Sources (OEC-CS-701(IV))	Image Processing (PEC-CS-A-501)
Digital System Design (OEC-CS-601(V))	Basics of Operations Research (OEC-CS-602(V))	Software Engineering(PEC-CS-S-601)	Advanced Computer Architecture (PEC-CS-S-501)

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

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:

Program	Duration	Credits to be earned*	Minimum CGPA
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 17th Academic Council Dated 11.06.2019 may be referred for the same.

DETAILED 4-YEAR CURRICULUM CONTENTS

Branch/Course: INFORMATION TECHNOLOGY

Second year (Third semester onwards)

HUMANITIES & SOCIAL SCIEMCES INCLUDING MANAGEMENT

SUBJECT NAME: ECONOMICS FOR ENGINEERS

NO. OF CREDITS :3

B.TECH SEMESTER III   SESSIONAL: 25

L T P   THEORY EXAM: 75

3 0 0   TOTAL: 100

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

TEXT/ REFERENCES BOOKS
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. **Dutt Rudar & 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: HSMC-03

ORGANIZATIONAL BEHAVIOUR

NO. OF CREDITS: 3

B.TECH SEMESTER IV	SESSIONAL:	25
L T P	THEORY EXAM:	75
3 0 0	TOTAL:	100

Objective: The objective of this course is to expose the students to basic concepts of management and provide insights necessary to understand behavioural processes at individual, team and organizational level.

Detailed contents:

MODULE 1 INTRODUCTION

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, Personalityconcept, 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 Outcome:

a. The students learn how to influence the human behaviour.
b. Students will be able to understand behavioural dynamics in organizations.
c. Students will be able to apply managerial concepts in practical life.
d. Students will be able to understand organizational culture and change.

TEXT/ REFERENCE BOOKS:

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. SatyaRaju, "*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 IV SEMESTER	SESSIONAL:	25
L T P	THEORY EXAM:	75
3 0 0	TOTAL :	100

Course Objectives:

The purpose of the course is to understand nature of accounting and its interaction with other accounting and their comparison. It also focuses what kind of information the manager need, from where these can be obtained and how this 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.
2. Khan, M.Y. and Jain, P.K., Management Accounting, TMH, New Delhi

CODE: HSMC-01

SUBJECT NAME : HUMANITIES- I

(EFFECTIVE TECHNICAL COMMUNICATION)

NO OF CREDITS: 3

B.TECH   SEMESTER V   SESSIONAL: 25

   L   T   P   THEORY EXAM: 75

   3   0   0   TOTAL: 100

Detailed contents:

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, Hunan 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.

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

The student will acquire basic proficiency in English including reading and listening comprehension, writing and speaking skills.

TEXT/REFERENCE BOOKS:

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)

DETAILED 4-YEAR CURRICULUM CONTENTS

Branch/Course: INFORMATION TECHNOLOGY

Second year (Third semester onwards)

BASIC SCIENCE COURSES (BSC)

CODE: BSC-301

SUBJECT NAME: **MATHEMATICS-III (CALCULUS AND ORDINARY DIFFERENTIAL EQUATIONS)**

NO. OF CREDITS :3

B.TECH SEMESTER III   SESSIONAL: 25

L   T   P   THEORY EXAM: 75

3   0   0   TOTAL: 100

Pre-requisites: Calculus, Multivariable Calculus (Differentiation)

Detailed contents:

MODULE 1: SEQUENCES AND SERIES

Convergence of sequence and series, tests for convergence, power series, Taylor's series. Series or 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.

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.

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, 11th 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.

CODE: BSC-01

SUBJECT NAME: **BIOLOGY**
NO OF CREDITS: 3

B.TECH   SEMESTER IV   SESSIONAL: 25

L   T   P   THEORY EXAM: 75

2   1   0   TOTAL :   100

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 utilization - Autotrophs, heterotrophs, lithotropes (d) Ammonia excretion – aminotelic, uricoteliec, ureotelic (e) Habitata- acquatic 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 catalyzed reactions. How does an enzyme catalyzereactions. 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 analyses biological processes at the reductionistic 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 Keq 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.

TEXT/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

DETAILED 4-YEAR CURRICULUM CONTENTS

Branch/Course: INFORMATION TECHNOLOGY

Second year (Third semester onwards)

ENGINEERING SCIENCE COURSE

SUBJECT NAME: **ANALOG ELECTRONIC CIRCUITS**

NO. OF CREDITS: 3

B.TECH   SEMESTER III   SESSIONAL: 25

L   T   P   THEORY EXAM: 75

3   0   0   TOTAL: 100

Course Objectives

The objectives are to study

1. To give the idea about fundamental properties of semiconductors.
2. To prepare students to perform the analysis of any Analog electronics circuit.
3. To empower students to understand the design and working of BJT / FET amplifiers, oscillators and Operational Amplifier.
4. To prepare the students for advanced courses in Communication system Circuit Design.

Detailed contents:

MODULE 1: DIODE CIRCUITS

P-N junction diode, I-V characteristics of a diode; review of half-wave and full-wave rectifiers, Zener diodes, clamping and clipping circuits.

MODULE 2: BJT CIRCUITS

Structure and I-V characteristics of a BJT; BJT as a switch. BJT as an amplifier: small-signal model, biasing circuits, current mirror; common-emitter, common-base and common collector amplifiers; Small signal equivalent circuits, high-frequency equivalent circuits

MODULE 3: MOSFET CIRCUITS

MOSFET structure and I-V characteristics. MOSFET as a switch. MOSFET as an amplifier: small-signal model and biasing circuits, common-source, common-gate and common-drain amplifiers; small signal equivalent circuits - gain, input and output impedances, transconductance, high frequency equivalent circuit.

MODULE 4: DIFFERENTIAL, MULTI-STAGE AND OPERATIONAL AMPLIFIERS

Differential amplifier; power amplifier; direct coupled multi-stage amplifier; internal structure of an operational amplifier, ideal op-amp, non-idealities in an op-amp (Output offset voltage, input bias current, input offset current, slew rate, gain bandwidth product)

MODULE 5: LINEAR APPLICATIONS OF OP-AMP

Idealized analysis of op-amp circuits. Inverting and non-inverting amplifier, differential amplifier, instrumentation amplifier, integrator, active filter, P, PI and PID controllers and lead/lag compensator using an op-amp, voltage regulator, oscillators (Wein bridge and phase shift). Analog to Digital Conversion.

MODULE 6: NONLINEAR APPLICATIONS OF OP-AMP

Hysteretic Comparator, Zero Crossing Detector, Square-wave and triangular-wave generators. Precision rectifier, peak detector. Monoshot.

Course Outcomes:

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

a. Understand the characteristics of transistors.
b. Design and analyse various rectifier and amplifier circuits.
c. Design sinusoidal and non-sinusoidal oscillators.
d. Understand the functioning of OP-AMP and design OP-AMP based circuits.

Text/References:

1. **S. Sedra and K. C. Smith, "*Microelectronic Circuits*", New York, Oxford University Press, 1998.**
2. **J. V. Wait, L. P. Huelsman and G. A. Korn, "*Introduction to Operational Amplifier theory and applications*", McGraw Hill U. S., 1992.**
3. **J. Millman and A. Grabel, "*Microelectronics*", McGraw Hill Education, 1988.**
4. **P. Horowitz and W. Hill, "*The Art of Electronics*", Cambridge University Press, 1989.**
5. **P. R. Gray, R. G. Meyer and S. Lewis, "*Analysis and Design of Analog Integrated Circuits*", John Wiley & Sons, 2001.**

CODE: ESC-302

SUBJECT NAME: **DIGITAL ELECTRONICS**

NO. OF CREDITS :3

B.TECH   SEMESTER III   SESSIONAL: 25

L   T   P   THEORY EXAM: 75

3   0   0   TOTAL: 100

Detailed contents:

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 lCs, 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 Bi stable latch, the clocked SR flip flop, J- K-T and D-types flip flops, Applications off 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 lCs, 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

a. Understand working of logic families and logic gates.
b. Design and implement Combinational and Sequential logic circuits.
c. Understand the process of Analog to Digital conversion and Digital to Analog conversion.
d. Be able to use PLDs to implement the given logical problem.

TEXT/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**

DETAILED 4-YEAR CURRICULUM CONTENTS

Branch/Course: INFORMATION TECHNOLOGY

Second year (Third semester onwards)

PROFESSIONAL CORE COURSES

CODE: PCC-CS-301

SUBJECT NAME: **DATA STRUCTURES & ALGORITHMS**

NO. OF CREDITS: 3

B.TECH   SEMESTER III   SESSIONAL: 25

L   T   P   THEORY EXAM: 75

3   0   0   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

Detailed contents:

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.

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:

a. For a given algorithm student will able to analyze the algorithms to determine the time and computation complexity and justify the correctness.

b. For a given Search problem (Linear Search and Binary Search) student will able to implement it.

c. 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.

d. 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.

e. 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**

CODE: PCC–CS-302

SUBJECT NAME: **IT WORKSHOP (MATLAB)**

NO OF CREDITS: 2

B.TECH   SEMESTER III   SESSIONAL: 15

L   T   P   PRACTICAL EXAM: 35

0   0   4   TOTAL: 50

Prerequisite
There are no formal prerequisites for this course.

Course Objective
The course is intended to assist undergraduates in learning the basics of programming in general and programming MATLAB in particular. Basics of programming in MATLAB will be covered, with the goal of having students become comfortable enough to continue learning MATLAB and other programming languages on their own.

Detailed contents:

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.

Course Outcomes

At the end of the course, students will be able to
- a. Use MATLAB for programming purposes
- b. Learn and explore MATLAB further on their own
- c. Use this learning experience to learn other programming languages.

TEXT/REFRENCES
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
1. https://ocw.mit.edu/courses/mathematics/18-s997-introduction-to-matlab programming-fall-2011/syllabus/

CODE: ESC-52
SUBJECT NAME: **ANALOG ELECTRONIC CIRCUITS LAB**

NO OF CREDITS: 2

B.TECH   SEMESTER III   SESSIONAL: 15

L   T   P   THEORY EXAM: 35

0   0   4   TOTAL: 50

Hands-on experiments related to the course contents of ESC-301.

SUBJECT NAME: **DIGITAL ELECTRONICS LAB**

NO. OF CREDITS : 2

B.TECH   SEMESTER III   SESSIONAL: 15

L   T   P   THEORY EXAM: 35

0   0   4   TOTAL: 50

Hands-on experiments related to the course contents of ESC-302.

CODE: PCC-CS-303

SUBJECT NAME**: DATA STRUCTURE & ALGORITHMS LAB**

NO OF CREDITS: 2

B.TECH   SEMESTER III   SESSIONAL: 15

L   T   P   THEORY EXAM: 35

0   0   4   TOTAL: 50

Hands-on experiments related to the course contents of PCC-CS-301.

CODE:PCC–CS-401

SUBJECT NAME: **DISCRETE MATHEMATICS**

NO OF CREDITS: 4

B.TECH   SEMESTER IV   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.

Detailed contents:

MODULE-1: INTRODUCTION

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

a. For a given logic sentence express it in terms of predicates, quantifiers, and logical connectives

b. For a given a problem, derive the solution using deductive logic and prove the solution based on logical inference

c. For a given a mathematical problem, classify its algebraic structure

d. Evaluate Boolean functions and simplify expressions using the properties of Boolean algebra

e. Develop the given problem as graph networks and solve with techniques of graph theory.

TEXT/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**

SUBJECT NAME: **COMPUTER ORGANIZATION & ARCHITECTURE**

NO OF CREDITS: 3

B.TECH   SEMESTER IV   SESSIONAL: 25

L   T   P   THEORY EXAM: 75

3   0   0   TOTAL: 100

Pre-requisites: Digital Electronics

Objectives of the course: To expose the students to the following

1. How Computer Systems work & the basic principles
2. Instruction Level Architecture and Instruction Execution
3. The current state of art in memory system design
4. How I/O devices are accessed and its principles.
5. To provide the knowledge on Instruction Level Parallelism
6. To impart the knowledge on micro programming
7. Concepts of advanced pipelining techniques.

Detailed contents:

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-andadd, 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 – SCII, 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.

Course outcomes

1. Draw the functional block diagram of a 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 microprocessor for computing 16 bit multiplication, division and I/O device interface (ADC, Control circuit, serial port communication).
3. Write a flowchart for Concurrent access to memory and cache coherency in Parallel Processors and describe the process.
4. Given a CPU organization and instruction, design a memory module and analyze its operation by interfacing with the CPU.
5. Given a CPU organization, assess its performance, and apply design techniques to enhance performance using pipelining, parallelism and RISC methodology

TEXT/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

SUBJECT NAME: **OPERATING SYSTEM**

NO OF CREDITS: 3

B.TECH SEMESTER IV	SESSIONAL:	25
L T P	THEORY EXAM:	75
3 0 0	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

Detailed 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;

MODULE 3: INTER-PROCESS COMMUNICATION

Critical Section, Race Conditions, Mutual Exclusion, Hardware Solution, Strict Alternation, Peterson's Solution, Semaphores **Classical IPC Problems:** The Producer\ Consumer Problem, Reader's & Writer Problem, Dinning Philosopher Problem etc.

MODULE 4: DEADLOCKS

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

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), Second Chance (SC), Not recently used (NRU) 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, disk management and kernel I/O subsystems

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

CODE: PCC-CS-404

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

NO OF CREDITS: 3

B.TECH SEMESTER IV	SESSIONAL:	25
L T P	THEORY EXAM:	75
3 0 0	TOTAL:	100

Pre-requisites: Data structure and Algorithm

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.

Detailed contents:

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 Sanguthevar Rajasekaran, "*Fundamentals of Algorithms*", Universities Press; 2nd edition [ISBN: 978-8173716126], 2008.

3. Jon Kleinberg and Éva Tardos, "*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: PCC-CS-63

SUBJECT NAME: **COMPUTER ORGANIZATION & ARCHITECTURE LAB**

NO. OF CREDITS: 2

B.TECH SEMESTER IV	SESSIONAL:	15
L T P	THEORY EXAM:	35
0 0 4	TOTAL:	50

Hands-on experiments related to the course contents of PCC-CS-402.

CODE: PCC-CS-64

SUBJECT NAME **OPERATING SYSTEM LAB**

NO. OF CREDITS: 2

B.TECH SEMESTER IV   SESSIONAL: 15

L   T   P   THEORY EXAM: 35

0   0 4   TOTAL: 50

Hands-on experiments related to the course contents of PCC-CS-403.

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

NO. OF CREDITS: 2

B.TECH SEMESTER IV	SESSIONAL:	15
L T P	THEORY EXAM:	35
0 0 4	TOTAL:	50

Hands-on experiments related to the course contents of PCC-CS-404.

CODE: **PCC-CS-501**

SUBJECT NAME: **DATABASE MANAGEMENT SYSTEMS**

NO OF CREDITS: 3

B.TECH   SEMESTER V   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 modelling, designing, and implementing a DBMS.

Detailed contents:

MODULE 1: INTRODUCTION

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 E_R 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

TEXT/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-CS-502

SUBJECT NAME: **FORMAL LANGUAGES, AUTOMATA AND COMPILER DESIGN**

NO OF CREDITS: 3

B.TECH SEMESTER V	SESSIONAL: 25
L T P	THEORY EXAM: 75
3 0 0	TOTAL: 100

Pre-requisites: Fundamentals of Computers

Course Objectives

1. To introduce formal notation for strings, languages and machines & design finite automata to accept strings of a language.
2. To design context free grammars for a given language and to convert them into normal forms.
3. To introduce context sensitive grammar and unrestricted grammars.
4. To design lexical analyzer and parsers.
5. To generate optimized intermediate code and Machine code for a target machine.

Detailed contents:

MODULE-1: FORMAL LANGUAGES AND AUTOMATA THEORY

Alphabet, languages and grammars, productions and derivation, Chomsky hierarchy of languages, Regular Expression and Finite Automata: Deterministic Finite Automata (DFA) & Nondeterministic Finite Automata (NFA).

Context-free grammars (CFG) and languages (CFL), Ambiguity in CFG, Chomsky and Greibach normal forms, Nondeterministic and deterministic pushdown automata (PDA). Introduction to Context-sensitive languages and linear bounded automata, Introduction to Turing machines.

MODULE-2: COMPILER DESIGN-ANALYSIS

Phases of compilation and overview, Lexical Analysis (scanner): scanner generator (lex, flex).

Syntax Analysis (Parser): ambiguity LL(1) grammars and top-down parsing, operator precedence parser, bottom up parsing: LR(0), SLR(1), LR(1), and LALR(1).

Semantic Analysis: Attribute grammars, syntax directed definition, evaluation and flow of attribute in a syntax tree.

MODULE-3: COMPILER DESIGN-SYNTHESIS

Symbol Table: Its structure, symbol attributes and management.

Intermediate Code Generation: Translation of different language features, different types of intermediate forms, Intermediate code optimization.

Machine code Generation and optimization: Instruction scheduling (for pipeline), loop optimization (for cache memory) etc. Register allocation and target code generation.

Course Outcomes:

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

a. Understand the different types of grammars such as regular, Context free, and context sensitive grammar.
b. Design finite state automata for Regular grammar and parser for CFG
c. Design schemes for semantic analysis.
d. Develop algorithms to generate and optimize intermediate and machine code.

TEXT/REFERENCES

1. **John E. Hopcroft, Rajeev Motwani and Jeffrey D. Ullman,** *Introduction to Automata Theory, Languages, and Computation,* **Pearson Education Asia.**
2. **John Martin,** *Introduction to Languages and The Theory of Computation***, Tata McGraw Hill.**
3. **Harry R. Lewis and Christos H. Papadimitriou,** *Elements of the Theory of Computation,* **Pearson Education Asia.**
4. **K. L. P Mishra,** *Theoy of Computation***, PHI.**
5. **A.V. Aho, M.S. Lam, R. Sethi, and J.D. Ullman,** *Compilers:Principles, Techniques, and Tools***, Pearson Education, 2007 (second ed.).**
6. **K.D. Cooper, and L. Torczon,** *Engineering a Compiler***, Elsevier, 2004.**

CODE: PCC-CS-503

SUBJECT NAME: **OBJECT ORIENTED PROGRAMMING**

NO OF CREDITS: 3

B.TECH   SEMESTER V   SESSIONAL: 25

L   T   P   THEORY EXAM: 75

3   0   0   TOTAL: 100

Pre-requisites: PCC-CS 301

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.

Detailed contents:

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, SortedSet Interface, SortedMap Interface

MODULE-5: GUIS. 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:
    a.   Specify simple abstract data types and design implementations, using abstraction functions to
         document them.
    b.   Recognize features of object-oriented design such as encapsulation, polymorphism, inheritance, and
         composition of systems based on object identity.
    c.   Name and apply some common object-oriented design patterns and give examples of
         their use.
    d.   Design applications with an event-driven graphical user interface.

TEXT/REFERENCES

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

SUBJECT NAME: **COMPUTER NETWORKS**

NO OF CREDITS: 3

B.TECH   SEMESTER V   SESSIONAL: 25

    L   T   P   THEORY EXAM: 75

    3   0   0   TOTAL: 100

Pre-requisites: PCC-CS 402, PCC-CS 403

Objectives of the course
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.

Detailed contents:

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:
a. Explain the functions of the different layer of the OSI Protocol.
b. Draw the functional block diagram of wide-area networks (WANs), local area networks (LANs) and Wireless LANs (WLANs) describe the function of each block.
c. 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
d. For a given problem related TCP/IP protocol developed the network programming.
e. Configure DNS DDNS, TELNET, EMAIL, File Transfer Protocol (FTP), WWW, HTTP, SNMP, Bluetooth, Firewalls using open source available software and tools.

TEXT/ 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-504

SUBJECT NAME: **DATABASE MANAGEMENT SYSTEMS LAB**

NO. OF CREDITS 2

B.TECH   SEMESTER V   SESSIONAL: 15

   L   T   P   THEORY EXAM: 35

   0   0   4   TOTAL: 50

Hands-on experiments related to the course contents of PCC-CS-501.

CODE: PCC-CS-505

SUBJECT NAME**: OBJECT ORIENTED PROGRAMMING LAB**

NO. OF CREDITS 2

B.TECH   SEMESTER V   SESSIONAL: 15

   L   T   P   THEORY EXAM: 35

   0   0   4   TOTAL: 50

Hands-on experiments related to the course contents of PCC-CS-503.

CODE: PCC-CS-601
SUBJECT NAME: **INTELLIGENT SYSTEMS**
NO OF CREDITS: 3

B.TECH   SEMESTER V   SESSIONAL: 25

    L   T   P   THEORY EXAM: 75

    3   0   0   TOTAL: 100

Pre-requisites: Data Structures and Data Management or Data Structures

Course Objectives

1. The aim of the course is to introduce to the field of Artificial Intelligence (AI) with emphasis on its use to solve real world problems for which solutions are difficult to express using the traditional algorithmic approach.
2. It explores 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.

Detailed contents:

MODULE-1:

Biological foundations to intelligent systems I: Artificial neural networks, Back propagation 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. Optimization 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:

    a. Able to Demonstrate knowledge of the fundamental principles of intelligent systems
    b. Able to analyse and compare the relative merits of a variety of AI problem solving techniques.

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, 3rd edition.**

CODE: PCC-IT- 601-A-2024

SUBJECT NAME: DATA ANALYTICS USING PYTHON

NO OF CREDITS: 3

B.TECH 6th SEMESTER   SESSIONAL: 25

L   T   P   THEORY EXAM: 75

3   0   0   TOTAL :   100

Pre-requisites: Basics of Data Structures and Mathematics

Course Objectives:

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." Swaroop, C. H. (2003). A Byte of Python. Python Tutorial.

2. Ken Black, sixth Editing. Business Statistics for Contemporary Decision Making. "John Wiley & Sons, Inc".

3. Anderson Sweeney Williams (2011). Statistics for Business and Economics. "Cengage Learning".

4. Douglas C. Montgomery, George C. Runger (2002). Applied Statistics & Probability for Engineering. "John Wiley & Sons, Inc"

CODE: PCC-CS-603

SUBJECT NAME: **INTELLIGENT SYSTEMS LAB**

NO OF CREDITS: 2

B.TECH   SEMESTER VI   SESSIONAL: 15

L   T P   THEORY EXAM: 35

0   0 4   TOTAL :   50

Hands-on experiments related to the course contents of PCC-CS-601.

CODE: PCC-IT-602

SUBJECT NAME: **DATA ANALYSIS USING PYTHON LAB**
NO OF CREDITS: 2

B.TECH   SEMESTER VI   SESSIONAL: 15

L   T P   THEORY EXAM: 35

0   0 4   TOTAL :   50

Hands-on experiments related to the course contents of PCC-IT- 601-A-2024.

DETAILED 4-YEAR CURRICULUM CONTENTS

Branch/Course: INFORMATION TECHNOLOGY

MANDATORY COURSES

CODE: MC-03

SUBJECT NAME: **ENVIRONMENTAL SCIENCES**

NO OF CREDITS: 0

B.TECH SEMESTER IV	SESSIONAL:	25
L T P	THEORY EXAM:	75
3 0 0	TOTAL:	100

Course Objective

1. The prime objective of the course is to 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.

Detailed contents:

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 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

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: insitu and ex-situ conservation of biodiversity.

MODULE 5 ENVIRONMENTAL POLLUTION

Definition, Causes, effects and control measures of: 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 completing this course the students will be able to

1. understand environmental legislation and policies of National and International regime.
2. know regulations applicable to industries and other organizations with significant environmental aspects.
3. get knowledge of the legal system operating in India and will be in a position to prepare compliance reports for getting environmental clearance.
4. prepare the environmental management system for an organization.

TEXT/ REFERENCES

1. "*Perspectives in Environmental Studies*" by A. Kaushik and C. P. Kaushik, New age international publishers.
2. "*Environmental Studies by Benny Joseph*", Tata McGraw Hill Co, New Delhi
3. "*Environmental Science: towards a sustainable future*" by Richard T. Wright. 2008 PHL Learning Private Ltd. New Delhi.
4. "*Environmental Engineering and science*" by Gilbert M. Masters and Wendell P. Ela 2008 PHI Learning Pvt Ltd.
5. "*Environmental Science*" by Daniel B. Botkin& Edwards A. Keller, Wiley INDIA edition.
6. "*Fundamentals of Ecology*" by Odum, E.P., Barrick, M. and Barret, G.W. Thomson Brooks/Cole Publisher, California, 2005.

SUBJECT NAME: **CONSTITUTION OF INDIA**

NO. OF CREDITS 0

B.TECH   SEMESTER V   SESSIONAL: 25

   L   T   P   THEORY EXAM: 75

   2   0   0   TOTAL: 100

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

TEXT/ REFERENCES:
1. "The Constitutional Law Of India" 9th 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. BakshiCourse Outcomes

Students will be able to:
   a. Discuss the growth of the demand for civil rights in India for the bulk of Indians before the arrival of Gandhi in Indian politics.
   b. Discuss the intellectual origins of the framework of argument that informed the conceptualization of social reforms leading to revolution in India.
   c. Discuss the circumstances surrounding the foundation of the Congress Socialist Party [CSP] under the leadership of Jawaharlal Nehru and the eventual failure of the proposal of direct elections through adult suffrage in the Indian Constitution.
   d. Discuss the passage of the Hindu Code Bill of 1956.

PROFESSIONAL ELECTIVE COURSES

STREAM -1

(INFORMATION & COMMUNICATION TECHNOLOGY)

CODE: ESC-501

SUBJECT NAME : **SIGNALS AND SYSTEMS**

NO OF CREDITS: 3

B.TECH   SEMESTER V   SESSIONAL: 25

   L   T   P   THEORY EXAM: 75

   3   0   0   TOTAL: 100

Course Objectives:

The aim of the course is for:
1. Understanding the fundamental characteristics of signals and systems.
2. Understanding the concepts of vector space, inner product space and orthogonal series.
3. Understanding signals and systems in terms of both the time and transform domains, taking advantage of the complementary insights and tools that these different perspectives provide.
4. Development of the mathematical skills to solve problems involving convolution, filtering, modulation and sampling.

Detailed contents:

MODULE 1: INTRODUCTION TO SIGNALS AND SYSTEMS

Signals and systems as seen in everyday life, and in various branches of engineering and science. Signal properties: periodicity, absolute integrability, determinism and stochastic character. Some special signals of importance: the unit step, the unit impulse, the sinusoid, the complex exponential, some special time-limited signals; continuous and discrete time signals, continuous and discrete amplitude signals. System properties: linearity: additivity and homogeneity, shift-invariance, causality, stability, realizability. Examples.

MODULE 2: BEHAVIOR OF CONTINUOUS AND DISCRETE-TIME LTI SYSTEMS

Impulse response and step response, convolution, input-output behavior with aperiodic convergent inputs, cascade interconnections. Characterization of causality and stability of LTI systems. System representation through differential equations and difference equations. State-space Representation of systems. State-Space Analysis, Multi-input, multi-output representation. State Transition Matrix and its Role. Periodic inputs to an LTI system, the notion of a frequency response and its relation to the impulse respons

MODULE 3: FOURIER, LAPLACE AND Z- TRANSFORMS

Fourier series representation of periodic signals, Waveform Symmetries, Calculation of Fourier Coefficients. Fourier Transform, convolution/multiplication and their effect in the frequency domain, magnitude and phase response, Fourier domain duality. The DiscreteTime Fourier Transform (DTFT) and the Discrete Fourier Transform (DFT). Parseval's Theorem. Review of the Laplace Transform for continuous time signals and

systems, system functions, poles and zeros of system functions and signals, Laplace domain analysis, solution to differential equations and system behavior. The z-Transform for discrete time signals and systems, system functions, poles and zeros of systems and sequences, z-domain analysis.

MODULE 4: SAMPLING AND RECONSTRUCTION

The Sampling Theorem and its implications. Spectra of sampled signals. Reconstruction: ideal interpolator, zero-order hold, first-order hold. Aliasing and its effects. Relation between continuous and discrete time systems. Introduction to the applications of signal and system theory: modulation for communication, filtering, feedback control systems.

Course Outcomes:

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

   a. Understand the concepts of continuous time and discrete time systems.
   b. Analyse systems in complex frequency domain.
   c. Understand sampling theorem and its implications.

TEXT/REFERENCES

   1. A. V. Oppenheim, A. S. Willsky and S. H. Nawab, "*Signals and systems*", Prentice Hall India, 1997.
   2. J. G. Proakis and D. G. Manolakis, "*Digital Signal Processing: Principles, Algorithms, and Applications*", Pearson, 2006.
   3. H. P. Hsu, "*Signals and systems*", Schaum's series, McGraw Hill Education, 2010.
   4. S. Haykin and B. V. Veen, "*Signals and Systems*", John Wiley and Sons, 2007.
   5. A. V. Oppenheim and R. W. Schafer, "Discrete-Time Signal Processing", Prentice Hall, 2009.
   6. M. J. Robert "*Fundamentals of Signals and Systems*", McGraw Hill Education, 2007.
   7. B. P. Lathi, "Linear Systems and Signals", Oxford University Press, 2009.

CODE: PEC-CS-A-702

SUBJECT NAME: **WEB & INTERNET TECHNOLOGY**

NO OF CREDITS: 3

B.TECH   SEMESTER V   SESSIONAL: 25

L   T P   THEORY EXAM: 75

3   0 0   TOTAL :   100

Pre-requisites: Computer Networks

Course Objectives:

1. To familiarize the students with the basic concepts of internet, its history, ways to connect to internet and basics of world wide web and search engines.
2. To familiarize the student with the fundamental language of internet i.e. HTML
3. To teach the student aware of the concepts of cascading style sheets
4. To teach the student the students the basics of client side and Server side scripting

Detailed contents:

MODULE-1: INTRODUCTION TO NETWORKS AND WWW
Introduction to internet, history, Working of Internet, Modes of Connecting to Internet, Internet Address, standard address, classful and classless ip addressing, subnetting, supernetting, w3c consortium, searching the www: Directories search engines and Meta search engines, search fundamentals, search strategies, Architecture of the search engines, Crawlers and its types, Delivering multimedia over web pages, VRML.

MODULE-2: HYPERTEXT MARKUP LANGUAGE
The anatomy of an HTML document: Marking up for structure and style: basic page markup, absolute and relative links, ordered and unordered lists, embedding images and controlling appearance, table creation and use, frames, nesting and targeting.

MODULE-3: STYLE SHEETS
Separating style from structure with style sheets, Internal style specifications within HTML, External linked style specification using CSS, page and site design considerations.

MODULE-4: CLIENT SIDE PROGRAMMING
Introduction to Client side programming, Java Script syntax, the Document object model, Event handling, Output in JavaScript, Forms handling, cookies, Introduction to VBScript, Form Handling.

MODULE 5 : SERVER SIDE SCRIPTING

CGI, Server Environment, Servlets, Servlet Architecture, Java Server Pages, JSP Engines, Beans, Introduction to J2EE.

Course Outcomes:

At the end of the course/session the student would be

a. Acquainted with the basics of internet &search engines.
b. Have a hands on HTML
c. Learned the need and basics of CSS
d. Learned the concepts of client side and server side scripting.

REFERENCES

1. "*Fundamentals of the Internet and the World Wide Web*", **Raymond Greenlaw and Ellen Hepp 2001, TMH .**
2. "*Internet & World Wide Programming*", **Deitel,Deitel & Nieto, 2000, Pearson Education**
3. "*Complete idiots guide to java script*". **Aron Weiss, QUE, 1997.**
4. "*Network firewalls*", **Kironjeet syan - New Rider Pub.**

ODE: PEC-IT-I-601

SUBJECT NAME: **ROUTING IN COMMUNICATION NETWORKS**

NO OF CREDITS: 3

B.TECH   SEMESTER   SESSIONAL: 25

L   T   P   THEORY EXAM: 75

3   0   0   TOTAL :   100

Pre-requisites:

Course Objectives:

1. To make the student understand the basic concepts of Circuit Switching Networks
2. To make the student understand the basic concepts of routing
3. To understand the application domain of High Speed Networks
4. To understand the Mobile Networks and Mobile Ad-hoc Networks

Detailed contents:

MODULE-1: CIRCUIT SWITCHING NETWORKS

Dynamic Alternative Routing- Dynamic Routing in Telephone Network - ATM networks with virtual paths - Statistical multiplexing and homogeneous sources , delay guarantees, No statistical multiplexing , heterogonous sources.

MODULE-2: PACKET SWITCHING NETWORKS

Distance vector Routing, Link State Routing, Inter domain Routing-Classless Interdomain routing (CIDR), Interior Gateway routing protocols (IGRP) - Routing Information Protocol (RIP), Open Shortest Path First (OSPF), Exterior Gateway Routing Protocol (EGRP) - Border Gateway Protocol (BGP), Apple Talk Routing.

MODULE-3: HIGH SPEED NETWORKS

Routing in optical networks- Optical link networks- Single hop, multi hop optical networks, hybrid optical networks, photonic networks , Routing in the PLANET networkPacket level Routing - Call level Routing - Network infrastructure -Deflection Routing.- Topologies, Deflection routing Algorithms- Performance of routing algorithms on regular topologies - Deflection routing on time varying topologies, resequencing - unslotted operation.

MODULE-4: MOBILE NETWORKS

Routing in Cellular Mobile Radio Communication networks- Network Architecture, Air interface functionality, Mobility management, Connectionless Data service for cellular systems, Mobility and Routing in Cellular Digital Packet Data (CDPD) network, Packet Radio RoutingDARPA packet radio network, Routing algorithms for small, medium and large sized packet radio networks.

MODULE-5: MOBILE AD-HOC NETWORKS

Internet based mobile ad-hoc networking, Routing algorithms - Table-driven routing - Destination Sequenced Distance Vector (DSDV), Source initiated on-demand routingDynamic Source Routing (DSR), Ad-hoc On-demand Distance Vector (AODV), Hierarchical based routing- Cluster head Gateway Switch Routing (CGSR) and TemporallyOrdered Routing Algorithm (TORA).

Course Outcomes:

a. Student will understand the basic concepts of Circuit Switching Networks
b. Student will be able to understand the basic concepts of routing
c. It will be easy for students to understand the application domain of High Speed Networks
d. Students will get knowledge about Mobile Networks and Mobile Ad-hoc Networks

REFERENCES

1. M. Steen strub, "*Routing in Communication networks*", Prentice Hall International, NewYork, 1995
2. "*Internetworking Technologies Handbook*", 4 th Edition, Inc. Cisco Systems, ILSG Cisco Systems, 2003.
3. William Stallings, "*ISDN and Broadband ISDN with Frame Relay and ATM*", PHI, New Delhi, 2004.
4. Behrouz A Forouzan, "*Data Communications and Networking*" , 3 rd Edition, TMH, 2004
5. William Stallings, "*High Speed Networks TCP/IP and ATM Design Principles*", Prentice Hall International, New York, 1998.

SUBJECT NAME: **OPTICAL NETWORK DESIGN**

NO OF CREDITS: 3

B.TECH   SEMESTER VI   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.
5. To study about LDP protocol in detail

Detailed contents:

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 graming, SDH transport overhead, SDH alarms, multiplexing, virtual containers, SDH network elements, SDH topologies, SDH protection mechanisms, APS, 1+1 protection, 1:1protection, 1:N protection, Unidirection v/s bidirectionsl rings, Path and multiplex section switching, Subetwork 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

   a. SONET and SDH Architecture.
   b. wavelength and time division multiplexing techniques.
   c. SONET and SDH frames and their architectures
   d. 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 DeCusatis**

CODE: PEC-IT-I-701

SUBJECT NAME: **WIRELESS COMMUNICATIONS AND AD-HOC NETWORKS**

NO OF CREDITS: 3

B.TECH   SEMESTER VII   SESSIONAL: 25

L   T P   THEORY EXAM: 75

3   0 0   TOTAL :   100

Pre-requisites: Computer Network

Course Objectives:

1. To provide an overview of Wireless Communication networks area and its applications and examples of wireless communication devices.

2. To make the student aware regarding the characteristics of different multiple access techniques such as TDMA, FDMA and CDMA in mobile/wireless communication

3. To make the student understand the concept of cellular system in higher generation (third and fourth generation of wireless system) along with the fundamental cellular radio concepts such as frequency reuse and handoff and to provides an overview for the need of Cell splitting and Cell sectoring in cellular networks.

4. To make the students familiar with the requirement of adhoc network along with its advantages and limitations.

5. To make the student understand the concept of routing and different strategies/protocols available for efficient routing in adhoc network.

6. To make the student aware about the quality of service in adhoc environment. To find out various QoS parameters and how QoS can be achieved in adhoc environment.

Detailed contents:

MODULE 1: INTRODUCTION TO WIRELESS COMMUNICATION SYSTEM

Evolution of mobile radio communications, Generation of wireless communication, examples of wireless communication systems, paging systems, Cordless telephone systems, comparison of various wireless systems.

MODULE 2: MULTIPLE ACCESS TECHNIQUES FOR WIRELESS COMMUNICATION & CELLULAR SYSTEM

Introduction to Multiple Access, ALOHA, SDMA, FDMA, TDMA, CDMA, spread Spectrum multiple Access

Basic cellular Systems, Operation of Cellular systems packet ratio, capacity of a cellular systems. Second generation cellular networks: GSM, third generation wireless networks: CDMA.

Channel Assignment Strategies, Hand Off Strategies (MAHO, MCHO, NCHO), Cell splitting, Cell sectoring, Zone concepts, Frequency Reuse, Interference and system capacity, tracking and grade off service.

MODULE 3: INTRODUCTION TO MOBILE ADHOC NETWORK

Introduction: Wireless Networks, Infrastructure and Infrastructure less Wireless Networks, Ad hoc Wireless Networks, Heterogeneity in Mobile Devices, Types of Ad hoc Mobile Communications, Challenges Facing Ad hoc Mobile Networks, Issues in Designing a Routing Protocol for Ad Hoc Wireless Networks , classifications of Routing Protocols.

MODULE 4: ROUTING PROTOCOLS IN MOBILE ADHOC NETWORKS

Table-Driven Ad hoc Routing Protocols: Destination Sequenced Distance Vector (DSDV), Wireless Routing Protocol (WRP), Cluster Switch Gateway Routing (CSGR)

On-Demand Ad hoc Routing Protocols: Ad hoc On–Demand Distance Vector Routing (AODV) , Dynamic Source Routing (DSR) ,Temporally Ordered Routing Algorithm (TORA) , Signal Stability Routing (SSR) , Location–Aided Routing (LAR) Hybrid Routing Protocol: Zone Routing Protocol (ZRP).

MODULE 5: QUALITY OF SERVICE IN MOBILE ADHOC NETWORK

 QoS in Ad-hoc Networks: Introduction to QoS, Issues and Challenges in Providing QoS in Ad hoc Wireless Networks , classifications of QoS Solutions , Network Layer Solutions (Ticket Based QoS Routing, Predictive Location Based QoS Routing, QAODV) , QoS Frameworks for Ad hoc Wireless Networks (IntServ, DiffServ, FQMM, INSIGNIA,INORA)

Course Outcomes:

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

a. Compare and Contrast different Wireless Communication System

b. Understand the Multiple Access Techniques and Different Generations of Cellular Systems.

c. Understand the techniques for improving the coverage & capacity of Cellular System

d. Understand the concept of ad-hoc network and differentiate between infrastructure based and infrastructure less networks.

e. Classify different categories of ad-hoc network and to identify the advantages and limitations of different protocols available for efficient routing in ad hoc networks.

f. Understand QoS and its parameters in ad-hoc networks. Classify QoS solution, why QoS provision is difficult in ad-hoc environment and what are various approaches related to QoS in MANET.

REFERENCES

1. **Jochen Schiller,*" Mobile Communication"* , Pcarson Education,200C**

2. **Theodore S. Rappaport ,***"Wireless Communications : Principles and Practice***", Prentice Hall India 1996.**
3. **Siva Ram Murthy and B. S. Manoj, "Ad *Hoc Wireless Networks Architectures and Protocols*", Prentice Hall, PTR, 2004.**
4. **C. K. Toh, "*Ad Hoc Mobile Wireless Networks Protocols and Systems*", Prentice Hall,PTR, 2001.**
5. **Charles E. Perkins, "*Ad Hoc Networking*", Addison Wesley, 2000**

CODE: OEC-CS-702(IV)

SUBJECT NAME: **HIGH SPEED NETWORK**

NO OF CREDITS: 3

B.TECH   SEMESTER VII   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

Detailed contents:

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:

a. Students will be able to understand basic high speed networks like Frame relay and ATM.
b. Students will be familiar with advantages and disadvantages of high speed network.
c. Students will be aware of congestion control traffic management techniques.
d. Students will be aware of TCP and ATM congestion control techniques.
e. To learn the functionality of integrated and differentiated services architecture.
f. Familiarity with various high speed protocols currently available.

REFERENCES

1. William Stallings, "*HIGH SPEED NETWORKS AND INTERNET*", Pearson Educatin, 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, Volume1 and 2, 2003.

CODE: PEC-IT-I-703

BASICS OF CLOUD COMPUTING

NO OF CREDITS: 3

B.TECH SEMESTER VII	SESSIONAL:	25
L T P	THEORY EXAM:	75
3 0 0	TOTAL :	100

COURSE OBJECTIVE

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.

Detailed contents:

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:

a. Identify security aspects of each cloud model
b. Develop a risk-management strategy for moving to the Cloud
c. Implement a public cloud instance using a public cloud service provider

TEXT/REFERENCES

1. **"*Cloud Computing Explained: Implementation Handbook for Enterprises*", John Rhoton, Publication Date: November 2, 2009**
2. **"*Cloud Security and Privacy: An Enterprise Perspective on Risks and Compliance (Theory in Practice)*", Tim Mather, ISBN-10: 0596802765,O'Reilly Media, September 2009**

INTERNET OF THINGS

NO OF CREDITS: 3

B.TECH   SEMESTER VII   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.

Detailed contents:

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:

a. Understand the concepts of Internet of Things
b. Analyze basic protocols network
c. Understand the concepts of Web of Things

d. Design IoT applications in different domain and be able to analyze their performance

TEXT/REFERENCE BOOKS:

1. **Vijay Madisetti, Arshdeep Bahga, "*Internet of Things: A Hands-On Approach*"**
2. **Waltenegus Dargie, Christian Poellabauer, "*Fundamentals of Wireless Sensor Networks: Theory and Practice*"**

DETAILED 4-YEAR CURRICULUM CONTENTS

Branch/Course: INFORMATION TECHNOLOGY

PROFESSIONAL ELECTIVE COURSES

STREAM -2

(DATA INFOMATIC SCIENCES)

CODE PEC-CS-D-702(II)

SUBJECT NAME: **INFORMATION RETRIEVAL**

NO OF CREDITS: 3

B.TECH   SEMESTER V   SESSIONAL: 25

   L   T   P   THEORY EXAM: 75

   3   0   0   TOTAL: 100

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

Detailed contents:

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 taking the course, students will be able to:
a. Understand basic Information Retrieval Systems and learn how Boolean queries are processed.
b. 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
c. 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
d. 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

TEXT/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*", AddisionWesley, 2009(available at http://ciir.cs.umass.edu/irbook/).**

SUBJECT NAME: SOFT COMPUTING
NO OF CREDITS: 3

B.TECH   SEMESTER VI   SESSIONAL: 25

L   T   P   THEORY EXAM: 75

3   0 0   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 an hand-on experience on MATLAB to implement various strategies.

Detailed contents:

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:

    a.   Identify and describe soft computing techniques and their roles in building intelligent Machines.
    b.   Apply fuzzy logic and reasoning to handle uncertainty and solve various engineering problems.
    c.   Apply genetic algorithms to combinatorial optimization problems.
    d.   Evaluate and compare solutions by various soft computing approaches for a given problem.

TEXT/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-D-601

SUBJECT NAME: **DATA MINING**

NO OF CREDITS: 3

B.TECH   SEMESTER VI   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.

Detailed contents:

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

a. The students will be able to understand basic concepts of data warehouse and data mining, techniques and applications

b. The students will be able to understand the techniques to extract patterns from transactional database using Association and Apriori algorithms

c. The students will be able to understand different clustering techniques and will be able to cluster data sets

d. The students will be able to classify data set into different classes and acquire the knowledge to make predications based on classified data

e. The students will be able to understand and analyze time series data

f. The students will be able to understand types of web mining viz. content, structure and usage mining.Web content mining in detail.

g. The students can extend the Graph mining algorithms to Web mining

h. 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-D-701

SUBJECT NAME: SPEECH AND NATURAL LANGUAGE PROCESSING

NO OF CREDITS: 3

B.TECH   SEMESTER VII   SESSIONAL: 25

L   T P   THEORY EXAM: 75

3   0 0   TOTAL :   100

NOTE: Question paper has two parts. Part-1 has 10 questions each of 2 marks. It covers the

entire syllabus. Attempt any four questions out of six from Part-2.

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.
   7.

MODULE-1: AUTOMATIC SPEECG 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:

a. 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.
b. The top down and the bottom up parsing approaches and their respective types of parsers like CKY, Earley & Tomita's
c. The Hidden Markov Model and its application in NLP
d. The student will be able to write small ATN & RTN grammars for simple English sentences.
e. 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, -1995Benjamin/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*", Mdlj Arbib & Kfaury, 1988, Springer Verlog.

CODE: PEC-IT-D-701

SUBJECT NAME: **DFS AND BIG DATA ANALYSIS**

NO OF CREDITS: 3

B.TECH   SEMESTER VII   SESSIONAL: 25

L   T   P   THEORY EXAM: 75

3   0   0   TOTAL :   100

Pre-requisites: Data Structure, Computer Architecture and Organization, DBMS

Course Objectives:

1. Understand big data for business intelligence.
2. Learn business case studies for big data analytics.
3. Understand NOSQL, big data management.
4. Perform map-reduce analytics using Hadoop and related tool

Detailed contents:

MODULE-1: INTRODUCTION TO BIG DATA

What is big data, why big data, convergence of key trends, unstructured data, industry examples of big data, web analytics, big data and marketing, fraud and big data, risk and big data, credit risk management, big data and algorithmic trading, big data and healthcare, big data in medicine, advertising and big data, big data technologies, introduction to Hadoop, open source technologies, cloud and big data

MODULE-2: NoSQL DATABASES

Introduction to NoSQL, aggregate data models, aggregates, key-value and document data models, relationships, graph databases, schemaless databases, materialized views, distribution models, sharding, master-slave replication, peerpeer replication, sharding and replication, consistency, relaxing consistency, version stamps, map-reduce, partitioning and combining, composing map-reduce calculation

MODULE-3: HADOOP FILE SYSTEM

Contents Data format, analyzing data with Hadoop, scaling out, Hadoop streaming, Hadoop pipes, design of Hadoop distributed file system (HDFS), HDFS concepts, Java interface, data flow, Hadoop I/O, data integrity, compression, serialization, Avro, file-based data structure.

MODULE-4: PROGRAMMING PARADIMS FcloudOR BIG DATA

Contents Map Reduce workflows, unit tests with MR Unit, test data and local tests, anatomy of Map Reduce job run, classic Map-reduce, YARN, failures in classic Map-reduce and YARN, job scheduling, shuffle and sort, task execution, Map Reduce types, input formats, output format

Course Outcomes:

After completion of course, students would be:

a. Describe big data and use cases from selected business domains
b. Explain NoSQL big data management
c. Install, configure, and run Hadoop and HDFS
d. Perform map-reduce analytics using Hadoop

REFERENCES

1. **Michael Minelli, Michelle Chambers, and AmbigaDhiraj,** *"Big Data, Big Analytics: Emerging Business Intelligence and Analytics Trends for Today's Business",* **Wiley 2013**

2. **Martin Fowler and Pramod J.Sadalage,** *"NoSQL Distilled: A Brief guide of Emerging World of Polyglot Persistance"*

3. *P. J. Sadalage and Addison-Wesley Professional,* **2012.**

4. **Tom White,** *"Hadoop: The Definitive Guide",* **Third Edition, O'Reilley, 2012.**

5. **Eric Sammer***, "Hadoop Operations",* **O'Reilley, 2012.**

CODE: PEC-CS-D-501
SUBJECT NAME: BASICS OF MACHINE LEARNING
NO OF CREDITS: 3

B.TECH   SEMESTER VII   SESSIONAL: 25

L T P   THEORY EXAM: 75

3   0 0   TOTAL :   100

Pre-requisites: Basics of Data Structures and Mathematics
COURSE OBJECTIVE

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.

Detailed contents:

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:

a. Extract features that can be used for a particular machine learning approach in various IOT applications.
b. 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.
c. To mathematically analyse various machine learning approaches and paradigms.

TEXT/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**

NEURAL NETWORK AND DEEP LEARNING

NO OF CREDITS: 3

B.TECH   SEMESTER VII   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

Detailed Contents:

MODULE-1: INTRODUCTION TO NEURAL NETWORKS

Artificial neurons, Neural networks and architectures, Feed forward 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:

a. Use neural networks concepts and associated techniques for solving classification and regression problems.
b. Design and Use neural networks for pattern recall, completion and repair.
c. Design and Use neural networks for self learning and unsupervised classifications.
d. 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

Branch/Course: INFORMATION TECHNOLOGY

OPEN ELECTIVE COURSES (OEC)

STREAM -I

CODE: OEC-CS-601(I)

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

NO. OF CREDITS:3

B.TECH SEMESTER VI   SESSIONAL: 25

L   T   P   THEORY EXAM: 75

3   0   0   TOTAL :   100

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

Course Objective: The course aims at creating awareness among the stock holders of the corporate world in which the role of individuals as team players and also as responsible leaders materializes to a great extent. The course, with its interactive and need based modules, will address various challenges of communication as well as behavioral skills faced by individuals at workplace and organizations in bridging the gaps through effective skills of interviews, group discussions, meeting management, presentations and nuances of drafting various business documents for sustainability in today's global world.

Detailed contents:

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: Part I, 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 INTERVIEW

Making Effective Presentations, Speeches for Various Occasions, Interviews, Planning & Preparing (Part I): Effective   Résumé,   Planning   &   Preparing   (Part   II):   Effective   Résumé

Week 12: Drafting an Effective Résumé, Facing Job Interviews, Emotional Intelligence & Critical Thinking, Applied Grammar

TEXT/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.

SUBJECTNAME: CYBER LAW AND ETHICS

NO OF CREDITS: 3

B.TECH VI SEMESTER   SESSIONAL: 25

L   T   P   THEORYEXAM: 75

3   0   0   TOTAL: 100

Pre-requisites: Basics of Data Structures and Mathematics

Course objectives:

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 Cyber crime, Asia-Pacific Economic Cooperation(APEC), Organization for Economic Co-operation and Development(OECD),World Bank, Common wealth of Nations

MODULE-3: CONSTITUTIONAL & HUMAN RIGHT SISSUES 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 CYBERSPACE

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

MODULE-7: E-COMMERCECONCEPT

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

MODULE-8: DISPUTERE SOLUTION 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.

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)**
- **Jonthan Rosenoer, Cyber Law, Springer, New York,(1997).**
- **Sudhir Naib, The Information Technology Act, 2005: A Handbook, OUP, NewYork, (2011)**
- **S. R. Bhansali, InformationTechnologyAct, 2000, University Book HousePvt.Ltd., Jaipur (2003).**
- **Vasu Deva, Cyber Crimes and Law Enforcement, Common wealth Publishers, New Delhi, (2003).**

SUBJECT NAME: COMPUTER GRAPHICS

NO OF CREDITS: 3

B.TECH 6th SEMESTER   SESSIONAL: 25

L   T   P   THEORY EXAM: 75

3   0 0   TOTAL :   100

Pre-requisites: Problem Solving and Programming

Course Objectives:

1. Understand the basics of computer graphics, different graphics systems and applications of computer graphics.
2. Learn the various algorithms for scan conversion and filling of basic objects and their comparative analysis. To improve the object appearance by filling relevant parts of the area.
3. Learning to use composite geometric transformations on graphical objects in 2D and 3D.
4. Understand the techniques for improving the object appearance with the help of clipping objects outside the view. Explore projections for display of 3D scene on 2D screen.
5. Study different techniques that help to remove the surfaces outside the view of user by understanding the concept of rendering.

MODULE-1: INTRODUCTION TO COMUTERGRAPHICS

Computer Graphics and Its Types, Application of computer graphics, Refresh CRT, Flat Panel displays, Raster Scan Systems, Random Scan Systems, shadow-mask method, beam-penetration method, color models- RGB, CMY, setting the color attributes of pixels.

MODULE-2: SCAN-CONVERSION

Output Primitives- Points, Lines, Circle, polygons; Attributes of Output Primitives: Line Attributes, Color and Grayscale Levels, Area fill Attributes, Character Attributes, Bundled Attributes; Scan–converting Lines- DDA line drawing algorithm, Bresenhams line drawing algorithm;

Scan-Converting Circles- parametric, trigonometric ,Brsenham's circle drawing algorithm; Scan–converting polygon; Region Filling-Boundary fill and Flood fill algorithm , Anti-aliasing Techniques.

MODULE-3: TRANSFORMATIONS

Two-dimensional Geometric Transformations:Basic Transformations, Matrix Representation and Homogeneous Coordinates, Composite Transformations, Reflection and Shearing; Two-Dimension Viewing : The viewing Pipeline, Window to viewport coordinate transformation ; Three-Dimensional Transformations.

MODULE-4: PROJECTION AND CLIPPING

Three dimensional Viewing Pipeline , Mathematics of projection- Taxonomy of projection, Perspective and parallel Projection; Clipping-Point Clipping, Line Clipping- Cohen-Sutherland Algorithm (4-bit code), polygon Clipping- Sutherland Hodgman Algorithm

MODULE-5: HIDDEN SURFACES

Image-space and Object-Space Method, Coherence and its types, Depth Comparison, Z-buffer (Depth Buffer), Area-subdivision

Course Outcomes:

Students completing this course are expected to be able to:

1. Understand the basics of computer graphics, different graphics systems and applications of computer graphics.
2. Implement the various algorithms for scan conversion and filling of basic objects and their comparative analysis.
3. Apply geometric transformations on graphics objects and their application in composite form in 2D and 3D.
4. Apply projection techniques for improving the object appearance from 3-D scene to 2-D Scene and remove the area of objects that lie outside the viewing window.
5. Apply different hidden surface removal algorithms to eliminate the surface outside the view world.

REFERENCES

1. **Foley & Van Dam : Fundamentals of Interactive Computer Graphics, Addison-Wesley.**
2. **Plastock : Theory & Problem of Computer Gaphics, Schaum Series.**
3. **Donald Hearn and M. Pauline Baker : Computer Graphics, PHI Publications.**

CODE: ELOE-101
SUBJECT NAME: **ELECTRONIC DEVICES**
NO OF CREDITS: 3

B.TECH   SEMESTER   SESSIONAL: 25

  L   T   P   THEORY EXAM: 75

  3   0   0   TOTAL: 100

Detailed contents:

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-Vcharacteristics, 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
- a.   Understand the principles of semiconductor Physics
- b.   Understand and utilize the mathematical models of semiconductor junctions and 1. MOS transistors for circuits and systems.

TEXT /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. Tsividis 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   SEMESTER VI   SESSIONAL: 25

   L   T   P   THEORY EXAM: 75

   3   0   0   TOTAL: 100

Course objectives
1. Consolidation of the design methodologies for combinational and sequential digital systems,
2. To attain knowledge and use of hardware description languages for simulation
3. To Implement of digital systems on reconfigurable programmable logic devices (CPLDs and FPGAs),
4. To study of different memory structures and technologies

Detailed contents:

MODULE 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, PseudoRandom 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
   a. Design and analyze combinational logic circuits

b. Design & analyze modular combinational circuits with MUX/DEMUX, Decoder, Encoder
c. Design & analyze synchronous sequential logic circuits
d. Use HDL & appropriate EDA tools for digital logic design and simulation

TEXT/REFERENCE
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, 2nd 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.**

DETAILED 4-YEAR CURRICULUM CONTENTS

Branch/Course: INFORMATION TECHNOLOGY

OPEN ELECTIVE COURSES (OEC)

STREAM -II

CODE: OEC-CS-602 (I)

SUBJECT NAME: **HUMAN RESOURCE MANAGEMENT**

NO. OF CREDITS: 3

B.TECH SEMESTER VI	SESSIONAL:	25
L T P	THEORY EXAM:	75
3 0 0	TOTAL :	100

Course Objective:
The primary concern of this course is to sensitize students to the various facts of managing people and to create an understanding of the various policies and practices of human resource management.

Detailed contents:

MODULE 1 HUMAN RESOURCE MANAGEMENT

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

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

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 Outcome:

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

TEXT/REFERENCE BOOKS

1. K. Aswathapa, "*Human resource Management: Text and cases*", 6th edition, Tata McGraw Hill, New Delhi.
2. Uday Kumar Haldar & Juthika Sarkar, "*Human resource Management*", New Delhi, Oxford University Press.
3. De Cenvo, Da & Robbins S.P., "*Fundamentals of Human Resource Management*", 9th edition, New York, John Wiley & Sons.
4. Gary Dessler, "*Human Resource Management*", 11th 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 SEMESTER VI	SESSIONAL:	25
L T P	THEORY EXAM:	75
3 0 0	TOTAL:	100

Course objectives

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

Detailed contents:

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; Undertstanding means of communication in different areas, developing an effective communicationstrategy Case: Warna 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 intetrface, 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, Iffco Kisaan 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 outcome

1. Distinguish between various development perspectives behind ICT for development.
2. Describe prerequisites to employ ICT in society for development purposes.
3. Identify and name key sectors in society in which ICT could play a significant difference.
4. Give example of structural impacts that could be obtained from employing ICT in developing regions' societies.
5. Recognize and explain the type of positive effects that ICT could have for the areas (a) health, (b) education, (c) governance, (d) business, and (e) rural livelihood.
6. Critically examine the arguments for and against using ICT in solving problems in developing countries.

REFERENCES

1. ICT 4 D- Connecting people for a better world. Lessons, Innovations and perspectives of Information and Communication technologies in development, 2004

CODE: OEC-CS-602(III)

SUBJECT NAME: **INTELLECTUAL PROPERTY RIGHTS (IPR)**

NO. OF CREDITS: 3

B.TECH   SEMESTER VI   SESSIONAL: 25

L   T   P   THEORY EXAM: 75

3   0   0   TOTAL :   100

Course Objectives

Students will be able to

1. Understand and adjust with changing needs of the society because creative work is useful to society and law relating to innovation/creativity.
2. Identify significance and importance of IPR in the present era.
3. Create IPR consciousness
4. Familiar about the documentation and administrative procedures relating to IPR in India.

Detailed Contents:

MODULE 1: NATURE OF INTELLECTUAL PROPERTY

Meaning of property, Is IP a property, Justifications for protection of IP, Major forms of IP Patents, Designs, Trade and Copyright.

MODULE 2: PATENTING AND DEVELOPMENT

Technological research, innovation, patenting, development.   International Scenario: International cooperation on Intellectual Property. Procedure for grants of patents, Patenting under PCT.

MODULE 3: PATENT RIGHTS

Scope of Patent Rights,Licensing and transfer of technology, Patent information and databases. Geographical Indications.

MODULE 4: NEW DEVELOPMENTS IN IPR

Administration of Patent System. New developments in IPR; IPR of Biological Systems, Computer Software etc. Traditional knowledge Case Studies, IPR and IITs.

Course Outcomes

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

a. Justifications for protection of IP.

b. Procedure for grants of patents, Patenting under PCT.
c. Licensing and transfer of technology
d. Understand that IPR protection provides an incentive to inventors for further research work and investment in R & D, which leads to creation of new and better products, and in turn brings about, economic growth and social benefits.

References

1. **Halbert, "*Resisting Intellectual Property*", Taylor & Francis Ltd,2007.**
2. **Robert P. Merges, Peter S. Menell, Mark A. Lemley, "*Intellectual Property in New Technological Age*", 2016.**
3. **T. Ramappa, "*Intellectual Property Rights Under WTO*", S. Chand, 2008**
4. **Lionel Bently & Brad Sherman, "*Intellectual Property Law*", Oxford.**

CODE: OEC-CS-602(IV)

SUBJECT NAME: **INTERNATIONAL BUSINESS ENVIRONMENT**

NO OF CREDITS: 3

B.TECH   SEMESTER   VI   SESSIONAL: 25

L   T   P   THEORY EXAM: 75

3   0   0   TOTAL: 100

Course Objective

To provide knowledge about International Business Environment. To provide the framework on basis of which business can be run smoothly.

Detailed contents:

MODULE 1 INTRODUCTION

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, Leontif 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

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

TEXT/REFERENCE BOOKS

1. Lasserre, Philippe "*Global Strategic Management*", Palgrave MacMillan.
2. John D Daniels, Lee H Radebaugh Daniel P Sullivan ,Prashant Salwan. "*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   SEMESTER VI   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 (Hyngarian 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 Hamdy A Taha**
2. **Introduction to Operations Research by Hiller and Dieherman, TMH**
3. **Optimization Theory and Application: SS Rao, John Wiley.**

DETAILED 4-YEAR CURRICULUM CONTENTS

Branch/Course: INFORMATION TECHNOLOGY

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OPEN ELECTIVE COURSES (OEC)

STREAM -III

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CODE:OEC-CS-701(I)

SUBJECT NAME: **FINANCIAL MANAGEMENT**

NO. OF CREDITS:3

B.TECH SEMESTER VII   SESSIONAL: 25

L   T P   THEORY EXAM: 75

3   0 0   TOTAL :   100

Course Objective

To develop understanding among the students regarding nature of finance and its interaction with other Management functions and the objectives of Financial Management.

Detailed contents:

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 Outcome

    a. It creates understanding among the students regarding the key decisions like Investment, Financing and dividend Decisions of financial Management.
    b. They are able to understand the usage and applications of leverages in financial decisions.

c. The students are able to use their best knowledge in finance towards the value creation for the organization.
d. The students will be made aware of working capital management concept.

TEXT/REFERENCE BOOKS

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: **ENTREPRENEURSHIP AND E-COMMERCE**

NO. OF CREDITS: 3

B.TECH   SEMESTER VII   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:

a. The students will be able to understand the basic concepts of electronic transactions.

b. Study of various types of business models and customer relationship management.

c. Students will be able to understand about various business strategies and marketing strategies.

d.   Study of various legal and ethical issues related to electronic transactions.

e. Study of intellectual property rights and its importance.

f. Study of Entrepreneurship management

g. Study of analyzing the external environment, the competition and designing the framework for establishing a venture capital.

h.   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   SEMESTER VII   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 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:

a. Familiarize themselves with R and the RStudio IDE
b. Understand and use R functions
c. Install and load a package into your R library
d. 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 Liquet, "*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

SUBJECT NAME: NON CONVENTIONAL ENERGY SOURCES

NO. OF CREDITS :3

B.TECH SEMESTER VII	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

Detailed contents

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
Students will be able to
   a. Knowledge about renewable energy
   b. Understand the working of distributed generation system in autonomous/grid connected modes

c. Know the Impact of Distributed Generation on Power System

TEXT/ REFERENCES BOOKS

1. **RanjanRakesh, 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**

SUBJECT NAME: **SOFTWARE ENGINEERING**

NO. OF CREDITS :3

B.TECH   SEMESTER VII   SESSIONAL: 25

L   T   P   THEORY EXAM: 75

3   0   0   TOTAL: 100

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 different phases to make a software & study them in detail.
3. To make the students understand project management concepts & their metrics.
4. To make the students understand the calculation of staffing for a particular project, its cost & schedule.
5. To make the students understand requirement engineering and its models (Information, functional, behavioural).
6. To make the students aware about the design models & its principles (data design, component design, interface design & architectural design).
7. To make the students understand different testing techniques for different projects. 8. 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.

MODULE 4 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 5 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; Design Heuristics for effective modularity, Data Design, Architecture Design, Interface Design

MODULE 6 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, debugging, debugging process debugging approaches. Software maintenance categories, Models

MODULE 7 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 Unit-8: Advanced topics in software Engineering: Configuration Management, Software reengineering, reverse engineering, restructuring, forward engineering, Clean Room software engineering. Case Study: To develop SRS and SDD for a Software Project.

Course Outcomes

    a. Students will be able to understand basic concepts of software engineering.
    b. Students will be able to implement Software life cycle models and have a knowledge of different phases of Software life cycle.
    c. Students will be able to calculate the cost & staff for a particular project at the start.
    d. Students will be able to schedule their software in an appropriate way & make it track.
    e. Students will be able to make an unambiguous SRS (software requirement specification) after

TEXT/REFERENCES BOOK

    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,

DETAILED 4-YEAR CURRICULUM CONTENTS

Branch/Course: INFORMATION TECHNOLOGY

OPEN ELECTIVE COURSES (OEC)

STREAM -IV

CODE: OEC-CS-702(I)

SUBJECT NAME: ECONOMIC POLICIES IN INDIA

CREDITS: 3

B.TECH SEMESTER VII   SESSIONAL: 25

L   T   P   THEORY EXAM: 75

3   0   0   TOTAL :   100

Prerequisite: The candidates are expected to analyze various issues pertaining to India's economic development. The performance of the economy is to be assessed on the backdrop of various Five Year Plans implemented in the economy. Wherever possible, critical appraisal is expected by taking cognizance of the contemporary developments in the economy.

Detailed Contents:

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 s, problems of India's Industrial Exports, Labour Market- issues in Labour Market Reforms and approaches to Employment Generation Basic

TEXT/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-CS-S-701(I)

SUBJECT NAME: **ADVANCED OPERATING SYSTEM**

NO OF CREDITS: 3

B.TECH SEMESTER VII	SESSIONAL:	25
L T P	THEORY EXAM:	75
3 0 0	TOTAL :	100

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:
   a. Understand the characteristics of different OS.
   b. Develop algorithms for process scheduling, synchronization for different OS.
   c. 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.
   d. Design and implement file management system for different OS.
   e. Design and implement security policies in OS.

TEXT/ REFERENCES

1. **Mukesh Singhal, Niranjan 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 Hail™; 4th edition, [ISBN: 9781292061429], 2014.**

3. **D. M. Dhamdhere," *Operating Systems*", Tata McGraw Hill; 1st edition, [ISBN: 9781282187245], 2006.**

SUBJECT NAME: **GAME THEORY**

NO OF CREDITS: 3

B.TECH SEMESTER VII	SESSIONAL:	25
L T P	THEORY EXAM:	75
3 0 0	TOTAL:	100

Pre-requisites: Mathematics (With applied calculus & Set theory)

Course Objectives:

1. To provide an introduction of game theory which has found wide applications in economics, political science, sociology, engineering apart from disciplines like mathematics and biology
2. To enable the students to choice different types and forms of the games depending upon the need and impact on the performance.
3. To enable the students to explore learning mechanisms in an environment of perfect/incomplete information and to understand the need of repeated game.
4. To enable the students to design mechanisms using game theory to understand and analyze real life situations such as market behavior, decentralized network model.

Detailed contents:

MODULE 1 INTRODUCTION TO GAME THEORY

Games and solutions, Game theory and mechanism design.

MODULE 2 STRATEGIC FORM GAMES

Matrix and continuous games, Iterated strict dominance, Rationalizability, Nash Equilibrium: existence and uniqueness, Mixed and correlated equilibrium, Super-modular games, Potential/congestion games

MODULE 3 LEARNING, EVOLUTION, AND COMPUTATION

Myopic learning: fictitious play, Bayesian learning, evolutionarily stable strategies, Computation of Nash equilibrium in matrix games.

MODULE 4 EXTENSIVE GAMES WITH PERFECT / INCOMPLETE INFORMATION

Backward induction and sub-game perfect equilibrium, Applications in bargaining games, Nash bargaining solution; Mixed and behavioral strategies, Bayesian Nash equilibrium, Applications in auctions, Different auction formats, Revenue and efficiency properties of different auctions.

MODULE 5 REPEATED GAMES

Infinitely/finitely repeated games, Trigger strategies, Folk theorems, Imperfect monitoring and perfect public equilibrium.

MODULE 6 MECHANISM DESIGN

Optimal auctions, revenue-equivalence theorem, Social choice viewpoint. Impossibility results, Revelation principle, Incentive compatibility, VCG mechanisms, Mechanisms in networking, decentralized mechanisms.

Course Outcomes:

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

  a. Understand the use of game theory in economics, political science, sociology, engineering apart from disciplines like mathematics and biology.

  b. Use different types and forms of the games and choose the type depending upon the need.

  c. Apply learning mechanisms in an environment of perfect/incomplete information and understand the need of repeated game.

  d. Design mechanisms using game theory to understand and analyze real life situations such as market behaviour, decentralized network model.

TEXT/ REFERENCES

1. **Osborne, M. J., *"An Introduction to Game Theory"*, Oxford University Press, 2004**

2. **Mas-Colell, A., M.D. Whinston and J.R. Green ,*"Microeconomic Theory"*, Oxford University Press, 1995.**

3. **Gibbons, R. ,*"A Primer in Game Theory"*, Pearson Education, 1992.**

SUBJECT NAME: **IMAGE PROCESSING**

NO OF CREDITS: 3

B.TECH   SEMESTER   SESSIONAL: 25

L   T   P   THEORY EXAM: 75

3   0   0   TOTAL :   100

Course Objectives

To learn and understand the fundamentals of digital image processing, and various image Transforms, Image Enhancement Techniques, Image restoration Techniques and methods, image compression and Segmentation used in digital image processing.

Detailed contents:

MODULE-1: DIGITAL IMAGE FUNDAMENTALS

Elements of visual perception, image sensing and acquisition, image sampling and quantization, basic relationships between pixels – neighborhood, adjacency, connectivity, distance measures.

MODULE-2: IMAGE ENHANCEMENTS AND FILTERING

Gray level transformations, histogram equalization and specifications, pixel-domain smoothing filters – linear and order-statistics, pixel-domain sharpening filters – first and second derivative, two-dimensional DFT and its inverse, frequency domain filters – low-pass and high-pass.

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: IMAGE SEGMENTATION

Detection of discontinuities, edge linking and boundary detection, thresholding – global and adaptive, region-based segmentation. Wavelets and Multi-resolution image processing- Uncertainty principles of Fourier Transform, Time-frequency localization, continuous wavelet transforms, wavelet bases and multi-resolution analysis, wavelets and Sub band filter banks, wavelet packets.

MODULE-5: IMAGE COMPRESSION

Redundancy–inter-pixel and psycho-visual; Loss less compression – predictive, entropy; Lossy compression- predictive and transform coding; Discrete Cosine Transform; Still image compression standards – JPEG and JPEG-2000.

Course Outcomes

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

a. Mathematically represent the various types of images and analyze them.

b. Process these images for the enhancement of certain properties or for optimized use of the resources.

c. Develop algorithms for image compression and coding

TEXT/REFERENCES

1. R.C. Gonzalez and R.E. Woods, "*Digital Image Processing, Second Edition*", Pearson Education 3rd edition 2008

2. Anil Kumar Jain, "*Fundamentals of Digital Image Processing*", Prentice Hall of India.2nd edition 2004

3. Murat Tekalp , "*Digital Video Processing*" Prentice Hall, 2nd edition 2015

CODE:PEC-CS-S-501

SUBJECT NAME: **ADVANCED COMPUTER ARCHITECTURE**

NO OF CREDITS: 3

B.TECH   SEMESTER VII   SESSIONAL: 25

L   T P   THEORY EXAM: 75

3   0 0   TOTAL :   100

Pre-requisites: Computer Organization and Architecture

Course Objectives:

1. To learn the basic aspects of computer architecture, microprogramming and data epresentations in different IEEE format.

2. Architectures exploiting instruction-level parallelism (ILP), data-level parallelism (DLP), thread-level and task-level parallelisms are treated. Furthermore new code generation techniques needed for exploiting ILP will be treated.

3. To understand the memory hierarchy, crosscutting issues in memory hierarchy design, the caches and concept of virtual memory.

4. The student is exposed to the major differences of RISC and CISC architecture and learn the various techniques to improve performance in shared memory multiprocessors.

 Detailed Contents

MODULE 1: INTRODUCTION

Some definition and terms, interpretation and microprogramming. Basic data types, Instructions set (L/S, R/M, R+M architecture), instructions (Classes, mnemonics, conventions), Computer Architectural Classification schemes, Flynn's Classification, System attributes to performance.

MODULE 2: PROGRAM AND NETWORK PROPERTIES
Conditions of parallelism, Data and resource Dependences, Hardware and software parallelism, Program partitioning and scheduling, Grain Size and latency, Program flow mechanisms, Control flow versus data flow, Data flow Architecture, Demand driven mechanisms, Comparisons of flow mechanisms.

Introduction to Data level-parallelism- SIMD and Vector, Introduction to Thread- level parallelism-Symmetric and shared memory architectures, Symbolic processors.

MODULE-3: CACHE MEMORY NOTION
Basic Notion, Cache Organization (direct, associative, set-associative and sectored), Write policies and Strategies for replacement, Introduction to different types of caches- Split I and D-Caches, on chip caches and Two level Caches.

MODULE–4: MEMORY SYSTEM DESIGN
The physical memory; memory module, error detection and correction, memory buffer, partitioning the address space, models of simple memory processor interaction (Hellerman's, Strecker's, Rau's) memory hierarchy Technology: inclusion, coherence and locality; Interleaved memory organization Virtual memory technology: models, TLB, paging and segmentation, memory replacement policies.

Course Outcomes

By the end of the course, a student should be able to:

a. Discuss the organization of computer-based systems and the advanced concepts of computer architecture. The student will be able to expose the major differences of RISC and CISC architecture. Also analyze the L/S, R/M and R+M architectures

b. Evaluate performance of different architectures with respect to various parameters and how a range of design choices are influenced by applications

c. Understand and identify cache and memory related issues in parallel computer systems, including multiprocessor systems.

d. Incorporate parallelism in systems to improve their performance.

TEXT/ REFERENCES

1. Advance computer architecture by Kai Hwang , TMH, ed 2001.
2. Pipelined and Parallel processor design by Michael J. Fiynn – 1995, Narosa.
3. Computer Architecture A Quantitative Approach, John L Hennessey and David A Patterson, Morgan Kaufmann/ Elsevier, Fifth Edition, 2012.

DETAILED 4-YEAR CURRICULUM CONTENTS

Branch/Course: INFORMATION TECHNOLOGY

VALUE ADDED COURSE

SUBJECT NAME: **UNIVERSAL HUMAN VALUES 2: UNDERSTANDING HARMONY**

NO OF CREDITS: 0

B.TECH SEMESTER V

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)

OBJECTIVE:

The objective of the course is fourfold:

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 world 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 selfregulation 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.

READINGS:

Text Book

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: Ek Parichaya, 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)

MODE OF CONDUCT (L-T-P-C 2-1-0-3 or 2L:1T:0P 3 credits)

Lectures hours are to be used for interactive discussion, placing the proposals about the topics at hand and motivating students to reflect, explore and verify them.

Tutorial hours are to be used for practice sessions. While analysing and discussing the topic, the faculty mentor's role is in pointing to essential elements to help in sorting them out from the surface elements. In other words, help the students explore the important or critical elements. In the discussions, particularly during practice sessions (tutorials), the mentor encourages the student to connect with one's own self and do self-observation, self-reflection and self-exploration.

Scenarios may be used to initiate discussion. The student is encouraged to take up "ordinary" situations rather than" extra-ordinary" situations. Such observations and their analyses are shared and discussed with other students and faculty mentor, in a group sitting.

Tutorials (experiments or practical) are important for the course. The difference is that the laboratory is everyday life, and practical are how you behave and work in real life. Depending on the nature of topics, worksheets, home assignment and/or activity are included. The practice sessions (tutorials) would also provide support to a student in performing actions commensurate to his/her beliefs. It is intended that this would lead to development of commitment, namely behaving and working based on basic human values.

It is recommended that this content be placed before the student as it is, in the form of a basic foundation course, without including anything else or excluding any part of this content. Additional content may be offered in separate, higher courses.

This course is to be taught by faculty from every teaching department, including HSS faculty. Teacher preparation with a minimum exposure to at least one 8-day FDP on Universal Human Values is deemed essential.

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.

OUTCOME OF THE COURSE:

By the end of the course, students are expected to become more aware of themselves, and their surroundings (family, society, nature); they would become more responsible in life, and in handling problems with sustainable solutions, while keeping human relationships and human nature in mind. They would have better critical ability. They would also become sensitive to their commitment towards what they have understood (human values, human relationship and human society). It is hoped that they would be able to 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

DETAILED 4-YEAR CURRICULUM CONTENTS

Branch/Course: INFORMATION TECHNOLOGY

AUDIT COURSE

CODE: **AC-02-23**

SUBJECT NAME: **MESSAGE OF BHAGWAT GITA**

NO OF CREDITS: 3

B.TECH SEMESTER VI	SESSIONAL:	25
L T P	THEORY EXAM:	75
2 1 0	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.

OBJECTIVES

To enable the students to create an awareness on Message of Bhagwat Gita to instill Moral, Social Values and to appreciate the Karma Yoga.

Unit I

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.

Unit 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.

Unit 3

Bhakti Yoga: Yoga of Devotion – Form and Formless Aspects of the Divine- Inner Qualities of a True Devotee, Ganatraya Vibhaga 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 realize the Relevance of Bhagavad Gita today Yoga to devotion, realize the responsibilities and duty in the society.

Textbooks

1. Swami Chinmayananda, : The Holy Geeta", Central Chinmaya Mission Trust 2002.
2. Swami Chinmayananda, " A Manual of Self Unfordment", Central Chinmaya Mission Trust, 2001.