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

(A Haryana State Government University)

(Established by Haryana State Legislative Act No. 21 of 2009 & Recognized by UGC Act 1956 u/s 22 to Confer Degrees)

Accredited 'A' Grade by NAAC

CERTIFICATE

This is to certify that the scheme & syllabi of B.Tech Electronics and Computer Engineering (ENC), 2019-20 is duly approved by the competent body/authority and to the best of my knowledge the contents of the same, are correct in all respect. The Scheme & Syllabus is approved in 13th BOS meeting held on 09.07.2021

Date: 3/9/21

Neelam 3/9/2021

Signature and Stamp of Chairperson

Name: Dr. Neelam Turk

Deptt. Name: Electronics Engg.

Chairperson
Deptt. of Electronics Engineering
J.C. Bose University of Science
and Technology, YMCA, Faridabad

SCHEME & SYLLABUS

for

B.TECH. COURSE

in

Electronics and Computer Engineering

(ENC)

(w.e.f. Session 2019-20)

DEPARTMENT OF ELECTRONICS ENGINEERING

J. C. BOSE UNIVERSITY OF SCIENCE AND TECHNOLOGY,

YMCA FARIDABAD

J.C.BOSE UNIVERSITY OF SCIENCE & TECHNOLOGY, YMCA, FARIDABAD

VISION

J.C. Bose University of Science and Technology, YMCA, Faridabad, aspires to be a nationally and internationally acclaimed leader in technical and higher education in all spheres which transforms the life of students through integration of teaching, research and character building.

MISSION

- To contribute to the development of science and technology by synthesizing teaching, research and creative activities.
- To provide an enviable research environment and state-of-the-art technological exposure to its scholars.
- To develop human potential to its fullest extent and make them emerge as world class leaders in their professions and enthuse them towards their social responsibilities.

Department of Electronics Engineering

VISION

To be a Centre of Excellence for producing high quality engineers and scientists capable of providing sustainable solutions to complex problems and promoting cost effective indigenous technology in the area of Electronics, Communication & Control Engineering for Industry, Research Organizations, Academia and all sections of society.

MISSION

- To frame a well-balanced curriculum with an emphasis on basic theoretical knowledge as well the requirements of the industry.
- To motivate students to develop innovative solutions to the existing problems for betterment of the society.
- To collaborate with the industry, research establishments and other academic institutions to bolster the research and development activities.
- To provide infrastructure and financial support for culmination of novel ideas into useful prototypes.
- To promote research in emerging and interdisciplinary areas and act as a facilitator for knowledge generation and dissemination through Research, Institute - Industry and Institute-Institute interaction.

About Electronics Engineering Department

J.C. Bose University of Science & Technology, YMCA Faridabad established in 2009, formerly known as YMCA University of Science & Technology (erstwhile YMCA Institute of Engineering, Faridabad), established in year 1969 as a Joint Venture of Govt. of Haryana and National Council of YMCA of India with active assistance from overseas agencies of West Germany to produce highly practical oriented personnel in specialized field of engineering to meet specific technical manpower requirement of industries. The Electronics Engineering Department started in 1969 and has been conducting B.Tech. Courses in Electronics Instrumentation and Control (EIC) started in 1997, Electronics and Communication Engineering (ECE) started in 1997, Electronics and Computer Engineering (ENC) started in 2019 and Electronics Engineering started in 2021 of 4-Years duration. Students are admitted through centralized counselling nominated by State Government in 1st year and 2nd year through lateral entry entrance test. Besides under graduate degree courses, it is also running M.Tech in VLSI Design and M.Tech in Electronics & Communication Engineering. Department of Electronics Engineering is also running Ph.D. Programme. All courses are duly approved by AICTE/ UGC. The Electronics Engineering Department has been well known for its track record of employment of the pass out students since its inception. The Department has good infrastructure consisting of 11 laboratories, 10 Lecture Halls and 1 Conference Room beside 6 workshops. It has excellent faculty with 05 Professors, 01 Associate Professors and 23 Assistant Professors. At present, 8 faculty members are pursuing PhD in various specializations. The various syllabi of UG/PG courses have been prepared with active participation from Industry. The Department is organizing number of expert lectures from industry experts for students in every semester. Seven month training is mandatory for every B.Tech student. Emphasis has been given on project work and workshop for skill enhancement of students. Choice based credit system allows students to study the subjects of his/her choice from a number of elective courses /audit courses.

PROGRAM EDUCATIONAL OBJECTIVES (PEOS)

1. To prepare students to excel in undergraduate programmes and succeed in industry/ technical profession through global, rigorous education.

2. To provide students with a solid foundation in mathematical, scientific and engineering fundamentals required to solve engineering problems and also to pursue higher studies.

3. To provide students with foundation in skill development required to design, develop and fabricate engineering products.

4. To inculcate professional, ethical attitude, effective communication skills, teamwork skills and multidisciplinary approach in the students and also develop the abilities to relate engineering skills to broader social context.

5. To provide student with an academic environment aware of excellence, outstanding leadership, written ethical codes & guidelines with moral values and the life-long learning needed for successful professional career.

PROGRAMME OUTCOMES (POs)

Engineering Graduates will be able to:

1) Engineering Knowledge: Apply knowledge of mathematics, science, engineering fundamentals and Electronics & Computer Engineering to the solution of engineering problems.

2) Problem Analysis: Identify, formulate, review literature and analyze Electronics & Computer Engineering problems to design, conduct experiments, analyze data and interpret data.

3) Design/Development of Solutions: Design solution for Electronics & Computer Engineering problems and design system component of processes that meet the desired needs with appropriate consideration for the public health and safety, and the cultural, societal and the environmental considerations.

4) 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 in Electronics & Computer Engineering.

5) Modern Tool Usage: Create, select, and apply appropriate techniques, resources, and modern engineering and IT tools including prediction and modeling to Electronics & Computer Engineering activities with an understanding of the limitations.

6) 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 Electronics & Computer Engineering practice.

7) Environment and Sustainability: Understand the impact of the Electronics & Computer Engineering solutions in societal and environmental contexts, and demonstrate the knowledge and need for sustainable development.

8) Ethics: Apply ethical principles and commit to professional ethics and responsibilities and norms of the Electronics & Computer Engineering practice.

9) Individual and Team work: Function affectively as an individual, and as a member or leader in diverse teams, and in multidisciplinary settings in Electronics & Computer Engineering

10) Communication: Communicate effectively on complex engineering activities with the engineering committee and with society at large, such as, being able to comprehend and write affective reports and design documentation, make effective presentations in Electronics & Computer Engineering.

11) Project Management and Finance: Demonstrate knowledge & understanding of the mechanical engineering principles 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 in Electronics & Computer Engineering

12) Life-Long Learning: Recognize the need for, and the preparation and ability to engage in independent research and lifelong learning in the broadest contest of technological changes in Electronics & Computer Engineering.

PROGRAMME SPECIFIC OUTCOMES (PSOs)

PSO 1. To apply the fundamental and design concepts in the areas of Electronics & Communication, Signal Processing, Image Processing, VLSI and Embedded Systems. (Professional Skill)

PSO 2. To apply the fundamental and design concepts of Science & Engineering to understand, analyze, design& develop the Computer Programs /Computer Based Systems in the areas related to Algorithms, Networking, Web Designing, Cloud Computing, IoT, Multimedia and Data Analytics of varying capabilities. (Professional Skill)

PSO 3. To pursue higher degree or get placed in Industries & Organizations after qualifying competitive examinations at National & Global Level. (Competitive Skill)

GRADING SCHEME

Marks %	**Grade**	**Grade points**	**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 average
45 ≤ marks < 50	C	5	Average
40 ≤ marks < 45	P	4	Pass
<40	F	0	Fail
	Ab	0	Absent

Percentage calculation= CGPA * 9.5

SEMESTER WISE SUMMARY OF THE PROGRAMME:

B.TECH. Electronics & Computer Engineering (ENC)

S.No.	**Semester**	**No. of Contact Hours**	**Marks**	**Credits**
1	**I**	**26**	**600**	**18.5**
2	**II**	**25**	**650**	**19.5**
3	**III**	**33**	**950**	**25**
4	**IV**	**35**	**1000**	**28**
5	**V**	**27**	**800**	**20**
6	**VI**	**32**	**950**	**24**
7	**VII**	**24**	**700**	**21**
8	**VIII**	**-**	**500**	**10**
9	**MOOCs**	**-**	**-**	**12***
Total		**202**	**6150**	**178**

Note:

1. The scheme will be applicable from Academic Session 2019-20 onwards.
2. ***It is mandatory to pass the MOOC course(s) by all the students as per implementation of credit transfer/ mobility policy of on line courses of the University-as mentioned in Annexure-A at the end of the syllabus.**

Chapter-1

General, Course structure &Theme

&

Semester-wise credit distribution

A. Definition of Credit:

1Hr.Lecture (L) per week	1credit
1Hr.Tutorial (T) per week	1credit
1 Hr. Practical (P) per week 2 Hours Practical(Lab) per week	0.5credits 1credit

B. Course code and definition:

Coursecode	**Definitions**
L	Lecture
T	Tutorial
P	Practical
BSC	Basic Science Courses
ESC	Engineering Science Courses
HSMC	Humanities and Social Sciences including Management
PCC	Professional core courses
PEC	Professional Elective courses
OEC	Open Elective courses
LC	Laboratory course
MC	Mandatory courses
PROJ	Project

C. Category of Courses:

BASIC SCIENCE COURSES

Sl. No.	Course Title	Hours per week			Credits
		L	T	P	
1	Physics	3	1	3	5.5
2	Chemistry	3	1	3	5.5
3	Mathematics–I	3	1	0	4
4	Mathematics–2	3	1	0	4

ENGINEERING SCIENCE COURSES

Sl.	Cours	Course Title	Hours per week			Credits
			L	T	P	
1		Basic Electrical Engineering	3	1	2	5
2		Engineering Graphics & Design	0	0	4	2
3		Programming for Problem	3	0	4	5
4		Workshop I	0	0	4	2
5		Workshop II	0	0	4	2

HUMANITIES & SOCIAL SCIENCES INCLUDING MANAGEMENT

Sl. No.	Cours eCode	CourseTitle	Hours per week			Credits
			L	T	P	
1		English	2	0	2	3

Chapter-2

Detailed first year curriculum contents

I. Mandatory Induction program

[Induction program is mandatory for all the students of the first year]

3 weeks duration
• Physical activity • Creative Arts • Universal Human Values • Literary • Proficiency Modules • Lectures by Eminent People • Visits to local Areas • Familiarization to Dept./Branch & Innovations

MANDARORY AUDIT COURSES (MC)

S. No.	Code	Name of Course	Contact Hours	Credits	Semester
1.	MC-03	Environmental Science	2	0	IV
2.	MC-02	Essence of Indian Traditional Knowledge	2	0	V
3.	MC-04G	Message of Bhagwat Gita	2	0	VI
		Total	**6**	**0**	

B.TECH 1st YEAR ELECTRONICS & COMPUTER ENGINEERING (SEMESTER-I)

COURSE STRUCTURE

S.No	Course Code	Course Title	L	T	P	Credits	Sessional	External	Category Code
1	BSC101C	Physics (Waves and Optics)	3	1	-	4	25	75	BSC
2	BSC103 D	Mathematics-I (Calculus and Linear Algebra)	3	1	-	4	25	75	BSC
3	ESC102	Engineering Graphics & Design	-	-	4	2	30	70	ESC
4	ESC103	Programming for Problem solving	3	-	-	3	25	75	ESC
5	ESC104	Workshop- I	-	-	4	2	30	70	ESC
6	BSC104C	Physics(Waves and Optics) lab	-	-	3	1.5	15	35	BSC
7	ESC105	Programming for Problem solving Lab	-	-	4	2	15	35	ESC
TOTAL			**9**	**2**	**15**	**18.5**	**165**	**435**	

B.TECH 1st YEAR ELECTRONICS & COMPUTER ENGINEERING (SEMESTER-II)

COURSE STRUCTURE

S.No.	Course Code	Course Title	L	T	P	Credits	Sessional	External	Category Code
1	BSC106 D	Mathematics-II (Calculus, Ordinary Differential Equations and Complex Variable)	3	1	-	4	25	75	BSC
2	ESC101/ ESC101A*	Basic Electrical Engineering/ Basic Electrical Technology	3	1	-	4	25	75	AECC
3	BSC 102	Chemistry	3	1	-	4	25	75	BEC
4	ESC106	Workshop- II	-	-	4	2	30	70	BEC
5	HSMC101	English	2	-	-	2	25	75	BEC
6	ESC107/ ESC107A*	Basic Electrical Engineering Lab/Basic Electrical Technology Lab	-	-	2	1	15	35	BSC
7	BSC 105	Chemistry Lab	-	-	3	1.5	15	35	BEC
8	HSMC102	English Lab	-	-	2	1	15	35	BEC
TOTAL			**11**	**3**	**11**	**19.5**	**175**	**475**	

Note:

- *** Applicable from 2020-2021 onwards**
- **Workshop I and Workshop II can be decided for specific branch by the respective Dean/Principal of respective UTD/Institutions.**

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

B.TECH 2nd YEAR ELECTRONICS & COMPUTER ENGINEERING (SEMESTER-III)

COURSE STRUCTURE

Sr. No.	Category	Course Code	Course Title	Hours per week			Credits	Sessional Marks	Final Marks	Total
				L	T	P				
1	PCC	ECP301	Digital Electronics & Computer Organization	3	0	0	3	25	75	100
2	PCC	ECP302	Semiconductor Devices	3	0	0	3	25	75	100
3	PCC	ECP303	Object Oriented Programming using C++	3	0	0	3	25	75	100
4	PCC	ECP304	Analog Communication	3	0	0	3	25	75	100
5	PCC	ECP305	Circuit Analysis and Synthesis	3	0	0	3	25	75	100
6	BSC	BS301	Mathematics-III	3	1	0	4	25	75	100
7	MC	MC01/ MC02	Indian Constitution/ Essence of Indian Traditional Knowledge	2	0	0	0	25	75	100
8	PCC	ECP351	Object Oriented Programming using C++ Lab	0	0	2	1	15	35	50
9	PCC	ECP352	Digital Electronics Lab	0	0	2	1	15	35	50
10	PCC	ECP353	Analog Communication Lab	0	0	2	1	15	35	50
11	PROJ	ESP303	Electronics Project Workshop-I	0	0	6	3	30	70	100
			Total Credits				**25**	**250**	**700**	**950**

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

(c) The MC are without any credits but it is compulsory to pass these courses.

B.TECH 2nd YEAR ELECTRONICS & COMPUTER ENGINEERING (SEMESTER-IV)

COURSE STRUCTURE

Sr. No.	Category	Course Code	Course Title	Hours per week			Credits	Sessional Marks	Final Marks	Total
				L	T	P				
1	PCC	ECP401	Digital Communication	3	0	0	3	25	75	100
2	PCC	ECP402	Analog Electronics Circuits	3	0	0	3	25	75	100
3	PCC	ECP403	Microprocessors & Its Application	3	0	0	3	25	75	100
4	PCC	ECP404	Data Structure using Python	3	0	0	3	25	75	100
5	PCC	ECP405	Digital System Design & Applications	3	0	0	3	25	75	100
6	PCC	ECP406	Theory of Signal & System	3	0	0	3	25	75	100
7	BSC	BSC01	Biology	2	1	0	3	25	75	100
8	PCC	ECP451	Digital System Design Lab	0	0	2	1	15	35	50
9	PCC	ECP452	Analog Electronic Circuit Lab	0	0	2	1	15	35	50
10	PCC	ECP453	Microprocessors & its Application Lab	0	0	2	1	15	35	50
11	PCC	ECP454	Data Structure using Python Lab	0	0	2	1	15	35	50
11	PROJ	ESP402	Electronics Project Workshop-II	0	0	6	3	30	70	100
			Total Credits				**28**	**265**	**735**	**1000**

Note: (a) Theory exams will be of 03 hours duration and Practical exams will be of 02 hours duration

(b) Workshop exam will be of 8 hours duration

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

B. TECH 3rd YEAR ELECTRONICS & COMPUTER ENGINEERING (SEMESTER-V)

COURSE STRUCTURE

Sr. No.	Category	Course Code	Course Title	Hours per week			Credits	Sessional Marks	Final Marks	Total
				L	T	P				
1	PCC	ECP501	Embedded System Design	3	0	0	3	25	75	100
2	PCC	CS-501	Database Management Systems	3	0	0	3	25	75	100
3	PCC	PCC-CS-403	Operating System	3	0	0	3	25	75	100
4	PCC	ECP502	Integrated Circuit Design	3	0	0	3	25	75	100
5	MC	MC03	Environmental Science	2	0	0	0	25	75	100
6	OEC		Open Elective-1	3	0	0	3	25	75	100
7	PCC	CS 504	Database Management Systems Lab	0	0	2	1	15	35	50
8	PCC	ECP 552	Integrated Circuit Design Lab	0	0	2	1	15	35	50
9	PROJ	ESP 555	Project Workshop-III	0	0	6	3	30	70	100
			Total Credits				**20**	**210**	**590**	**800**

	Course Code	Course Title
Open Elective-I	OEL501	Smart Materials and Systems
	OEL502	Electrical Measurement and Instrumentation
	OEL504	Electromechanical Energy Conversion
	OEL 506	Solid & Structures
	OEL 507	Optimization Techniques
	ESC 01	Engineering Mechanics

Note: (a) Theory exams will be of 03 hours duration and Practical exams will be of 02 hours duration

(b) Workshop exam will be of 8 hours duration

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

B.TECH 3rd YEAR ELECTRONICS & COMPUTER ENGINEERING (SEMESTER-VI)

COURSE STRUCTURE

Sr. No.	Category	Course Code	Course Title	Hours per week			Credits	Sessional Marks	Final Marks	Total
				L	T	P				
1	PCC	ECP 601	Mobile Communication	3	0	0	3	25	75	100
2	PCC	ECC 04	Digital Signal Processing	3	0	0	3	25	75	100
3	PCC	EC 602	Computer Networks	3	0	0	3	25	75	100
4	MC	MC-04G	Message of Bhagwat Gita	2	0	0	0	25	75	100
5	PEC		Program Elective-I	3	0	0	3	25	75	100
6	PEC		Program Elective-II	3	0	0	3	25	75	100
7	OEC		Open Elective -II	3	0	0	3	25	75	100
8	PCC	ECC 53	Digital Signal Processing Lab	0	0	2	1	15	35	50
9	PCC	ECP 651	Mobile Communication Lab	0	0	2	1	15	35	50
10	PEC	EC 652	Computer Networks Lab	0	0	2	1	15	35	50
11	PROJ	ESP 655	Project Workshop-IV	0	0	6	3	30	70	100
			Total Credits				**24**	**250**	**700**	**950**

	Course Code	Course Title
Program Elective-I	ECPEL601	Information Management System
	ECPEL602	ERP Information System
	PCC-CS-601	Intelligent Systems
	PEC-CS-S-601	Software Engineering
	PEC-CS-A-602	Computer Graphics
Program Elective-II	ECPEL603	Microwave Engineering
	ECPEL604	Antenna and wave propagation
	PEC-CS-S-703	Internet of Things

	ECPEL 605	Remote Sensing
	Course Code	**Course Title**
Open Elective-II	OEL601	Virtual Instruments Design
	PEC-ME-461	Quality Management
	OEC-CS-601(I)	Soft Skills and Interpersonal Communication
	OEL 606	Principles of Control System
	PEC-CS-D601	Data Mining

Note: (a) Theory exams will be of 03 hours duration and Practical exams will be of 02 hours duration

(b) Workshop exam will be of 8 hours duration

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

B.TECH 4th YEAR ELECTRONICS & COMPUTER ENGINEERING (SEMESTER- VII)

COURSE STRUCTURE

Sr. No.	Category	Course Code	Course Title	Hours per week			Credits	Sessional Marks	Final Marks	Total
				L	T	P				
1	PEC		Program Elective-III	3	0	0	3	25	75	100
2	PEC		Program Elective-IV	3	0	0	3	25	75	100
3	PEC		Program Elective-V	3	0	0	3	25	75	100
4	HMSC	HSMC01	Effective Technical Communication	3	0	0	3	25	75	100
5	OEC		Open Elective-III	3	0	0	3	25	75	100
6	OEC		Open Elective -IV	3	0	0	3	25	75	100
7	PROJ	ECP751	Major Project	0	0	2	1	15	35	50
8	PROJ	ESP752	Project Workshop-V	0	0	4	2	15	35	50
			Total Credits				**21**	**180**	**520**	**700**

	Course Code	Course Title
Program Elective-III	ECPEL701	Computer Vision
	ECPEL702	Data Analytics and Visualization
	ECPEL703	Cloud Computing and Security
	PEC-CS-A-702	Web & Internet Technology
	PEC-CS-D-702(II)	Information Retrieval
Program Elective-IV	ECEL704	Optical Fiber Communication
	ECPEL704	Neural Networks and Soft Computing
	ECPEL 705	Wireless Sensor Networks and Applications
	ECPEL706	Cognitive Radio
	ECPEL 707	Digital Image Processing and Analysis
	ECPEL 708	Information & Coding Theory
Program Elective-V	ECPEL 709	Machine Learning
	ECEL 706	Mixed Signal Design
	ECPEL710	Mobile Application Development
	PCC-CS-404	Design & Analysis of Algorithms
	ECPEL 711	Graph Theory and Applications

	Course Code	Course Title
Open Elective-III	OEC-CS-602 (I)	Human Resource Management
	OEC-CS-701(I)	Financial Management
	ECEL 604	Scientific Computing
	OEL709	Industrial Safety Engineering
	ECEL 503	Power Electronics
	PEC-CS-T-702	Game Theory
	PCC-CS-502	Formal Languages, Automata and Compiler Design
Open Elective-IV	OEL 707	Operation Research
	OEL 708	Advanced Digital System Design
	OEL 711	Transportation Engineering
	OEL 712	Banking System & Taxation

Note: (a) Theory exams will be of 03 hours duration and Practical exams will be of 02 hours duration

(b) Workshop exam will be of 8 hours duration

B.TECH 4thYEAR ELECTRONICS & COMPUTER ENGINEERING (SEMESTER-VIII)

COURSE STRUCTURE

Sr No.	Course	Title	Teaching Schedule	Examination Schedule (Marks)			Credits
				Annual Exam.	Continuous Assessment	Total	
1	ECP801	Industrial Training	**6 Months**	**350**	**150**	**500**	**10**

A) PROCEDURE FOR ANNUAL EXAMINATION AND MARKS.

1. PROJECT EVALUATION	150 MARKS	**350**
2. PROJECT SEMINAR	100 MARKS	
3. PROJECT VIVA	100 MARKS	

B) CONTINUOUS ASSESSMENT MARKS

1. ASSESSMENT BY INSTITUTE FACULTY	50 MARKS.	**150**
2. ASSESSMENT BY INDUSTRIAL GUIDE	50 MARKS.	
3. CONDUCT MARKS	50 MARKS.	
TOTAL		**500**

*** 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.**

Note: The question paper consists of two sections. Question No. 1 in Section-A is compulsory having 10 short answer type questions and should cover entire syllabus. Section-B should have six questions covering the whole syllabus and students are required to attempt any four out of six

B.TECH 1st YEAR ELECTRONICS & COMPUTER ENGINEERING (SEMESTER-I)

BSC 101C	**Physics (Waves and Optics)**		
L T P CR	**Theory**	**:**	**75**
3 1 0 4	**Class Work**	**:**	**25**
	Total	**:**	**100**
	Duration of Exam	**:**	**3 Hrs.**

Course Objectives:

- To focus on the concept of oscillators, energy decay & power consumption
- To understand the longitudinal waves and dispersion
- To introduce the propagation of light concept, geometric and wave optics
- To familiarize different types of lasers and its properties

Syllabus

Prerequisites:

(i) Mathematics course on Differential equations

Unit 1: Simple harmonic motion, damped and forced simple harmonic oscillator Mechanical and electrical simple harmonic oscillators, complex number notation and phasor representation of simple harmonic motion, damped harmonic oscillator – heavy, critical and light damping, energy decay in a damped harmonic oscillator, quality factor, forced mechanical and electrical oscillators, electrical and mechanical impedance, steady state motion of forced damped harmonic oscillator, power absorbed by oscillator

Unit 2: Non-dispersive transverse and longitudinal waves in one dimension and introduction to dispersion : Transverse wave on a string, the wave equation on a string, Harmonic waves, reflection and transmission of waves at a boundary, impedance matching, standing waves and their eigen frequencies, longitudinal waves and the wave equation for them, acoustics waves and speed of sound, standing sound waves. Waves with dispersion, water waves, superposition of waves and Fourier method, wave groups and group velocity.

Unit 3: The propagation of light and geometric optics : Fermat's principle of stationary time and its applications e.g. in explaining mirage effect, laws of reflection and refraction, Light as an electromagnetic wave and Fresnel equations, reflectance and transmittance, Brewster's angle, total internal reflection, and evanescent wave.

Mirrors and lenses and optical instruments based on them, transfer formula and the matrix method

Unit 4: Wave optics: Huygens' Principle, superposition of waves and interference of light by wave front splitting and amplitude splitting; Young's double slit experiment, Newton's rings, Michelson interferometer, Mach-Zehnder interferometer. Farunhofer diffraction from a single slit and a circular aperture, the Rayleigh criterion for limit of resolution and its application to vision; Diffraction gratings and their resolving power

Unit 5: Lasers: Einstein's theory of matter radiation interaction and A and B coefficients; amplification of light by population inversion, different types of lasers: gas lasers (He-Ne, CO2), solid-state lasers(ruby,Neodymium), dye lasers; Properties of laser beams: monochromaticity, coherence, directionality and brightness, laser speckles, applications of lasers in science, engineering and medicine.

Course Outcomes

- Student will be able to identify and apply formulas of optics and wave physics using course literature.
- Illustration of physical concepts and terminology used in optics and to be able to explain them in appropriate detail.
- To be able to make approximate judgements about optical and other wave phenomena when necessary.
- To acquire skills allowing the student to organise and plan simpler laboratory course experiments and to prepare an associated oral and written report.

Reference books:

1. Ian G. Main, Oscillations and waves in physics
2. H.J. Pain, The physics of vibrations and waves
3. Hecht, A. Ghatak, Optics
4. O. Svelto, Principles of Lasers

BSC 103 D	**Mathematics-I (Calculus and Linear Algebra)**		
L T P CR	**Theory**	**:**	**75**
3 1 0 4	**Class Work**	**:**	**25**
	Total	**:**	**100**
	Duration of Exam	**:**	**3 Hrs.**

OBJECTIVES:

- To introduce the idea of applying differential and integral calculus to notions of curvature and to improper integrals. Apart from some applications it gives a basic introduction on Beta and Gamma functions.
- To introduce the fallouts of Rolle's Theorem that is fundamental to application of analysis to Engineering problems.
- To develop the tool of power series and Fourier series for learning advanced Engineering Mathematics.
- To familiarize the student with functions of several variables that is essential in most branches of engineering.

Syllabus

Module 1: Calculus: (6 hours): Evolutes and involutes; Evaluation of definite and improper integrals; Beta and Gamma functions and their properties; Applications of definite integrals to evaluate surface areas and volumes of revolutions.

Module 2: Calculus: (6 hours): Rolle's Theorem, Mean value theorems, Taylor's and Maclaurin theorems with remainders; indeterminate forms and L'Hospital's rule; Maxima and minima.

Module 3:Sequences and series: (10 hours): Convergence of sequence and series, tests for convergence; Power series, Taylor's series, series for exponential, trigonometric and logarithm functions; Fourier series: Half range sine and cosine series, Parseval's theorem.

Module 4:Multivariable Calculus (Differentiation): (8 hours): 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 5:Matrices (10hours): Inverse and rank of a matrix,rank-nullity theorem; System of linear equations; Symmetric, skew- symmetric and orthogonal matrices; Determinants;

Eigenvalues and eigenvectors; Diagonalization of matrices; Cayley-Hamilton Theorem, and Orthogonal transformation.

Couse Outcomes

- Students were familiarized with functions of several variables that is essential in most branches of engineering.
- Essential tool of matrices and linear algebra in a comprehensive manner developed.

Text books/References:

1. G.B. Thomas and R.L. Finney, Calculus and Analytic geometry, 9th Edition,Pearson, Reprint, 2002.
2. Erwin kreyszig, Advanced Engineering Mathematics, 9th Edition, John Wiley & Sons, 2006.
3. Veerarajan T., Engineering Mathematics for first year, Tata McGraw-Hill, New Delhi, 2008.
4. Ramana B.V., Higher Engineering Mathematics, Tata McGraw Hill New Delhi, 11thReprint, 2010.
5. D. Poole, Linear Algebra: A Modern Introduction, 2nd Edition, Brooks/Cole, 2005.
6. N.P. Bali and Manish Goyal, A text book of Engineering Mathematics, Laxmi Publications, Reprint, 2008.
7. B.S. Grewal, Higher Engineering Mathematics, Khanna Publishers, 36th Edition, 2010.

ESC 102	**Engineering Graphics & Design**		
L T P CR	**Theory**	**:**	**70**
0 0 4 2	**Class Work**	**:**	**30**
	Total	**:**	**100**
	Duration of Exam	**:**	**3 Hrs.**

Syllabus

Module 1: Introduction to Engineering Drawing

Principles of Engineering Graphics and their significance, usage of Drawing instruments, lettering, Conic sections including the Rectangular Hyperbola (General method only); Cycloid, Epicycloid, Hypocycloid and Involute; Scales – Plain, Diagonal and Vernier Scales;

Module 2: Orthographic Projections

Principles of Orthographic Projections-Conventions - Projections of Points and lines inclined to both planes; Projections of planes inclined Planes - Auxiliary Planes;

Module 3: Projections of Regular Solids

Those inclined to both the Planes- Auxiliary Views; Draw simple annotation, dimensioning and scale. Floor plans that include: windows, doors, and fixtures such as WC, bath, sink, shower, etc.

Module 4: Sections and Sectional Views of Right Angular Solids

Prism, Cylinder, Pyramid, Cone – Auxiliary Views; Development of surfaces of Right Regular Solids - Prism, Pyramid, Cylinder and Cone; Draw the sectional orthographic views of geometrical solids, objects from industry and dwellings (foundation to slab only)

Module 5: Isometric Projections

Principles of Isometric projection – Isometric Scale, Isometric Views, Conventions; Isometric Views of lines, Planes, Simple and compound Solids; Conversion of Isometric Views to Orthographic Views and Vice-versa, Conventions;

Module 6: Overview of Computer Graphics

Listing the computer technologies that impact on graphical communication, Demonstrating knowledge of the theory of CAD software [such as: The Menu System, Toolbars (Standard, Object Properties, Draw, Modify and Dimension), Drawing Area (Background, Crosshairs, Coordinate System), Dialog boxes and windows, Shortcut menus (Button Bars), The Command Line (where applicable), The Status Bar, Different methods of zoom as used

in CAD, Select and erase objects.; Isometric Views of lines, Planes, Simple and compound Solids];

Module 7: Customisation& CAD Drawing

set up of the drawing page and the printer, including scale settings, Setting up of units and drawing limits; ISO and ANSI standards for coordinate dimensioning and tolerance; Orthographic constraints, Snap to objects manually and automatically; Producing drawings by using various coordinate input entry methods to draw straight lines, Applying various ways of drawing circles.

Course Outcomes

All phases of manufacturing or construction require the conversion of new ideas and design concepts into the basic line language of graphics. Therefore, there are many areas (civil, mechanical, electrical, architectural and industrial) in which the skills of the CAD technicians play major roles in the design and development of new products or construction. Students prepare for actual work situations through practical training in a new state-of-the-art computer designed CAD laboratory using engineering software. This course is designed to:

- Learn about the visual aspects of engineering design.
- Analyse engineering graphics standards.
- Prepare orthographic and isometric projection.
- Draw section of solids and conic sections.
- Exposure to computer-aided geometric design

Suggested Text/Reference Books:

1. Bhatt N.D., Panchal V.M. & Ingle P.R., (2014), Engineering Drawing, Charotar Publishing House
2. Shah, M.B. & Rana B.C. (2008), Engineering Drawing and Computer Graphics, Pearson Education
3. Agrawal B. & Agrawal C. M. (2012), Engineering Graphics, TMH Publication
4. Aggarwal M L & Sandhya Dixit (2017), Engineering Graphics and Machine Drawing, Dhanpat Rai & Company P Ltd.
5. Narayana, K.L. & P Kannaiah (2008), Text book on Engineering Drawing, Scitech Publishers
6. Corresponding set of) CAD Software Theory and User Manuals

ESC 103	**Programming for Problem Solving**		
L T P CR	**Theory**	**:**	**75**
3 0 0 3	**Class Work**	**:**	**25**
	Total	**:**	**100**
	Duration of Exam	**:**	**3 Hrs.**

Syllabus

Unit 1 Introduction to Programming Introduction to components of a computer system (disks, memory, processor, where a program is stored and executed, operating system, compilers etc.) Idea of Algorithm: steps to solve logical and numerical problems. Representation of Algorithm: Flowchart/Pseudocode with examples. From algorithms to programs; source code, variables (with data types) variables and memory locations, Syntax and Logical Errors in compilation, object and executable code

Unit 2:Arithmetic expressions and precedence Conditional Branching and Loops Writing and evaluation of conditionals and consequent branching Iteration and loops

Unit 3 Arrays Arrays (1-D, 2-D), Character arrays and Strings

Unit 4 Basic Algorithms (6 lectures) Searching, Basic Sorting Algorithms (Bubble, Insertion and Selection), Finding roots of equations, notion of order of complexity through example programs (no formal definition required)

Unit 5 Function Functions (including using built in libraries), Parameter passing in functions, call by value, Passing arrays to functions: idea of call by reference

Unit 6 Recursion Recursion, as a different way of solving problems. Example programs, such as Finding Factorial, Fibonacci series, Ackerman function etc. Quick sort or Merge sort.

Unit 7 Structure Structures, Defining structures and Array of Structures

Unit 8 Pointers Idea of pointers, Defining pointers, Use of Pointers in self-referential structures, notion of linked list (no implementation)

Unit 9 File handling (only if time is available, otherwise should be done as part of the lab)

Suggested Text Books

(i) Byron Gottfried, Schaum's Outline of Programming with C, McGraw-Hill

(ii) E. Balaguruswamy, Programming in ANSI C, Tata McGraw-Hill

Suggested Reference Books

(i) Brian W. Kernighan and Dennis M. Ritchie, The C Programming Language, Prentice Hall of India

Course Outcomes

The student will learn

- To formulate simple algorithms for arithmetic and logical problems.
- To translate the algorithms to programs (in C language).
- To test and execute the programs and correct syntax and logical errors.
- To implement conditional branching, iteration and recursion.
- To decompose a problem into functions and synthesize a complete program using divide and conquer approach.
- To use arrays, pointers and structures to formulate algorithms and programs.

ESC 104 **Workshop-I**

L T P CR	**Theory**	**:**	**70**
0 0 4 2	**Class Work**	**:**	**30**
	Total	**:**	**100**
	Duration of Exam	**:**	**3 Hrs.**

PART-A

Computer Engineering Workshop

1. To study and demonstrate Block diagram of Digital Computer System and brief explanation of each unit.
2. To demonstrate History/ Generation/ classifications and different types of Personnel Computer.To study and demonstrate internal parts of a Computer System (Card level) and other peripheral devices and explanation of POST & BIOS.
3. To study and demonstrate primary memory and secondary memory.
4. To demonstrate CPU Block diagram and other Peripheral chips, Mother Board/ Main Board and its parts, Connectors, Add On Card Slots etc.
5. To study working of various types of monitors: CRT type, LCD type & LED type.
6. To study Keyboard and Mouse: Wired, Wireless, Scroll & Optical with detail working.
7. To study Printers: Dot Matrix Printers, Daisy wheel Printers, Ink-Jet Printers and Laser Jet Printers with detailed working explanation.
8. Assembly / Installation and Maintenance of Personnel Computer Systems: Practical exercise on assembly of Personnel Computer System, Installation of Operating System: Windows & Linux etc, Installation of other Application Softwares and Utility Softwares, Fault finding in Personnel Computers: Software or Hardware wise, Virus: Introduction, its Types & Removal techniques, Data Backup and Restore, Data Recovery Concepts, Typical causes of Data loss.
9. To demonstrate networking concepts: Introduction of Connecting devices: Hub, Switch & Router etc, Networking Cable preparation: Normal & Cross Cables, Data

Transferring Techniques from one Computer System to another Computer System, Configuration of Switch/ Routers etc.

PART-B

Electrical Workshop

1. Introduction of Electrical Safety precautions, Electrical Symbols, Electrical Materials, abbreviations commonly used in Electrical Engg. and familiarization with tools used in Electrical Works.
2. To make a Straight Joint & Tee joint on 7/22 PVC wire and Britannia Joint on GI wire.
3. To study fluorescent Tube Light, Sodium Lamp and High Pressure Mercury Vapour Lamp.
4. To study different types of earthing and protection devices e.g. MCBs, ELCBs and fuses.
5. To study different types of domestic and industrial wiring and wire up a circuit used for Stair case and Godown wiring.
6. To make the connection of fan regulator with lamp to study the effect of increasing and decreasing resistance in steps on the lamp.
7. To fabricate half wave and full wave rectifiers with filters on PCB.
8. Maintenance and Repair of Electrical equipment i,e Electric Iron , Electric Toaster ,Water heater, Air coolers and Electric Fans etc.
9. To study soldering process with simple soldering exercises.
10. To make the connection of a three core cable to three pin power plug and connect the other cable end by secured eyes connection using 23/0.0076”or 40/0.0076” cable.

PART- C

Electronics Workshop

1. To study and demonstrate basic electronic components, Diode, Transistor, Resistance, Inductor and capacitor.
2. To study and demonstrate resistance color coding, measurement using color code and multimeter and error calculation considering tolerance of resistance.
3. To study and demonstrate Multimeter and CRO- front panel controls, description of block diagram of CRT and block diagram of CRO.
4. To study and demonstrate Vp(peak voltage),Vpp(peak to peak voltage), Time, frequency and phase using CRO.
5. Introduction to function generator. Functions of front panel controls and measurement of different functions on CRO.

6. To study and demonstrate variable DC regulated power supply, function of controls and DC measurement using multimeter and CRO.
7. Soldering practice on wire mesh or a resistance decade board includes fabrication, soldering, lacing, harnessing forming and observation.
8. Testing of components using multimeter and CRO like diode, transistor, resistance capacitor, Zener diode and LED.
9. To study and demonstrate rectification, half wave, Full wave and bridge rectifier. Fabrication,assembly and waveform observation.
10. To design and fabricate a printed circuit board of a Zener regulated/ series regulated power supply and various measurements, testing of power supply.

Note: At least 8 exercises are to be performed from each part by the students.

Course Outcomes (COs):

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

CO1- Acquire skills in basic engineering practice.

CO2- Have working knowledge of various equipments used in workshop.

CO3- Have hands on experience about various machines and their components.

CO4- Obtain practical skills of basic operation and working of tools used in the workshop.

BSC 104 C	**Physics (Waves and Optics) Lab**		
L T P CR	**Theory**	**:**	**35**
0 0 3 1.5	**Class Work**	**:**	**15**
	Total	**:**	**50**

List of Experiments

At least 06 experiments from the following

1. To determine the frequency of an electric tuning fork by Melde's experiment and verify λ2 –T law.
2. To study Lissajous Figures.
3. Familiarization with: Schuster`s focusing; determination of angle of prism.
4. To determine refractive index of the Material of a prism using sodium source.
5. To determine the dispersive power and Cauchy constants of the material of a prism using mercury source.
6. To determine the wavelength of sodium source using Michelson's interferometer.
7. To determine wavelength of sodium light using Fresnel's Biprism.
8. To determine wavelength of sodium light using Newton's Rings.
9. To determine wavelength of (1) Na source and (2) spectral lines of Hg source using plane diffraction grating.
10. To determine dispersive power and resolving power of a plane diffraction grating.
11. To determine the wavelength of laser source using diffraction of single slit.
12. To determine the wavelength of laser source using diffraction of double slits.
13. To determine angular spread of He-Ne laser using plane diffraction grating

Note: Experiments may be added or deleted as per the availability of equipments.

LABORATORY OUTCOMES

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

- Analyze Lissajous Figures.
- Understand the various physical phenomenon used to determine the wavelength.
- Understand the concept of dispersive power.

Reference Books

1. Advanced Practical Physics for students, B.L. Flint and H.T. Worsnop, 1971, Asia Publishing House
2. A Text Book of Practical Physics, I.Prakash & Ramakrishna, 11th Ed., 1511,Kitab Mahal
3. Advanced level Physics Practicals, Michael Nelson and Jon M. Ogborn, 4th Edition, reprinted 1985, Heinemann Educational Publishers

ESC 105	**Programming for Problem Solving Lab**		
L T P CR	**Theory**	**:**	**35**
0 0 4 2	**Class Work**	**:**	**15**
	Total	**:**	**50**

Programming for Problem Solving Lab

[The laboratory should be preceded or followed by a tutorial to explain the approach or algorithm to be implemented for the problem given.]

Tutorial 1: Problem solving using computers:

Lab1: Familiarization with programming environment

Tutorial 2: Variable types and type conversions:

Lab 2: Simple computational problems using arithmetic expressions

Tutorial 3: Branching and logical expressions:

Lab 3: Problems involving if-then-else structures

Tutorial 4: Loops, while and for loops:

Lab 4: Iterative problems e.g., sum of series

Tutorial 5: 1D Arrays: searching, sorting:

Lab 5: 1D Array manipulation

Tutorial 6: 2D arrays and Strings

Lab 6: Matrix problems, String operations

Tutorial 7: Functions, call by value:

Lab 7: Simple functions

Tutorial 8 &9: Numerical methods (Root finding, numerical differentiation, numerical integration):

Lab 8 and 9: Programming for solving Numerical methods problems

Tutorial 10: Recursion, structure of recursive calls

Lab 10: Recursive functions

Tutorial 11: Pointers, structures and dynamic memory allocation

Lab 11: Pointers and structures

Tutorial 12: File handling:

Lab 12: File operations

Laboratory Outcomes

- To formulate the algorithms for simple problems
- To translate given algorithms to a working and correct program
- To be able to correct syntax errors as reported by the compilers
- To be able to identify and correct logical errors encountered at run time
- To be able to write iterative as well as recursive programs
- To be able to represent data in arrays, strings and structures and manipulate them through a program
- To be able to declare pointers of different types and use them in defining self- referential structures.
- To be able to create, read and write to and from simple text files.

B.TECH 1st YEAR ELECTRONICS & COMPUTER ENGINEERING (SEMESTER-II)

BSC 106 D Mathematics –II (Calculus, Ordinary Differential Equations and Complex Variable)

L T P CR			
3 1 0 4	**Theory**	**:**	**75**
	Class Work	**:**	**25**
	Total	**:**	**100**
	Duration of Exam	**:**	**3 Hrs.**

The objective of this course is to familiarize the prospective engineers with techniques in multivariate integration, ordinary and partial differential equations and complex variables. It aims to equip the students to deal with advanced level of mathematics and applications that would be essential for their disciplines. More precisely, the objectives are:

a. To acquaint the student with mathematical tools needed in evaluating multiple integrals and their usage.
b. To introduce effective mathematical tools for the solutions of differential equations that model physical processes.
c. To introduce the tools of differentiation and integration of functions of complex variable that are used in various techniques dealing engineering problems.

Module 1:Multivariable Calculus (Integration): (10 hours) Multiple Integration: Double integrals (Cartesian), change of order of integration in double integrals, Change of variables (Cartesian to polar), Applications: areas and volumes, Center of mass and Gravity (constant and variable densities);Triple integrals (Cartesian), orthogonal curvilinear coordinates, Simple applications involving cubes, sphere and rectangular parallelepipeds; Scalar line integrals, vector line integrals, scalar surface integrals, vector surface integrals, Theorems of Green, Gauss and Stokes.

Module 2:First order ordinary differential equations:(6 hours) 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 3: Ordinary differential equations of higher orders:(8 hours) 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.

Module 4: Complex Variable – Differentiation:(8 hours): Differentiation, Cauchy-Riemann equations, analytic functions, harmonic functions, finding harmonic conjugate; elementary analytic functions (exponential, trigonometric, logarithm) and their properties; Conformal mappings, Mobius transformations and their properties.

Module 5: Complex Variable – Integration:(8 hours): Contour integrals, Cauchy-Goursat theorem (without proof), Cauchy Integral formula (without proof), Liouville's theorem and Maximum-Modulus theorem (without proof); Taylor's series, zeros of analytic functions, singularities, Laurent's series; Residues, Cauchy Residue theorem (without proof), Evaluation of definite integral involving sine and cosine, Evaluation of certain improper integrals using the Bromwich contour.

Course Outcomes

• Students will be able to develop mathematical tools needed in evaluating multiple integrals and their usage.

• Effective mathematical tools for the solutions of differential equations that model physical processes built.

• Differentiation and integration of functions of complex variable will be developed that are used in various techniques dealing engineering problems

Textbooks/References:

1. G.B. Thomas and R.L. Finney, Calculus and Analytic geometry, 9th Edition, Pearson, Reprint, 2002.

2. Erwin kreyszig, Advanced Engineering Mathematics, 9th Edition, John Wiley & Sons, 2006.

3. W. E. Boyce and R. C. DiPrima, Elementary Differential Equations and Boundary Value Problems, 9th Edn., Wiley India, 2009.

4. S. L. Ross, Differential Equations, 3rd Ed., Wiley India, 1984.

5. E. A. Coddington, An Introduction to Ordinary Differential Equations, Prentice Hall India, 1995.

6. E. L. Ince, Ordinary Differential Equations, Dover Publications, 1958.

7. J. W. Brown and R. V. Churchill, Complex Variables and Applications, 7th Ed., Mc- Graw Hill, 2004.

8. N.P. Bali and Manish Goyal, A text book of Engineering Mathematics, Laxmi Publications, Reprint, 2008.

9. B.S. Grewal, Higher Engineering Mathematics, Khanna Publishers, 36th Edition, 2010

ESC 101	**Basic Electrical Engineering**		
L T P CR	**Theory**	**:**	**75**
3 1 0 4	**Class Work**	**:**	**25**
	Total	**:**	**100**
	Duration of Exam	**:**	**3 Hrs.**

Syllabus

Module 1 : DC Circuits (8 hours) Electrical circuit elements (R, L and C), voltage and current sources, Kirchoff current and voltage laws, analysis of simple circuits with dc excitation. Superposition, Thevenin and Norton Theorems. Time-domain analysis of first-order RL and RC circuits.

Module 2: AC Circuits (8 hours) Representation of sinusoidal waveforms, peak and rms values, phasor representation, real power, reactive power, apparent power, power factor. Analysis of single-phase ac circuits consisting of R, L, C, RL, RC, RLC combinations (series and parallel), resonance. Three- phase balanced circuits, voltage and current relations in star and delta connections.

Module 3: Transformers (6 hours) Magnetic materials, BH characteristics, ideal and practical transformer, equivalent circuit, losses in transformers, regulation and efficiency. Auto-transformer and three-phase transformer connections.

Module 4: Electrical Machines (8 hours) Generation of rotating magnetic fields, Construction and working of a three-phase induction motor, Significance of torque-slip characteristic. Loss components and efficiency, starting and speed control of induction motor. Single-phase induction motor. Construction, working, torque-speed characteristic and speed control of separately excited dc motor. Construction and working of synchronous generators.

Module 5: Power Converters (6 hours) DC-DC buck and boost converters, duty ratio control. Single-phase and three-phase voltage source inverters; sinusoidal modulation.

Module 6: Electrical Installations (6 hours) Components of LT Switchgear: Switch Fuse Unit (SFU), MCB, ELCB, MCCB, Types of Wires and Cables, Earthing. Types of Batteries, Important Characteristics for Batteries. Elementary calculations for energy consumption, power factor improvement and battery backup.

Course Outcomes

- To understand and analyze basic electric and magnetic circuits
- To study the working principles of electrical machines and power converters.
- To introduce the components of low voltage electrical installations

Suggested Text / Reference Books

(ii) D. P. Kothari and I. J. Nagrath, "Basic Electrical Engineering", Tata McGraw

Hill, 2010.

(iii) D. C. Kulshreshtha, “Basic Electrical Engineering”, McGraw Hill, 2009.

(iv) L. S. Bobrow, “ Fundamentals of Electrical Engineering”, Oxford University Press, 2011.

(v) E. Hughes, “Electrical and Electronics Technology”, Pearson, 2010.

(vi) V. D. Toro, “Electrical Engineering Fundamentals”, Prentice Hall India, 1989.

ESC 101A	**Basic Electrical Technology**		
L T P CR	**Theory**	**:**	**75**
3 1 0 4	**Class Work**	**:**	**25**
	Total	**:**	**100**
	Duration of Exam	**:**	**3 Hrs.**

Module 1: DC Circuits (8 hours)

Basic definitions, Electrical circuit elements (R, L and C), voltage and current sources, Ohm's law and its limitations, Kirchhoff current and voltage laws, analysis of simple circuits with dc excitation by mesh analysis and node analysis, Superposition, Thevenin's, Norton's and Maximum Power Transfer Theorems.

Module 2: AC Circuits (8 hours)

Representation of sinusoidal waveforms, peak and rms values, phasor representation, real power, reactive power, apparent power, power factor. Analysis of single-phase ac circuits consisting of R, L, C, RL, RC, RLC combinations (series and parallel), resonance.

Module3: Poly Phase Systems (5 hours)

Advantages of 3-phase systems, generation of 3-phase voltages, three phase connections (starand delta), voltage and current relations in star and delta connections, three phase powers, analysis of 3-phase balanced circuits, measurement of 3-phase power- 2 wattmeter method.

Module 4: Transformers (6 hours)

Magnetic Circuits, construction and working of single phase transformer, ideal and practical transformer, equivalent circuit, losses in transformers, regulation and efficiency, Auto- transformer

Module 5: Electrical Machines (8 hours)

*Induction motor***:** Construction, principle and working of a three-phase induction motor, Single-phase induction motor: Construction, principle and working, Applications

*DC machine***:** Construction, principle and working of dc motor and generator. Applications

*Synchronous machine***:** Construction, principle and working of synchronous motor and generators. Applications

Module 6: Electrical Installations (6 hours)

Components of LT Switchgear: Fuses, MCB, ELCB, MCCB, Types of Wires, Earthing, Power factor improvement.

Course Outcomes:

- To analyze and solve D. C. networks by different analysis methods and theorems.
- To formulate and solve complex AC single phase and three circuits
- To identify the type of electrical machines and their applications
- To introduce the components of low voltage electrical installations

TEXT / REFERENCE BOOKS

1.D. P. Kothari and I. J. Nagrath, "Basic Electrical Engineering", Tata McGraw Hill, 2010. 2. D. C. Kulshreshtha, "Basic Electrical Engineering", McGraw Hill, 2009.
3. L. S. Bobrow, "Fundamentals of Electrical Engineering", Oxford University Press, 2011.
4. E. Hughes, "Electrical and Electronics Technology", Pearson, 2010.
5. V. D. Toro, "Electrical Engineering Fundamentals", Prentice Hall India, 1989.

Online Recourses:

1. **NPTL Web Course, Basic Electrical Technology,** Prof. G. D. Roy, Prof. N. K. De, Prof. T.K. Bhattacharya, IIT Kharagpur **(**https://nptel.ac.in/courses/108/105/108105053/)
2. **NPTL Web Course, Electrical Machines-I,** Prof. P. Sasidhara Rao, Prof. G.Sridhara Rao, Dr. Krishna Vasudevan, IIT Madras **(**https://nptel.ac.in/courses/108/106/108106071/)
3. **NPTL Web Course, Electrical Machines-II,** Prof. P. Sasidhara Rao, Prof. G. Sridhara Rao, Dr. Krishna Vasudevan, IIT Madras https://nptel.ac.in/courses/108/106/108106072/

BSC 102	**Chemistry**		
L T P CR	**Theory**	**:**	**75**
3 1 0 4	**Class Work**	**:**	**25**
	Total	**:**	**100**
	Duration of Exam	**:**	**3 Hrs.**

Detailed contents

(i) Atomic and molecular structure (12 lectures)

Schrodinger equation. Particle in a box solutions and their applications for conjugated molecules and nanoparticles. Forms of the hydrogen atom wave functions and the plots of these functions to explore their spatial variations. Molecular orbitals of diatomic molecules and plots of the multicenter orbitals. Equations for atomic and molecular orbitals. Energy level diagrams of diatomic. Pi-molecular orbitals of butadiene and benzene and aromaticity. Crystal field theory and the energy level diagrams for transition metal ions and their magnetic properties. Band structure of solids and the role of doping on band structures.

(ii) Spectroscopic techniques and applications (8 lectures)

Principles of spectroscopy and selection rules. Electronic spectroscopy. Fluorescence and its applications in medicine. Vibrational and rotational spectroscopy of diatomic molecules. Applications. Nuclear magnetic resonance and magnetic resonance imaging, surface characterisation techniques. Diffraction and scattering.

(iii) Intermolecular forces and potential energy surfaces (4 lectures)

Ionic, dipolar and van Der Waals interactions. Equations of state of real gases and critical phenomena. Potential energy surfaces of H_3, H_2F and HCN and trajectories on these surfaces.

(iv) Use of free energy in chemical equilibria (6 lectures)

Thermodynamic functions: energy, entropy and free energy. Estimations of entropy and free energies. Free energy and emf. Cell potentials, the Nernst equation and applications. Acid base, oxidation reduction and solubility equilibria. Water chemistry. Corrosion. Use of free energy considerations in metallurgy through Ellingham diagrams.

(v) Periodic properties (4 Lectures)

Effective nuclear charge, penetration of orbitals, variations of s, p, d and f orbital energies of atoms in the periodic table, electronic configurations, atomic and ionic sizes, ionization energies, electron affinity and electronegativity, polarizability, oxidation states, coordination numbers and geometries, hard soft acids and bases, molecular geometries.

(vi) Stereochemistry (4 lectures)

Representations of 3 dimensional structures, structural isomers and stereoisomers, configurations and symmetry and chirality, enantiomers, diastereomers, optical activity, absolute configurations and conformational analysis. Isomerism in transitional metal compounds

(vii) Organic reactions and synthesis of a drug molecule (4 lectures)

Introduction to reactions involving substitution, addition, elimination, oxidation, reduction, cyclization and ring openings. Synthesis of a commonly used drug molecule.

Suggested Text Books

1. University chemistry, by B. H. Mahan
2. Chemistry: Principles and Applications, by M. J. Sienko and A. Plane
3. Fundamentals of Molecular Spectroscopy, by C. N. Banwell
4. Engineering Chemistry (NPTEL Web-book), by B. L. Tembe, Kamaluddin and M. S. Krishnan
5. Physical Chemistry, by P. W. Atkins
6. Organic Chemistry: Structure and Function by K. P. C. Volhardt and N. E. Schore, 5th Edition

Course Outcomes

The concepts developed in this course will aid in quantification of several concepts in chemistry that have been introduced at the 10+2 levels in schools. Technology is being increasingly based on the electronic, atomic and molecular level modifications.

Quantum theory is more than 100 years old and to understand phenomena at nanometer levels; one has to base the description of all chemical processes at molecular levels. The course will enable the student to:

- Analyse microscopic chemistry in terms of atomic and molecular orbitals and intermolecular forces.
- Rationalise bulk properties and processes using thermodynamic considerations.
- Distinguish the ranges of the electromagnetic spectrum used for exciting different molecular energy levels in various spectroscopic techniques
- Rationalise periodic properties such as ionization potential, electronegativity, oxidation states and electronegativity.
- List major chemical reactions that are used in the synthesis of molecules.

ESC 106	**Workshop-II**		
L T P CR	**Theory**	**:**	**70**
0 0 4 2	**Class Work**	**:**	**30**
	Total	**:**	**100**
	Duration of Exam	**:**	**3 Hrs.**

MECHANICAL WORKSHOP

Course Outcomes (COs): After studying this course the students would:

CO 1- Have exposure to mechanical workshop layout and safety aspects.

CO 2- Understand the functions of various machines and cutting tools used in machine shop.

CO 3- Practice real time job preparation using various operations related to machine shop such as filing, drilling, milling & turning.

CO 4 - Practice job preparation in welding shop.

CO 5 - Learn to use different measuring tools like vernier caliper, vernier height gauge and micrometer.

CO 6 - Practice job preparation in sheet metal shop.

List of Exercises:

Fitting, sheet metal and welding workshop:

1. To study layout, safety measures and different engineering materials (mild steel, medium carbon steel, high carbon steel, high speed steel and cast iron etc) used in workshop.
2. To study and use of different types of tools, equipments, devices & machines used in fitting, sheet metal and welding section.
3. To determine the least count of vernier calliper, vernier height gauge, micrometer and take different reading over given metallic pieces using these instruments.
4. To study and demonstrate the parts, specifications & operations performed on lathe machine.
5. To study and demonstrate the parts, specifications & operations performed on milling machine.
6. To study and demonstrate the parts, specifications & operations performed on shaper machine.
7. To prepare a job involving different type of filing practice exercise in specified dimensions.
8. To prepare a job involving multi operational exercise (drilling, counter sinking, tapping, reaming, hack sawing etc.)

9. To prepare a multi operational sheet metal job (self secured single groove joint/ hasp & stay etc.).
10. To practice striking an arc, straight short bead, straight continuous bead and restart of electrode in flat position by arc welding on given M.S. plate as per size.
11. To practice tack weld of two close plate in flat position by arc welding on given M.S. plate as per size.
12. To practice close butt joint in flat position by arc welding on given M.S. plate as per size.

NOTE: - At least nine exercises should be performed from the above list; remaining three may either be performed from above list or designed by the concerned institution as per the scope of the syllabus and facilities available in institute.

HSMC 101	**English**		
L T P CR	**Theory**	**:**	**75**
2 0 0 2	**Class Work**	**:**	**25**
	Total	**:**	**100**
	Duration of Exam	**:**	**3 Hrs.**

Syllabus

1. Vocabulary Building

The concept of Word Formation, Root words from foreign languages and their use in English, Acquaintance with prefixes and suffixes from foreign languages in English to form derivatives. Synonyms, antonyms, and standard abbreviations.

2. Basic Writing Skills

Sentence Structures, Use of phrases and clauses in sentences, Importance of proper punctuation, Creating coherence, Organizing principles of paragraphs in documents, Techniques for writing precisely

3. Identifying Common Errors in Writing

Subject-verb agreement, Noun-pronoun agreement, Misplaced modifiers, Articles, Prepositions, Redundancies, Clichés

4. Nature and Style of sensible Writing

Describing, Defining, Classifying, Providing examples or evidence

5. Writing introduction and conclusion

6. Writing Practices

Comprehension, Précis Writing, Essay Writing

7. Oral Communication

(This unit involves interactive practice sessions in Language Lab)

- Listening Comprehension
- Pronunciation, Intonation, Stress and Rhythm
- Common Everyday Situations: Conversations and Dialogues
- Communication at Workplace
- Interviews
- Formal Presentations

COURSE OUTCOMES

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

Suggested Readings:

(i) *Practical English Usage.* Michael Swan. OUP. 1995.

(ii) *Remedial English Grammar*. F.T. Wood. acmillan.2007

(iii) *On Writing Well.* William Zinsser. Harper Resource Book. 2001

(iv) *Study Writing.* Liz Hamp-Lyons and Ben Heasly. Cambridge University Press. 2006.

(v) *Communication Skills*. Sanjay Kumar and PushpLata. Oxford University Press. 2011.

(vi) *Exercises in Spoken English.* Parts. I-III. CIEFL, Hyderabad. Oxford University Press

ESC 107	**Basic Electrical Engineering Lab**		
L T P CR	**Theory**	**:**	**35**
0 0 2 1	**Class Work**	**:**	**15**
	Total	**:**	**50**

Basic Electrical Engineering Laboratory

List of experiments/demonstrations:

- Basic safety precautions. Introduction and use of measuring instruments – voltmeter, ammeter, multi-meter, oscilloscope. Real-life resistors, capacitors and inductors.
- Measuring the steady-state and transient time-response of R-L, R-C, and R-L-C circuits to a step change in voltage (transient may be observed on a storage oscilloscope). Sinusoidal steady state response of R-L, and R-C circuits – impedance calculation and verification. Observation of phase differences between current and voltage. Resonance in R-L-C circuits.
- Transformers: Observation of the no-load current waveform on an oscilloscope (non-sinusoidal wave-shape due to B-H curve nonlinearity should be shown along with a discussion about harmonics). Loading of a transformer: measurement of primary and secondary voltages and currents, and power.
- Three-phase transformers: Star and Delta connections. Voltage and Current relationships (line-line voltage, phase-to-neutral voltage, line and phase currents). Phase-shifts between the primary and secondary side. Cumulative three-phase power in balanced three-phase circuits.
- Demonstration of cut-out sections of machines: dc machine (commutator-brush arrangement), induction machine (squirrel cage rotor), synchronous machine (field winging - slip ring arrangement) and single-phase induction machine.
- Torque Speed Characteristic of separately excited dc motor.
- Synchronous speed of two and four-pole, three-phase induction motors. Direction reversal by change of phase-sequence of connections. Torque-Slip Characteristic of an induction motor. Generator operation of an induction machine driven at super- synchronous speed.
- Synchronous Machine operating as a generator: stand-alone operation with a load. Control of voltage through field excitation.
- Demonstration of (a) dc-dc converters (b) dc-ac converters – PWM waveform (c) the use of dc-ac converter for speed control of an induction motor and (d) Components of LT switchgear.

Laboratory Outcomes

- Get an exposure to common electrical components and their ratings.
- Make electrical connections by wires of appropriate ratings.
- Understand the usage of common electrical measuring instruments.
- Understand the basic characteristics of transformers and electrical machines.
- Get an exposure to the working of power electronic converters.

ESC 107A	**Basic Electrical Technology Lab**		
L T P CR	**Theory**	**:**	**35**
0 0 2 1	**Class Work**	**:**	**15**
	Total	**:**	**50**

List of experiments/demonstrations:

- Basic safety precautions. Introduction and use of measuring instruments – voltmeter, ammeter, multi-meter, oscilloscope. Real-life resistors, capacitors and inductors.
- Verification of network theorem in DC circuits, Thevenin's Theorem, Norton's, Theorem, Superposition Theorem etc.
- Sinusoidal steady state response of R-L, and R-C circuits – impedance calculation and verification. Observation of phase differences between current and voltage. Resonance in R-L-C circuits.
- Poly phase systems, three phase connections (star and delta), measurement of three phase power
- Transformers: Observation of the no-load current waveform on an oscilloscope (non- sinusoidal wave-shape due to B-H curve nonlinearity should be shown along with a discussion about harmonics). Loading of a transformer: measurement of primary and secondary voltages and currents, and power.
    - Demonstration of cut-out sections of machines: dc machine (commutator-brush arrangement), induction machine (squirrel cage rotor), synchronous machine (field winging - slip ring arrangement) and single-phase inductionmachine.
    - Torque Speed Characteristic of separately excited dc motor.
    - Components of LT switchgear.

LABORATORY OUTCOMES

- Get an exposure to common electrical components and their ratings.
- Make electrical connections by wires of appropriate ratings.
- Understand the usage of common electrical measuring instruments.
- Understand the basic characteristics of transformers and electrical machines.

BSC 105	**Chemistry Lab**		
L T P CR	**Theory**	**:**	**35**
0 0 3 1.5	**Class Work**	**:**	**15**
	Total	**:**	**50**

(ii) Chemistry Laboratory[L : 0; T:0 ; P : 3 (1.5 credits)]

Choice of 10-12 experiments from the following:

- Determination of surface tension and viscosity
- Thin layer chromatography
- Ion exchange column for removal of hardness of water
- Determination of chloride content of water
- Colligative properties using freezing point depression
- Determination of the rate constant of a reaction
- Determination of cell constant and conductance of solutions
- Potentiometry - determination of redox potentials and emfs
- Synthesis of a polymer/drug
- Saponification/acid value of an oil
- Chemical analysis of a salt
- Lattice structures and packing of spheres
- Models of potential energy surfaces
- Chemical oscillations- Iodine clock reaction
- Determination of the partition coefficient of a substance between two immiscible liquids
- Adsorption of acetic acid by charcoal
- Use of the capillary viscosimeters to the demonstrate of the isoelectric point as the pH of minimum viscosity for gelatin sols and/or coagulation of the white part of egg .

Laboratory Outcomes

- The chemistry laboratory course will consist of experiments illustrating the principles of chemistry relevant to the study of science and engineering. The students will learn to:
- Estimate rate constants of reactions from concentration of reactants/products as a function of time
- Measure molecular/system properties such as surface tension, viscosity, conductance of solutions, redox potentials, chloride content of water, etc

HSMC 102	**English lab**		
L T P CR	**Theory**	**:**	**35**
0 0 2 1	**Class Work**	**:**	**15**
	Total	**:**	**50**

Interactive practice sessions in Language Lab on following topics:

- Listening Comprehension
- Pronunciation, Intonation, Stress and Rhythm
- Common Everyday Situations: Conversations and Dialogues
- Communication at Workplace
- Interviews
- Formal Presentations

Course Outcomes

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

B.TECH 2nd YEAR ELECTRONICS & COMPUTER ENGINEERING (SEMESTER -III)

COURSE STRUCTURE

Digital Electronics & Computer Organization

ECP 301			
L T P CR	**Theory**	**:**	**75**
3 0 0 3	**Class Work**	**:**	**25**
	Total	**:**	**100**
	Duration of Exam	**:**	**3 Hrs.**

Course Objectives:

- To introduce Digital signals, numbers systems, various types of logic gates and various types of codes
- To introduce Combinational design using gates, K-map and Q-M methods of simplification
- To introduce Multiplexers and Demultiplexers, Decoders, Adders / Subtractors, BCD arithmetic circuits, Encoders, Decoders / Drivers for display devices.
- To introduce Sequential circuits, F/F Conversions, sequence generators, Counters and design of Synchronous and Asynchronous sequential circuits.
- To introduce instruction set architecture, addressing modes and operations in instruction set.
- To introduce Basic non pipelined CPU Architecture

SYLLABUS

Unit-1 : Fundamentals of Digital Techniques : Digital signal, logic gates: AND, OR, NOT, NAND, NOR, EX-OR, EX-NOR, Boolean algebra, Binary codes: BCD, Excess-3, Gray, Error detection and correction codes.

Unit-2: Combinational Design Using Gates: Design using gates, Karnaugh map and Quine Mcluskey methods of simplification.

Unit-3: Combinational Design Using MSI Devices: Multiplexers and Demultiplexers and their use as logic elements, Decoders, Adders / Subtractors, BCD arithmetic circuits, Encoders, Decoders / Drivers for display devices.

Unit-4 : Sequential Circuits : Flip Flops : S-R, J-K, T, D, master-slave, edge triggered, shift registers, sequence generators, Counters, Asynchronous and Synchronous Ring counters and Johnson Counter, Design of Synchronous and Asynchronous sequential circuits.

Unit-5: Instruction Set Architecture and Design of ALU: Instruction set based classification of processors (RISC, CISC and their comparison); addressing modes: register, immediate, direct, indirect, indexed; Operations in the instruction set; Arithmetic and Logical, Data Transfer, Control Flow; Instruction set formats (fixed, variable, hybrid); Language of the machine: 8086; simulation using MSAM, ALU Design: Adders, Multipliers and Dividers, Floating point arithmetic.

Unit-6: Basic non pipelined CPU Architecture: CPU Architecture types (accumulator, register, stack, memory/register) detailed data path of a typical register based CPU, Fetch-Decode-Execute cycle (typically 3 to 5 stage); microinstruction sequencing, implementation of control unit, Enhancing performance with pipelining.

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

A. Design and analyze combinational logic circuits.
B. Acquire basic knowledge of digital logic families.
C. Understand the instruction set and CPU architecture.
D. Develop knowledge of ALU.

Text Books :

- Modern Digital Electronics(Edition III) : R. P. Jain; TMH
- Digital Design : Morris Mano; PHI.

Reference Book :

- Digital Integrated Electronics : Taub& Schilling; MGH
- Digital Principles and Applications : Malvino& Leach; McGraw Hill.
- Computer Organization and Design: The Hardware/Software Interface, 5th Edition by David A. Patterson and John L. Hennessy, Elsevier.
- Computer Organization and Embedded Systems, 6th Edition by Carl Hamacher, McGraw Hill Higher Education.
- Computer Architecture and Organization, 3rd Edition by John P. Hayes WCB/McGraw-Hill
- Computer Organization and Architecture: Designing for Performance, 10th Edition by William Stallings, Pearson Education.

ECP 302	**Semiconductor Devices**		
L T P CR	**Theory**	**:**	**75**
3 0 0 3	**Class Work**	**:**	**25**
	Total	**:**	**100**
	Duration of Exam	**:**	**3 Hrs.**

Course Objectives:

• To give exposure to students about Semiconductor Physics.

• To give the exposure about characteristics of semiconductor devices.

• To introduce the working of different semiconductor electronics devices.

• To introduce about the fabrication technologies of semiconductor electronics devices.

Syllabus

Unit 1: Introduction to Semiconductor Physics: Review of Quantum Mechanics, Electrons in periodic Lattices, E-k diagrams. Energy bands in intrinsic and extrinsic silicon: Carrier transport: diffusion current, drift current, mobility and resistivity, sheet resistance.

Unit 2: Generation and recombination of carriers, Poisson and continuity equation, P-N junction, P-N junction diode, I-V characteristics, and small signal switching models: Avalanche breakdown, Zener breakdown, Zener diode, zener diode as constant voltage regulator, Schottky diode, LED, photodiode and Solar Cell.

Unit 3: Bipolar Junction Transistor (BJT), Structure, Working, Common Base CB, Common Emitter CE and Common Collector CC configuration, I-V characteristics and Current gain, Ebers-Moll Model.

Unit 4: Field Effect transistor (FET), Junction FET, MOSFET: Depletion Type, Enhancement type MOSFET, Structure, Working, I-V characteristics and small signal models of MOS transistor, MOS capacitor.

Unit 5: Integrated circuit fabrication process: oxidation, diffusion, ion implantation, photolithography, etching, chemical vapor deposition, sputtering, twin-tub CMOS process.

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

• Understand the principles of semiconductor Physics.

• Understand and utilize the mathematical models of semiconductor junction diodes

• Understand the design & characteristics of BJT and FETs

• Understand various semiconductor Fabrication Process.

Text /Reference Books:

1. David A. Bell, “Electronics Devices and Circuits,” 5th edition, Oxford Higher Education.

2. G. Streetman, and S. K. Banerjee, “Solid State Electronic Devices,” 7th edition, Pearson,2014.

3. D. Neamen, D. Biswas "Semiconductor Physics and Devices," McGraw-Hill Education

4. S. M. Sze and K. N. Kwok, “Physics of Semiconductor Devices,” 3rd edition, John Wiley & Sons, 2006.

5. C.T. Sah, “Fundamentals of solid state electronics,” World Scientific Publishing Co. Inc, 1991.

6. Y. Tsividis and M. Colin, “Operation and Modeling of the MOS Transistor,” Oxford Univ.Press, 2011.

ECP 303	**Object-Oriented Programming using C++**		
L T P CR	**Theory**	**:**	**75**
3 0 0 3	**Class Work**	**:**	**25**
	Total	**:**	**100**
	Duration of Exam	**:**	**3 Hrs.**

Course Objectives:

- To become familiar with procedural and object oriented techniques of problem solving
- Become familiar with the syntax of C++ while understanding the features such as composition of objects, encapsulation, data hiding, inheritance, polymorphism and advanced features like generic classes, exception handling and File I/O
- Be able to build the classes by following the principles of object oriented programming
- Be able to improve the problem solving skills, so that object oriented or non-object oriented techniques can be applied to solve bigger real-world computing problems.

Syllabus

Unit 1: Introduction to C++; Characters used in C++; Basic data types, Data type modifiers; C++ Tokens – identifiers, keywords, constants, variables; Input – Output statements, structure of a C++ program; Escape Sequence (Backslash Character Constants); Operators and Expressions – arithmetic, relational, logical, and conditional operator; special operators – size of (), comma, assignment operators; Flow of control – compound statement, the if and if-else, and switch statements, the while, do-while, and for loops, break and continue statements, exit() function; Arrays – one dimensional and multi-dimensional arrays, array initialization; Structures – referencing structure elements, arrays of structures, initializing structures, assigning structures, nested structures; Functions – prototypes, calling a function, parameter passing , call by value, call by reference, array parameters, returning values from functions.

Unit 2:POINTERS Introduction to pointers- the '&' and '*'operators; pointer variables; dangling pointers; pointers and arrays; array of pointers; pointers and structures; dynamic allocation; self-referential structures, introduction to linked structures and lists;

Unit 3: Programming Techniques- A Survey Introduction to programming paradigms – unstructured programming, structured , procedural, and modular programming; drawbacks of structured programming; Object Oriented programming.

Unit 4: Classes and Objects Introduction to objects; classes – declaration in C++, abstraction and encapsulation, creating objects; array of objects; objects as function arguments, scope resolution operator, static data members; properties of classes and objects.

Unit 5: Functions: advanced concepts Polymorphism, Function overloading; inline functions; friend functions- Member functions of a class as friends of another class, Friend Function as a bridge between two classes; friend classes; recursion – types of recursion: linear, binary, tail recursion

Unit 6: Constructors and Destructors Constructors – types of constructors: default, user defined, parameterized, copy constructors, and constructors with default arguments; rules for constructor definition and usage; destructors -rules for destructor definition and usage.

Unit 7: Inheritance: Extending classes Introduction to code reuse; containership-aggregation; inheritance – visibility modes, 'Open Close Principle'(OCP) types of inheritance: multilevel, multiple inheritance; function overriding – virtual functions, 'Liskov's Substitution Principle' (LSP), pure virtual functions; roles of constructors and destructors in inheritance; virtual base class – graph inheritance.

Unit 8: Templates: code sharing (Genericity): Introduction to code sharing; templates; generic classes; templates with more than one generic parameter;

Unit 9: Operator overloading 21 Introduction to operator overloading, Overloading of binary operators, arithmetic assignment operators; overloading of unary operators; overloading of input-output operators; rules of operator overloading.

Unit 10: File handling in C++ File concepts; files and streams; opening and closing of files – functions get(), getline(), put() etc., opening files using function open(); reading and writing blocks and objects into the files; detecting 'end of file' (eof)

Unit 11: Exception handling Introduction – traditional error handling; exception handling in C++ - 'try, throw, and catch blocks', multiple throw and multiple catch blocks, throwing objects; situations of usage of exception handling.

Course Outcomes: After the successful completion of the course, student is able to:

1. Differentiate between various programming paradigms available
2. Is able to build the classes using proper syntax and applying the various features of the language.
3. Is able to implement and build the advanced concepts of the language into the classes like inheritance, polymorphism, templates, pointers, exception handling and file I/O
4. To apply the object oriented concepts to the real world problems.

REFERENCES

1. C++ How to Program by H M Deitel and P J Deitel, 1998, Prentice Hall

2. Object Oriented Programming in Turbo C++ by Robert Lafore ,1994, The WAITE Group Press.
3. Programming with C++ By D Ravichandran, 2003, T.M.H
4. Computing Concepts with C++ Essentials by Horstmann, 2003, John Wiley,

ECP 304	**Analog Communication**		
L T P CR	**Theory**	**:**	**75**
3 0 0 3	**Class Work**	**:**	**25**
	Total	**:**	**100**
	Duration of Exam	**:**	**3 Hrs.**

Course Objectives:

- To introduce the basic of communication system, signals and their classification
- To introduce the signal analysis using Fourier Series and Fourier Transform along with their properties.
- To introduce the methods used for generation and detection of AM,DSB, SSB, FM and PM
- To introduce Sampling theorem. PAM, PWM and PPM
- To introduce the generation and detection of PCM, DM and ADM.
- To introduce basic concepts of noise, Internal and external noise, SNR, noise figure.

Syllabus

UNIT 1. INTRODUCTION TO COMMUNICATION SYSTEMS: The essentials of a Communication system, modes and media‘s of Communication, Block diagrams of wired and wireless communication systems, and their examples. Classification of signals and systems, Fourier analysis of signals.

UNIT 2.AMPLITUDE MODULATION: Amplitude modulation, Generation of AM waves, Demodulation of AM waves, DSBSC, Generation of DSBSC waves, Coherent detection of DSBSC waves, single side band modulation, generation of SSB waves, demodulation of SSB waves, vestigial sideband modulation (VSB).

UNIT 3.ANGLE MODULATION: Basic definitions: Phase modulation (PM) & frequency modulation (FM), narrow band frequency modulation, wideband frequency modulation, generation of FM waves, Demodulation of FM waves.

UNIT 4. PULSE MODULATION: Sampling theory, pulse modulation techniques: PAM,PWM,PPM, Elements of pulse code modulation, Quantization, Uniform & non uniform Quantization, Necessity of non uniform quantization, A law of companding, μ law of companding, Quantization error in PCM, transmission BW of PCM, Differential Pulse Code Modulation, Delta Modulation, Adaptive Delta Modulation, Granular and slope-overload errors, TDM, FDM.

UNIT 5.INTRODUCTION TO NOISE: External noise, internal noise, factors affecting the noise, Computation of S/N ratio in each analog modulation scheme.

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

- Understand Fourier Series and Fourier Transform and their applications in communication system.
- Understand Amplitude modulation, frequency modulation and Phase modulation and their mathematical expression, their generation and detection.
- Understand Sampling theorem, basic concept of PAM, PWM, PPM and PCM. Quantization and necessity of quantization.
- Understand basic concepts of noise, internal and external noise, signal to noise ratio and noise figure

TEXT BOOKS:

1. Communication systems (4th edn.): Simon Haykins; John wiley&sons.
2. Communication systems: Singh &Sapre;TMH.

REFERENCE BOOKS:

1. Electronic Communication systems: Kennedy;TMH.
2. Communication Electronics: Frenzel;TMH.
3. Communication system: Taub&Schilling;TMH.
4. Communication systems: Bruce Carlson, McGraw Hill.

ECP 305	**Circuit Analysis and Synthesis**		
L T P CR	**Theory**	**:**	**75**
3 0 0 3	**Class Work**	**:**	**25**
	Total	**:**	**100**
	Duration of Exam	**:**	**3 Hrs.**

Course Objectives:

- To introduce students about basic electrical circuits with nodal & mesh analysis.
- To give exposure to the students about various network theorem applicable to AC circuits.
- To introduce the application of Laplace transform.
- To introduce students about network functions, two port network for analysis of electrical networks.
- To introduce students about different types of filters.

Syllabus

Unit 1: Node and Mesh Analysis: matrix approach of network containing voltage and current sources, and reactances, source transformation and duality. Network theorems: Superposition, reciprocity, Thevenin's, Norton's, Maximum power Transfer, compensation and Tallegen's theorem as applied to AC circuits.

Unit 2: Laplace transforms and properties: Partial fractions, Transfer functions, analysis of RC, RL, and RLC networks with and without initial conditions with Laplace transform.

Unit 3: Network functions:Terminal pairs or Ports, concept of complex frequency ,Network functions for one-port and two-port networks, poles and zeros of Network functions, Restrictions on pole and zero Locations for driving point functions and transfer functions, Time domain behavior from the pole-zero plot.

Unit 4:Two port network:Relationshipof two-port variables, short-circuit Admittance parameters, open circuit impedance parameters, Transmission parameters, hybrid parameters, relationships between parameter sets, condition for reciprocity, condition for symmetry, Inter-connection of two port networks.

Unit 5:Filter fundamentals: parameters of a filter, filter networks, characteristics of filter networks, Introduction of filters: low pass, high pass, band pass and band reject filters.

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

- Analyze basics electrical circuits with nodal and mesh analysis and apply network theorems to AC circuits
- Apply Laplace Transform for steady state and transient analysis.

- Identify different network functions and behavior based on pole zelo plot.
- Evaluate two port network parameters, relationship between parameters and interconnection of two port network.
- Analyze filter fundamentals and behavior of different filters

Text/Reference Books:

1. Van, Valkenburg; “Network analysis”; Prentice hall of India, 2000.

2. Sudhakar, A., Shyammohan, S. P.; “Circuits and Network”; Tata McGraw-Hill New Delhi, 1994.

3. A William Hayt, “Engineering Circuit Analysis” 8th Edition, McGraw-Hill Education.

BS 301	**Mathematics III**		
L T P CR	**Theory**	**:**	**75**
3 1 0 4	**Class Work**	**:**	**25**
	Total	**:**	**100**
	Duration of Exam	**:**	**3 Hrs.**

COURSE OBJECTIVES:

To gain knowledge about: Laplace Transform, Fourier Transform, Z- transform and Numerical Methods.

Unit 1: Transform Calculus-1: Polynomials – Orthogonal Polynomials – Lagrange's, Chebysev Polynomials; Trigonometric Polynomials. Laplace Transform, Properties of Laplace Transform, Laplace transform of periodic functions. Finding inverse Laplace transform by different methods, convolution theorem. Evaluation of integrals by Laplace transform, solving ODEs and PDEs by Laplace Transform method.

Unit 2: Transform Calculus-2: Fourier transforms, Z-transform : Properties, methods, inverses and their applications.

Unit 3: Vector differentiation, gradient, divergence and curl, line and surface integrals, path independence, statements and illustrations of theorems of Green, Stokes and Gauss, arc length parameterization, applications.

Course Outcome:

- To understand Laplace Transform and its applications
- To understand Fourier Transform, Z Transform and their applications
- To solve the curl, gradient and divergence
- To apply the applications curl, gradient and divergence in various theorems in various applications

Textbooks/References

1. Erwin Kreyszig, Advanced Engineering Mathematics, 9th Edition, John Wiley & Sons, 2006.
2. B.S. Grewal, Higher Engineering Mathematics, Khanna Publishers, 35th Edition, 2000.
3. Veerarajan T., Engineering Mathematics, Tata McGraw-Hill, New Delhi, 2008.
4. P. Kandasamy, K. Thilagavathy, K. Gunavathi, Numerical Methods, S. Chand & Company, 2nd Edition, Reprint 2012.

MC01/MC02 Indian Constitution/ Essence of Indian Traditional Knowledge

L T P CR	**Theory**	**:**	**75**
2 0 0 0	**Class Work**	**:**	**25**
	Total	**:**	**100**
	Duration of Exam	**:**	**3 Hrs.**

Course Objectives

- To gain knowledge about Historical perspectives, salient features and Characteristics of CoI .
- To gain knowledge about various schemes of Fundamental Rights, Fundamental Duties, Article-19 & Article 21 and D.P.S.P
- To know about the basic structure of the Government of India.
- To know about Constitutional Amendments and Emergency Provisions.
- To gain knowledge about the Local Government of India and its Three Tier Structure.

Unit I

Meaning of the terms: Constitution, Constitutional Laws and Constitutionalism. History of Indian Constitution -Company rule and Crown Rule. Salient features and Characteristics of Constitution of India.

Unit II

Part-1to Part-V of Constitution of India . Various Schemes of Fundamental Rights, Scheme of Fundamental Duties and its legal status, DPSP- Its importance and implementation .

Unit III

Federal Structure and distribution of Legislative and Financial Powers between the Union and the States . Parliamentary form of Government in India- The Constitution Power and the Status of President of India.

Unit IV

Amendments of the Constitutional Powers and Procedure . The Historical Perspectives of the Constitutional Amendments in India . Various Emergency Provisions in India .

Unit V

Local Self Government-Its three tier structure and Constitutional scheme of India .

Course Outcomes:

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

- Understand the Historical Perspective of Constitution of India.
- Understand various schemes and scope of Fundamental Rights, Fundamental Duties and D.P.S.P

- Understand the Type of Government in India and its Federal Structure.
- Understand Constitutional Amendments and Emergency Provisions in India.
- Understand Local Self Government and its three tier structure.

References

1. The Constitutional Law of India 9th Edition, by Pandey. J.N
2. The Constitution of India by P.M Bakshi.
3. Constitutional Law of India by Narender Kumar.

Essence of Indian Traditional Knowledge

भारतीय विद्यासार

Course objective

The course aims at imparting basic principles of thought process, reasoning and inferencing. Sustainability is at the core of Indian Traditional knowledge Systems connecting society and nature. Holistic life style of yogic science and wisdom capsules in Sanskrit literature are also important in modern society with rapid technological advancements and societal disruptions. Part-I focuses on introduction to Indian Knowledge Systems, Indian perspective of modern scientific world-view, and basic principles of Yoga and holistic health care system.

C Basic structure of Indian Knowledge System: अष्टादशविद्या -४वेद,४उपवेद (आयुर्वेद, धनुर्वेद, गन्धर्ववेद, स्थापत्य आदि) ६वेदांग (शिक्षा, कल्प, निरुक्त, व्याकरण, ज्योतिष, छंद) ४ उपाङ्ग (धर्मशास्त्र, मीमांसा, पुराण, तर्कशास्त्र)

−Yoga and Holistic Health care

−Case studies

References

•V. Sivaramakrishnan (Ed.), Cultural Heritage of India-course material, BharatiyaVidyaBhavan, Mumbai. 5th Edition, 2014

•Swami Jitatmanand, Modern Physics and Vedant, BharatiyaVidya Bhavan

•Swami Jitatmanand, Holistic Science and Vedant, Bharatiya Vidya Bhavan

•Fritzof Capra, Tao of Physics

•Fritzof Capra, The Wave of life

•VN Jha (Eng. Trans.), Tarkasangraha of Annam Bhatta, International Chinmay Foundation, Velliarnad, Arnakulam

•Yoga Sutra of Patanjali, Ramakrishna Mission, Kolkata

•GN Jha (Eng. Trans.), Ed. RN Jha, Yoga-darshanam with Vyasa Bhashya, Vidyanidhi Prakashan, Delhi 2016

•RN Jha, Science of Consciousness Psychotherapyand Yoga Practices, Vidyanidhi Prakashan, Delhi 2016

•P B Sharma (English translation), Shodashang Hridayan

Pedagogy: Problem based learning, group discussions, collaborative mini projects.

Outcome: Ability to understand, connect up and explain basics of Indian traditional knowledge in modern scientific perspective.

ECP 351	**Object Oriented Programming using C++ lab**		
L T P CR	**Theory**	**:**	**35**
0 0 2 1	**Class Work**	**:**	**15**
	Total	**:**	**50**

List of Experiments

- To understand the C++ improves C with object-oriented features.
- To learn how to write inline functions for efficiency and performance.
- To learn the syntax and semantics of the C++ programming language.
- To learn how to design C++ classes for code reuse.
- To learn how to implement copy constructors and class member functions.
- To understand the concept of data abstraction and encapsulation.
- To learn the overload functions and operators in C++.
- To learn the containment and inheritance promote code reuse in C++.
- To learn the inheritance and virtual functions implement dynamic binding with polymorphism.
- To learn the design and implement generic classes with C++ templates.
- To learn the use exception handling in C++ programs.

Laboratory Outcomes

- To formulate the algorithms for simple problems
- To translate given algorithms to a working and correct program
- To be able to correct syntax errors as reported by the compilers
- To be able to identify and correct logical errors encountered at run time
- To be able to understand the concept of functions through program.
- To be able to understand the concept of classes, inheritance and abstraction through program.

ECP 352	**Digital Electronics Lab**		
L T P CR	**Theory**	**:**	**35**
0 0 2 1	**Class Work**	**:**	**15**
	Total	**:**	**50**

List of Experiments

1. Study of TTL gates – AND, OR, NOT, NAND, NOR, EX-OR, EX-NOR.
2. Design & realize a given function using K-maps and verify its performance.
3. To verify the operation of multiplexer &Demultiplexer.
4. To verify the operation of comparator.
5. To verify the truth tables of S-R, J-K, T & D type flip flops.
6. To verify the operation of bi-directional shift register.
7. To design & verify the operation of 3-bit synchronous counter.
8. To design and verify the operation of synchronous UP/DOWN decade counter using J K flip-flops & drive a seven-segment display using the same.
9. To design and verify the operation of asynchronous UP/DOWN decade counter using J K flip-flops & drive a seven-segment display using the same.
10. To design & realize a sequence generator for a given sequence using J-K flip-flops.
11. Study of CMOS NAND & NOR gates and interfacing between TTL and CMOS gates.
12. Design a 4-bit shift-register and verify its operation. Verify the operation of a ring counter and a Johnson counter.
13. To realize the given function using decoder and OR gate.

Course Outcome: On the successful competition of this course, the students should be able to:

- Verify the operation of basic & universal gates.
- Design & verify the standards of combinational circuits.
- Verify the operations of different type of flip flops.
- Design the counters using flip flops for a given sequence.
- Verify the working of shift registers.
- Write experimental reports and work in a team in professional way

ECP 353	**Analog Communication Lab**		
L T P CR	**Theory**	**:**	**35**
0 0 2 1	**Class Work**	**:**	**15**
	Total	**:**	**50**

List of Experiments

1. Study of Amplitude Modulation and determination of Modulation index.
2. Study of Frequency Modulation and determination of Modulation index.
3. Study of Phase Modulation.
4. Study of Pulse Amplitude Modulation.
5. Study of Pulse Width Modulation.
6. Study of Pulse Frequency Modulation.
7. Study of Pulse Code Modulation.
8. Study of Delta modulation.
9. Study of Pulse code modulation.
10. Study of TDM and FDM.

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

- Demonstrate about various blocks in communication system.
- Analyze the types of modulations.
- Analyze and design the analog modulator and demodulator circuits.
- Generate the waveforms of AM,FM, PM, PWM,PPM and PAM.
- Calculate Power relations in Amplitude and Frequency modulated waves.
- Write experimental reports and work in a team in professional way

B.TECH 2nd YEAR ELECTRONICS & COMPUTER ENGINEERING (SEMESTER -IV)
COURSE STRUCTURE

ECP 401	**Digital Communication**		
L T P CR	**Theory**	**:**	**75**
3 0 0 3	**Class Work**	**:**	**25**
	Total	**:**	**100**
	Duration of Exam	**:**	**3 Hrs.**

Unit-1: Communication system components: Introduction to Communication: Definition & means of communications; Digital and analog signals: sign waves, square waves; Properties of signals: amplitude, frequency, phase; Theoretical basis for data communication: Fourier analysis: Fourier series and Fourier Transform (property, ESD, PSD and Raleigh) effect of limited bandwidth on digital signal.

Unit-2: Data Transmission System: Physical connections: modulation, amplitude-,frequency-, phase- modulation; Data encoding: binary encoding (NRZ), Manchester encoding, differential Manchester encoding. Transmission Media: Twisted pair-, co-axial, fiber optic-cables, wireless media Transmission impairments: attenuation, limited bandwidth of the channels, delay distortion, noise, and data rate of the channels (Nyquist theorem, Shannon limit). Physical layer interfaces: RS 232, X.21

Unit-3: Standards in data communications: Communication modes: simplex, half duplex, full duplex; Transmission modes: serial, parallel-transmission; Synchronizations: Asynchronous,synchronous-transmission; Type of services: connection oriented, connectionless-services; Flow control: unrestricted simplex protocol, simplex stop- and - wait protocol, sliding window protocol; Switching systems: circuit switching; packet switching: data gram , virtual circuits, permanent virtual circuits. Telephone Systems: PSTN, ISDN, asynchronous digital subscriber line. Multiplexing: frequency division, time, wave division multiplexing

Unit-4: Security in data communications: Transmission errors: feedback, forward-error control approaches; Error detection; Parity check, block sum check, frame check sequences; Error correction: hamming codes, cyclic redundancy check; Data encryption: secret key cryptography, public key cryptography; Data compression: run length encoding, Huffman encoding.

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

- Analyze the components of a communication system.
- Analyze different encoding schemes and transmission impairments.
- Understand error detection, correct and security in data communication
- Be comfortable with the standards in data communication.

Text Book:

- Data Communications, Computer Networks and Open Systems Halsall Fred, (4^{th}editon) 2000, Addison Wesley, Low Price edition

Reference Books:

- Business Data Communications, Fitzgerald Jerry, 7^{th} Ed. New York, 2001, JW&S
- Communication Systems, 4^{th} Edi, by A. Bruce Carlson, Paul B. Crilly, Janet C. Rutledge, 2002, TMH.

- Data Communications, Computer Networks and Open Systems, Halsall Fred, 1996, AW. Digital Communications, J.G. Proakiss, 4^{th} Ed., MGH
- Satellite Communication, Pratt, John Wiley

- Data & Computer Communications, W.Stallings PHI Digital & Data Communication systems, Roden 1992, PHI, Introduction to Digital & Data Communications, Miller Jaico Pub.
- Data Communications and Networking, Behrouz A. Forouzan, 2003, 2^{nd} Edition, T.M.H

ECP 402	**Analog Electronics Circuits**		
L T P CR	**Theory**	**:**	**75**
3 0 0 3	**Class Work**	**:**	**25**
	Total	**:**	**100**
	Duration of Exam	**:**	**3 Hrs.**

Course Objectives:

- To introduce basic concept of Diode and diode as rectifier, clipper, clamper circuits, voltage multiplier circuits.
- To introduce basic concepts of transistor and its operation, characteristics of transistor, analysis of a transistor amplifier circuits using h parameters.
- To introduce basic concepts of transistor biasing, concept of operating point, different methods of biasing.
- To introduce basic concepts of JFET, V-I characteristics of FET, small signal model of FET, common source amplifier, source follower, biasing of FET, application of FET as VVR.
- To introduce Operational amplifier and their linear & nonlinear applications.

SYLLABUS

UNIT 1: DIODE CIRCUITS P-N junction diode, V-I characteristics of a diode; review of half-wave and full-wave rectifiers, Zener diodes, clamping and clipping circuits, voltage multiplier circuits.

UNIT 2: BJT & BIASING CIRCUITS Structure and V-I characteristics of a BJT, BJT as an amplifier, common-emitter, common-base and common collector amplifiers; Analysis of transistor amplifier circuits using h parameters. Biasing: operating point, bias stability, stability factor, and different biasing methods

UNIT 3: FET CIRCUITS Junction field effect transistor, pinch off voltage, V-I characteristics, small signal model, common source amplifier, source follower, biasing of FET, application of FET as VVR.

UNIT 4: MULTI-STAGE AND POWER AMPLIFIERS Frequency response of an amplifier, R C coupled amplifier, low frequency response of RC coupled amplifier, various classes of operation (Class A, B, AB, C etc), their power efficiency.

UNIT 5: OSCILLATORS Review of the basic concept, Barkhausen criterion, RC oscillators (Phase Shift, Wein Bridge), LC oscillators (Hartley, Colpitt, Clapp), non-sinusoidal oscillators.

UNIT 6: OPERATIONAL AMPLIFIER Ideal and practical operational amplifier, inverting and non inverting amplifier, differential amplifier, offset error: voltage and current, common mode rejection ratio (CMRR).

UNIT 7: LINEAR & NONLINEAR APPLICATIONS OF OP-AMP Scale changer, phase shifter, adder, subtractor, integrator, differentiator, comparators, schimitt trigger, zero crossing detector, active filters, precision rectifier.

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

- Understand diodes as a device, rectifier circuits, and applications of diode as clipper and clamper circuits.
- Understand the concepts of transistor and their characteristics, analysis of transistor amplifier using h parameters.
- Describe the basic concept of biasing and different biasing techniques.
- Understand the concepts of FET, V-I characteristics and small signal model of FET. Also discuss biasing of FET and application of FET as VVR.
- Understand basics of Operational amplifier and their linear and non linear applications.

TEXT BOOKS:

1. Integrated Electronics: MilmanHalkias,TMH.
2. Operational Amplifiers: Gaikwad,PHI

REFERENCE BOOKS:

1. Electronic Circuit Analysis and Design (Second edition) : D.A.Neamen;TMH
2. Integrated Circuits: K RBotkar.
3. Linear Integrated Circuits : D R Chaudhary(WEL).
4. Electronics Devices & Circuits: Boylestad&Nashelsky ;Pearson.

ECP 403 **Microprocessors & Its Application**

L T P CR **Theory : 75**

3 0 0 3 **Class Work : 25**

Total : 100

Duration of Exam : 3 Hrs.

Course Objectives:

- To understand the architecture and operations of 8085 and 8086 microprocessor.
- To elaborate the addressing modes, instruction set and programming of 8085 & 8086.
- To introduce the various types of interrupts of 8085 and 8086 microprocessor.
- To comprehend various peripheral devices (8255, 8254, 8259 and 8257).
- To describe various methods of interfacing of Peripherals with 8085/8086 microprocessor.

Syllabus

UNIT 1.ARCHITECTURE OF 8085: Functional block diagram—Registers, ALU, Bus systems. Pin configuration, Timing and control signals, Machine cycle and timing diagrams. Interrupts—Types of interrupt, interrupt structure.

UNIT 2. PROGRAMMING OF 8085: Instruction format, Addressing modes, Instruction set. Development of assembly language programs

UNIT3. INTERFACING DEVICES: (a).The 8255 PPI chip: Architecture, pin configuration, control words, modes and Interfacing with 8085. (b). The 8254 PIC chip: Architecture, pin configuration, control words, modes and Interfacing with 8085.

UNIT 4. INTERRUPT AND DMA CONTROLLER: (a). The 8259 Interrupt controller chip: Architecture, pin configuration, control words, modes (b). The 8257 DMA controller chip: Architecture, pin configuration, control words, modes

UNIT 5. ARCHITECTURE OF 8086: Functional block diagram of 8086, details of sub-blocks such as EU, BIU, memory segmentation, physical address computations, pin configuration, program relocation, Minimum and Maximum modes of 8086— Block diagrams and machine cycles. Interrupts—Types of interrupt, interrupt structure.

UNIT 6. PROGRAMMING OF 8086: Instruction format, Addressing modes, Instruction set. Development of assembly language programs. Assembler directives.

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

1. Acquaint with the architecture and operations of 8085 and 8086 microprocessor

2. Elucidate the addressing modes, instruction set and programming of 8085 & 8086.
3. Recognize the various types of interrupts of 8085 and 8086 microprocessor
4. Explicate various peripheral devices (8255, 8254, 8259 and 8257)
5. Illustrate various methods of interfacing of Peripherals with 8085/8086 microprocessor

TEXT BOOKS:

1. Microprocessor Architecture, Programming & Applications with 8085: Ramesh S Gaonkar; Wiley Eastern Ltd.
2. Advanced Microprocessors and Peripherals by AK Ray & KM Bhurchandi, TMH Publications

REFERENCE BOOKS:

1. Microprocessors and interfacing: Hall; TMH
2. The 8088 & 8086 Microprocessors-Programming, interfacing, Hardware & Applications: Triebel& Singh; PHI
3. Microcomputer systems: the 8086/8088 Family: architecture, Programming & Design: Yu-Chang Liu & Glenn A Gibson; PHI.
4. Advanced Microprocessors and Interfacing: Badri Ram; TMH

ECP 404	**Data Structure using Python**		
L T P CR	**Theory**	**:**	**75**
3 0 0 3	**Class Work**	**:**	**25**
	Total	**:**	**100**
	Duration of Exam	**:**	**3 Hrs.**

Course Objectives:

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

MODULE 1: INTRODUCTION

Python: Python types, expressions, strings, lists, tuples. Python memory model: names, mutable and immutable values, Basic Terminologies: Elementary Data Organizations, Analysis of an Algorithm, Asymptotic Notations, Time-Space trade off.

Arrays: Operations: insertion, deletion, traversal etc

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, Tree operations on each of the trees and their algorithms with complexity analysis. Applications of Binary Trees.

MODULE 4: SORTING AND HASHING

Objective and properties of different sorting algorithms: Selection Sort, Bubble Sort, Insertion Sort, Quick Sort, Merge Sort, Heap Sort; Performance and Comparison among all the methods. Hashing and collision resolution. Graph: Basic Terminologies and Representations, Graph search and traversal algorithms and complexity analysis.

Course Outcomes:

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

ECP 405	**Digital System Design & Applications**		
L T P CR	**Theory**	**:**	**75**
3 0 0 3	**Class Work**	**:**	**25**
	Total	**:**	**100**
	Duration of Exam	**:**	**3 Hrs.**

Course Objectives:

- To understand and use of hardware description language, its various elements and design unit.
- To apply various modeling approaches in VHDL to model a combinational or sequential circuit.
- To apply various modeling approaches in Verilog to model a combinational or sequential circuit.
- To implement of state machines for various digital systems.

Syllabus

Unit 1: INTRODUCTION TO HDL: Design flow, Design Methodologies, Overview of Digital Design with HDL Evolution of CAD, emergence of HDLs, Capabilities of HDL, Model analysis. Introduction to VHDL and Verilog.

Unit 2: VHDL: Basic VHDL elements - Identifiers, data objects, data classes, data types, Operators, Entity declaration, Architecture body, various statements and constructs. Various types of modelings - Behavioral modeling, Dataflow modeling, Structural modeling. Generics, Configuration, Package declaration, package body.

Unit 3: Verilog: Basic Concepts, Lexical conventions, data types, system tasks, modules and module instances, compiler directives. Modules and Ports, Module definition, port declaration, connecting ports, Introduction to various modeling in Verilog.

Unit 4: COMBINATIONAL AND SEQUENTIAL CIRCUIT DESIGN: Modeling and Simulation of combinational and sequential circuits such as Multiplexers, Demultiplexers, encoders, decoders, code converters, comparators, flip-flops, Shift Registers, Counters and implementation of Boolean functions etc.

Unit 5: State Machines: Design of State Machines, Mealy and Moore Circuits, Example of Pattern Detector.

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

- Understand and use of hardware description language, its various elements and design unit.
- Apply various modeling approaches in VHDL to model a combinational or sequential circuit.
- Apply various modeling approaches in Verilog to model a combinational or sequential circuit.
- Implement of state machines for various digital systems.

Text Books:

1. "A VHDL Primer: Bhasker; Prentice Hall 1995.
2. Modern Digital Electronics- III Edition: R.P Jain; TMH (2003).
3. Verilog HDL: A Guide to Digital Design and Synthesis: Samir Palnitkar;PHI (Second Edition).

Reference Books:

1. IEEE Standard VHDL Language Reference Manual (1993).
2. Digital Design and Modelling with VHDL and Synthesis : KC Chang; IEEE Computer Society Press.
3. Digital System Design using VHDL : Charles. H.Roth ; PWS (1998).
4. "VHDL-Analysis &Modelling of Digital Systems :Navabi Z; McGraw Hill.
5. VHDL-IV Edition :Perry; TMH (2002)
6. Introduction to Digital Systems :Ercegovac. Lang & Moreno; John Wiley (1999).
7. Fundamentals of Digital Logic with VHDL Design : Brown and Vranesic; TMH (2000)

ECP 406	**Theory of Signal & System**		
L T P CR	**Theory**	**:**	**75**
3 0 0 3	**Class Work**	**:**	**25**
	Total	**:**	**100**
	Duration of Exam	**:**	**3 Hrs.**

Course Objectives:

- To introduce students about classification of signals and systems.
- To introduce students about Linear Time Invariant systems and their properties.
- To introduce students about properties of Fourier Transforms like CTFT, DTFT and DFT.
- To introduce students about Laplace Transform and z- Transform

Syllabus

Unit 1: Classification of signals and systems, Transformation of independent variable (Time), basic system properties: linearity(additivity and homogeneity), shift-invariance, causality, stability.

Unit 2: Linear Time-Invariant systems, properties of LTI systems, impulse response and step response, convolution, system representation through differential equations and difference equations, response to complex exponentials.

Unit 3: Continuous time Fourier Transform: properties of CTFT, Discrete-Time Fourier Transform: properties of DTFT, Discrete Fourier Transform (DFT), Parseval's Theorem, Sampling Theorem.

Unit 4: The z-Transform for discrete time signals and systems eigen functions, region of convergence, properties of z-transform, inverse z transform, applications of z – transform in the analysis of LTI system.

Unit 5: The Laplace Transform, notion of eigen functions of LTI system, properties of Laplace transform, relationship between Laplace transform and fourier transform, region of convergence, poles and zeros of system, Laplace domain analysis: solution to differential equations and system behavior.

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

- Analyze the signals and systems as continuous time and discrete time.
- Identify LTI system properties and behavior based on impulse response.
- Evaluate the spectral characteristics of signals and systems using CTFT, DTFT and DFT.
- Apply transform techniques to analyze the behavior of -continuous-time and discrete-time signals and systems.

Text/Reference Books:

- A.V. Oppenheim, A.S. Willsky and I.T. Young, "Signals and Systems", Prentice Hall, 1983.
- R.F. Ziemer, W.H. Tranter and D.R. Fannin, "Signals and Systems - Continuous and Discrete", 4th edition, Prentice Hall, 1998.
- Papoulis, "Circuits and Systems: A Modern Approach", HRW, 1980.
- Douglas K. Lindner, "Introduction to Signals and Systems", McGraw Hill International Edition: 1999.
- Simon Haykin, Barry van Veen, "Signals and Systems", John Wiley and Sons (Asia) Private Limited, 1998.

BSC 01	**Biology**		
L T P CR	**Theory**	**:**	**75**
2 1 0 3	**Class Work**	**:**	**25**
	Total	**:**	**100**
	Duration of Exam	**:**	**3 Hrs.**

Course Objectives:

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

1) "Genetics is to biology what Newton's laws are to Physical Sciences", 2) all forms of life have the same building blocks and yet the manifestations are as diverse as one can imagine, 3) without catalysis life would not have existed on earth, 4) molecular basis of coding and decoding (genetic information) is universal and that 5) fundamental principles of chemical and physical energy transactions are the same in physical/chemical and biological world.

Module 1.(2 hours)- 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. (3 hours)- 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. (4 hours)-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. (4 hours)-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. (4 Hours). 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. (4 hours)- 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. (5 hours). 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. (4 hours)- 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 CO2 + H2O (Glycolysis and Krebs cycle) and synthesis of glucose from CO2 and H2O (Photosynthesis). Energy yielding and energy consuming reactions. Concept of Energy charge

Module 9. (3 hours)- 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 (COs)

1. Classify enzymes and distinguish between different mechanisms of enzyme action.
2. Identify DNA as a genetic material in the molecular basis of information transfer.
3. Analyze biological processes at the reductionist level
4. Apply thermodynamic principles to biological systems.
5. Identify and classify microorganisms.

Textbooks/ 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

ECP 451	**Digital System Design Lab**		
L T P CR	**Theory**	**:**	**35**
0 0 2 1	**Class Work**	**:**	**15**
	Total	**:**	**50**

List of Experiments

1. Design all logic gates using VHDL.
2. Write VHDL programs for the following circuits, check the wave forms and the hardware generated

a)Half adder

b) Full adder

3. Write VHDL programs for the following circuits, check the wave forms and the hardware generated

a) Multiplexer

b) De-multiplexer

4. Write VHDL programs for the following circuits, check the wave forms and the hardware generated

a) Decoder

b) Encoder

5. Write a VHDL program for a Comparator and check the wave forms and the hardware generated
6. Write a VHDL program for a Code Converter and check the wave forms and the hardware generated
7. Write a VHDL program for a Flip-Flops and check the wave forms and the hardware generated
8. Write a VHDL program for an Up/Down counter and check the wave forms and the hardware generated.
9. Write a VHDL program for a Mod-n counter and check the wave forms and the hardware generated
10. Write VHDL programs for Shift Register check the wave forms and the hardware generated
11. Write a VHDL program for ALU of microcomputer and check the wave forms and the hardware generated
12. Implement any three (given above) on FPGA/CPLD kit
13. Implement above experiments using VERILOG also.

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

- Verify the operation of basic & universal gates and design & verify the standards of combinational circuits.
- Verify the operations of different type of flip flops and design the counters using flip flops for a given sequence.
- Verify the working of shift registers.
- Write experimental reports and work in a team in professional way

ECP 452	**Analog Electronic Circuit Lab**		
L T P CR	**Theory**	**:**	**35**
0 0 2 1	**Class Work**	**:**	**15**
	Total	**:**	**50**

List of Experiments

1. Study of Half wave & Full wave rectifiers.
2. Study of Diode as clipper and clamper.
3. Study of CE amplifier for voltage, current & Power gains and input, output impedances
4. Study of CC amplifier as a buffer
5. Design & realize inverting amplifier, non-inverting and buffer amplifier using 741 Op Amp.
6. Verify the operation of a differentiator circuit using 741 op amp and show that it acts as a high pass filter.
7. Verify the operation of a integrator circuit using 741 op amp and show that it ac ts as a low pass filter.
8. Design and verify the operations of op amp adder and subtractor circuits.
9. Design and realize Wein-bridge oscillator using op amp741
10. To design & realize Schmitt trigger using op amp741.
11. To design & realize square wave generator using op amp741.
12. To design & realize zero crossing detector using op amp741

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

- Understand the operation of half wave & full wave rectifier.
- Understand the application of diode experimentally.
- Understand the transistor as an amplifier.
- Implement amplifiers, differentiator, Integrator and active filters circuit using opamp.
- Design op-amp as Wein-Bridge Oscillator, Square Wave Generator, schimtt trigger and zero crossing detector.
- Write experimental reports and work in a team in professional way.

ECP 453	**Microprocessors & its Applications Lab**		
L T P CR	**Theory**	**:**	**35**
0 0 2 1	**Class Work**	**:**	**15**
	Total	**:**	**50**

List of Experiments

1. Study of architecture of 8085 & familiarization with its hardware, commands & operation of Microprocessor kit.
2. Write a program using 8085 and verify for :

   (i) Addition of two 8-bit numbers.

   (ii) Addition of two 8-bit numbers (with carry).
3. Write a program using 8085 and verify for :

   (i) 8-bit subtraction (display borrow)

   (ii) 16-bit subtraction (display borrow)
4. Write a program using 8085 for multiplication of two 8- bit numbers by repeated addition method. Check for minimum number of additions and test for typical data.
5. Write a program using 8085 for multiplication of two 8- bit numbers by bit rotation method and verify.
6. Write a program using 8085 for division of two 8- bit numbers by repeated subtraction method and test for typical data.
7. Write a program using 8085 for dividing two 8- bit numbers by bit rotation method and test for typical data.
8. Write a program using 8086 and verify for:

   (i) Finding the largest number from an array.

   (ii) Finding the smallest number from an array.
9. Write a program using 8086 for arranging an array of numbers in descending order and verify.
10. Write a program using 8086 for arranging an array of numbers in ascending order and verify.

11. Write a program for finding square of a number using look-up table and verify.
12. Write a program to interface microprocessor with 8253 to generate square wave. Use 8085/8086 microprocessor.
13. Write a program to interface microprocessor with 8253 to generate interrupt on terminal count. Use 8085/8086 microprocessor.
14. Write a program to interface a two digit number using seven-segment LEDs. Use 8085/8086 microprocessor and 8255 PPI.
15. Write a program to control the operation of stepper motor using 8085/8086 microprocessor and 8255 PPI.

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

- Identify various modules embedded on the kit.
- Write the assembly code for various operations on 8-bit and 16-bit numbers.
- Interface various peripherals with microprocessor and to write the program for same.
- Interface various devices such as seven segment LEDS & stepper motor with microprocessor through 8255 and to write the program for same.

ECP 454	**Data Structure using Python Lab**		
L T P CR	**Theory**	**:**	**35**
0 0 2 1	**Class Work**	**:**	**15**
	Total	**:**	**50**

List of Experiments

1 SEARCHING TECHNIQUES:

Write Python programs for implementing the following searching techniques.

a. Linear search

b. Binary search

c. Fibonacci search

2. SORTING TECHNIQUES

Write Python programs for implementing the following sorting techniques to arrange a list of integers in ascending order.

a. Bubble sort

b. Insertion sort

c. Selection sort

d. Quick sort

e. Merge sort

3. IMPLEMENTATION OF STACK AND QUEUE :Write Python programs to

a. Design and implement Stack and its operations using List.

b. Design and implement Queue and its operations using List.

4. APPLICATIONS OF STACK : Write Python programs for the following:

a. Uses Stack operations to convert infix expression into postfix expression.

b. Uses Stack operations for evaluating the postfix expression.

5. Implementation Of Single Linked List

6. Implementation Of Double Linked List

7. Implementation Of Stack Using Linked List

8. Implementation Of Queue Using Linked List

9. Implementation Of Binary Search Tree

10. Implementation Of Graph Traversal Techniques

Laboratory Outcomes

- To formulate the algorithms for simple problems
- To translate given algorithms to a working and correct program
- To be able to correct syntax errors as reported by the compilers
- To be able to identify and correct logical errors encountered at run time
- To be able to understand the concept of stack through program.
- To be able to understand the concept of Linked list through program.

B.TECH 3rd YEAR ELECTRONICS & COMPUTER ENGINEERING

(SEMESTER -V)

ECP 501	**Embedded System Design**	
L T P CR	**Theory:**	**75**
3 0 0 3	**Class Work:**	**25**
	Total:	**100**
	Duration of Exam:	**3 Hrs.**

Course Objectives:

- To teach the students about different components and blocks of embedded system
- To introduce the students about Architecture and Operations of 8051 Microcontroller
- To familiarize the students about timers and programming techniques of 8051
- To focus the students about Architecture and Operations of PIC Microcontroller
- To introduce the students about Timing diagram, Interrupts, Instruction set and Addressing modes of PIC Microcontroller
- To study of Interfacing of physical devices with microcontroller like SSD, LCD, Switches etc.

Syllabus

UNIT1. INTRODUCTION:

Different types of Micro-controllers, embedded micro-controller, external memory micro-controller, Processor architectures: Harvard vs Princeton, CISC vs. RISC, Micro-controller memory types. Development tools/environment, Intel Hex Format object files, debugging.

UNIT 2 ARCHITECTURE OF 8051:

Block diagram, pin Configuration, Functional descriptions of internal Units-- registers, PSW, internal RAM, ROM, Stack, Oscillator and Clock. Other features-- I/O Pins, Ports and Circuits, Counters and timers, Serial data transmission/reception. Interrupts--Timer flag interrupt, serial communication interrupt, External interrupt, software generated interrupts.

UNIT3. PROGRAMMING OF 8051:

Instruction format, addressing modes, Data transfer instructions, logical instructions, arithmetic instructions, Jump and Call instructions. Interrupts and interrupt handler subroutines. Development of assembly Language programs

UNIT4. ARCHITECTURE OF PIC:

Block diagram, pin Configuration, Functional descriptions of internal blocks program memory considerations, register file structure, registers, oscillators and clock. Other features--I/O Pins, Counters and timers, Watchdog timer, SPI port USART. Interrupts—Interrupt structure.

UNIT5. APPLICATION DESIGN & HARDWARE INTERFACING WITH 8051 &

PIC: Hardware Interfacing with LED, Seven segment LED, LCD, Switches and stepper motor.

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

- Learn embedded system, microcontrollers and its basis of classification.
- Understand the operation of microcontrollers 8051 and PIC.
- Memorize the working of different working blocks of microcontrollers 8051 and PIC.
- Understand the instruction set and addressing modes of microcontrollers 8051 and PIC.
- Realize different inbuilt features/ modules of 8051 and PIC and way of writing assembly language programs using instructions, features and interfacing devices.

Text Books

1. Design with PIC Micro-controller by John B. Peatman, Pearson.
2. The 8051 microcontroller and embedded system by M.A.Mazidi, PHI

REFERENCE BOOKS:

1. Programming and customizing the 8051 micro-controller- Predko,TMH.
2. Designing Embedded Hardware: John Catsoulis: Shroff Pub and Dist.
3. Programming embedded systems in C and C++: Michael Barr: Shroff Pub and distr.

CS 501	**Database Management Systems**	
L T P CR	**Theory:**	**75**
3 0 0 3	**Class Work:**	**25**
	Total:	**100**
	Duration of Exam:	**3 Hrs.**

Course Objectives:

- To understand the different issues involved in the design and implementation of a database system.
- To study the physical and logical database designs, database modeling, relational, hierarchical, and network models
- To understand and use data manipulation language to query, update, and manage a Database
- 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.
- To design and build a simple database system and demonstrate competence with the fundamental tasks involved with modeling, designing, and implementing a DBMS

Syllabus

Unit 1: Database system architecture:

Data Abstraction, Data Independence, Data Definition Language (DDL), Data Manipulation Language (DML). Data models: Entity-relationship model, network model, relational and object-oriented data models, integrity constraints, data manipulation operations.

Unit 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.

Unit 3: Storage strategies: Indices, B-trees, hashing.

Unit 4: Transaction processing: Concurrency control, ACID property, Serializability of scheduling, Locking and timestamp-based schedulers, multi-version and optimistic Concurrency Control schemes, Database recovery.

Unit 5: Database Security: Authentication, Authorization and access control, DAC, MAC and RBAC models, Intrusion detection, SQL injection.

Unit-6: Advanced topics: Object oriented and object relational databases, Logical databases, Web databases, Distributed databases, Data warehousing and data mining.

Course Outcomes

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

REFERENCES:

1. "Database System Concepts", 6th Edition by Abraham Silberschatz, Henry F. Korth, S. Sudarshan, McGraw-Hill.

2. "Principles of Database and Knowledge – Base Systems", Vol 1 by J. D. Ullman, Computer Science Press.

3. "Fundamentals of Database Systems", 5th Edition by R. Elmasri and S. Navathe, Pearson Education

4. "Foundations of Databases", Reprint by Serge Abiteboul, Richard Hull, Victor Vianu, Addison-Wesley

PCC-CS-403	**Operating System**		
L T P CR	**Theory**	**:**	**75**
3 0 0 3	**Class Work**	**:**	**25**
	Total	**:**	**100**
	Duration of Exam	**:**	**3 Hrs.**

Course Objectives:

- To learn the fundamentals of Operating Systems.
- To learn the mechanisms of OS to handle processes, threads and their communication.
- To know the components and management aspects of concurrency management viz.
- Mutual exclusion algorithms, deadlock detection algorithms and agreement protocols.
- To learn the mechanisms involved in memory management in contemporary OS.
- To gain knowledge on Input/Output management aspects of Operating systems.

Unit-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, Concept of Virtual Machine. Case study on UNIX and WINDOWS Operating System.

Unit-II: Processes

Definition, Process Relationship, Different states of a Process, Process State transitions, Process Control Block (PCB), Context switching Thread: Definition, Various states, Benefits of threads, Types of threads, Concept of multithreads, Process Scheduling: Foundation and 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; Multiprocessor scheduling: Real Time scheduling: RM and EDF.

Unit -III: Inter-process Communication

Critical Section, Race Conditions, Mutual Exclusion, Hardware Solution, Strict Alternation, Peterson's Solution, The Producer/Consumer Problem, Semaphores, Event Counters, Monitors, Message Passing, Classical IPC Problems: Reader's & Writer Problem, Dinning Philosopher Problem etc.

Unit IV: Deadlocks

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

Unit V: 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. Virtual Memory: Basics of Virtual Memory – Hardware and control structures – 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).

Unit VI: 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 (linear list, hash table), efficiency and performance. Disk Management: Disk structure, Disk scheduling - FCFS, SSTF, SCAN, C-SCAN, Disk reliability, Disk formatting, Boot-block, Bad blocks

Course Outcomes:

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

- Create processes and threads.
- Develop algorithms for process scheduling for a given specification of CPU utilization, Throughput, Turnaround Time, Waiting Time, and Response Time.
- 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.
- Design and implement file management system.
- For a given I/O device and OS (specify), develop the I/O management functions in OS as part of a uniform device abstraction by performing operations for synchronization between CPU and I/O controllers.

Reference Books:

1. Abraham Silberschatz, Peter Galvin, Greg Gagne, “Operating System Concepts Essentials”, 9th Edition, Wiley Asia Student Edition.

2. William Stallings, “Operating Systems: Internals and Design Principles”, 5th Edition, Prentice Hall of India.

3. Charles Crowley, “Operating System: A Design-oriented Approach”, 1st Edition, Irwin Publishing.

4. Gary J. Nutt, “Operating Systems: A Modern Perspective”, 2nd Edition, Addison-Wesley 5. Maurice Bach, “Design of the Unix Operating Systems”, 8th Edition, PHI

ECP 502	**Integrated Circuit Design**		
L T P CR	**Theory**	**:**	**75**
3 0 0 3	**Class Work**	**:**	**25**
	Total	**:**	**100**
	Duration of Exam	**:**	**3 Hrs.**

Course Objectives:

- To introduce the micro-electronics technology, design concepts, circuit properties and modeling of Very Large-Scale Integrated circuits.
- To learn the basics of MOS Circuit Design & modeling.
- To learn the basics of MOS process and fabrication Technology.
- To introduce both Circuits and System views on design together

Syllabus

Unit 1 Introduction to MOSFET

Basic MOS transistors, Enhancement mode and depletion mode transistor, Structure and Operation of MOSFET, MOSFET current-voltage characteristics. Current-voltage equations of n-channel and p-channel MOSFETs, Channel length modulation, substrate bias effect, Threshold voltage calculation, MOSFET Scaling, advantages and disadvantages of scaling, short channel effects.

Unit 2 Electrical Characteristics of MOSFET

Voltage transfer characteristics (VTC), Noise immunity and noise margins, critical voltage calculation, Resistive load inverter, static power consumption, Inverters with n-type MOSFET load, enhancement load nMOS inverter, depletion load nMOS inverter, CMOS Inverter circuit, Design of CMOS inverters,

Unit 3 Fabrication of MOSFETs

Fabrication process flow: Basic steps, fabrication of nMOS transistor, Fabrication of pMOS transistor, fabrication of n-type and p-type depletion transistors, CMOS fabrication: n-well process, p-well process and twin-tub process, Physical design of digital logic circuits using n-MOS and CMOS technology, stick diagram and layout design rules.

Unit 4 Dynamic Logic Circuits

Pass transistor logic, Transmission gate logic structures, CMOS dynamic logic structures, various issues in cascading of dynamic logic circuits, Domino CMOS logic, NORA CMOS logic, Zipper CMOS logic structures

Unit 5 Circuit Characterization and Performance Estimation

Resistance estimation, capacitance estimation, Delay time definition and delay calculation, Inverter delays: nMOS and CMOS, switching power dissipation of CMOS Inverters.

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

• Understand about the trends in semiconductor technology, and how it impacts scaling and performance.

• Analyze the electrical characteristics of MOS.

• Learn design rules, stick diagrams, Fabrication steps, Static and Switching characteristics of inverters

•. Familiarize MOS transistor as a switch, its capacitance and performance with ideal and non-ideal characteristics.

TEXT BOOKS :

1. Introduction to Digital Integrated Circuits :Rabaey, Chandrakasan & Nikolic.

2. Principles of CMOS VLSI Design : Neil H.E. Weste and Kamran Eshraghian; Pearson.

REFERENCE BOOKS :

1. Introduction to Digital Circuits :Rabaey LPE (PHI)

3. VLSI Technology: S.M. Sze; McGraw-Hill.

4. Integrated Circuits: K.R. Botkar; Khanna

MC 03 **Environmental Science**

L T P CR	**Theory**	**:**	**75**
2 0 0 0	**Class Work**	**:**	**25**
	Total	**:**	**100**
	Duration of Exam	**:**	**3 Hrs.**

Course Objectives

- 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.
- The students will be able to identify the natural resources and suitable methods for their conservation and sustainable development.
- The focus will be on awareness of the students about the importance of ecosystem and biodiversity for maintaining ecological balance.
- The students will learn about various attributes of pollution management and waste management practices.
- The course will also describe the social issues both rural and urban environment and environmental legislation.

Syllabus

Unit 1: THE MULTIDISCIPLINARY NATURE OF ENVIRONMENTAL STUDIES

Definition, scope and importance. Need for public awareness.

Unit 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.

Unit 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).

Unit 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.

Unit 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.

Unit 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.

Unit 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.

Unit 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

- The course is to will provide the students a detailed knowledge on the threats and challenges to the environment due to developmental activities.
- The students learned suitable methods for their conservation and sustainable development.
- The importance of ecosystem and biodiversity for maintaining ecological balance defined.
- The various attributes of pollution management and waste management practices learned.
- The course will also describe the social issues both rural and urban environment and environmental legislation.

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

OPEN ELECTIVES

OEL 501 **Smart Materials and Systems**

L T P CR	**Theory**	**:**	**75**
3 0 0 3	**Class Work**	**:**	**25**
	Total	**:**	**100**
	Duration of Exam	**:**	**3 Hrs.**

Course Objectives:

- To familiarize the students with the different smart materials and their characteristics.
- To expose the students to understand the functionalities through the mathematical equations.
- To teach the students about the significant features of smart materials in sensing, actuation and control.
- To teach the students to design and develop smart structures using smart material-based actuators and sensors.

Syllabus

Unit 1: Piezoelectric materials: Properties, Piezoelectricity, characteristics, applications, vibration control, health monitoring, energy harvesting.

Unit 2: Shape-memory materials: Properties, shape memory materials, characteristics, applications – vibration control, shape control, health monitoring.

Unit 3: Electro-Rheological (ER) fluids: Suspensions and ER fluids, ER phenomenon, charge migration mechanism, ER fluid actuators, applications of ER fluids.

Unit 4: Magneto-Rheological (MR) fluids: Composition of MR fluid, applications of Fluids.

Unit 5: Other smart materials and their applications: Magneto strictive materials, Electrostrictive materials, Magnetic Shape Memory Alloy, Composites, Ionic Polymer Metal Composites. Bio inspired engineering and micro electro mechanical systems using smart materials.

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

- Acquire knowledge about the smart materials, their characteristics and design aspects.
- Design, model and control smart materials-based structures/systems, through simulation and experimentation.
- Understand the various applications of smart materials.
- Analyze and design techniques, to offer solutions to industrial problems using smart materials.

Text Books:

1. Mukesh V Gandhi, Brian S Thompson, Smart Materials and Structures, Chapman & Hall Publishers, 1st Edition, 1992.
2. Mel Schwartz, Encyclopedia of smart materials, John Wiley and Sons, 1st Edition,2002.
3. Srinivasan A.V., Michael McFarland D., Smart Structures Analysis and Design, Cambridge University Press, 1st Edition,2010.
4. Culshaw B., Smart structures and Materials, Artech house, 1st Edition, 2004.
5. Leo, D.J. Engineering Analysis of Smart Material Systems, John Wiley & sons,1stEditon 2008.
6. R.C.Smith, smart material systems: model development, frontiers in applied mathematics, SIAM, 2005.
7. H.Janocha, Adaptronics and smart structures: Basics, Materials, Design,and Applications, springer, 2nd Edition, 2007.

Reference Material:

1. www.iop.org/sms
2. http:jim.sagepub.com.

OEL 502 **Electrical Measurement and Instrumentation**

L T P CR	**Theory**	**:**	**75**
3 0 0 3	**Class Work**	**:**	**25**
	Total	**:**	**100**
	Duration		**3 Hrs**

Course Objectives

- To introduce the fundamentals of various types of Instruments.
- To focus on the principle, working and applications of various types of measuring instruments.
- To introduce the principle, working and applications of various types of Wattmeters and Energy Meters.
- To study the principle, working and applications of various types of Instrument Transformers.
- To introduce the principle, working and applications of various types of AC and DC bridges.
- To introduce the various types of transducers and Electronics Instruments.

Syllabus

Unit 1: Analog Ammeters and Voltmeters: PMMC and MI Instruments, Construction,Torque Equation, Range Extension, Effect of temperature, Classification, Errors, Advantages and Disadvantages.

Unit 2: Analog Wattmeters and Power Factor Meters: Power and Power Factor,Electrodynamometer type wattmeter, power factor meter, Construction, theory, Shape of scale, torque equation, Advantages and disadvantages, active and reactive power measurement in single phase.

Unit 3: Analog Energy Meter: Single phase induction type energy meters, construction,theory, Operation, lag adjustments, Max Demand meters/indicators.

Unit 4: DC and AC Bridges: Measurement of resistance, Wheatstone Bridge, Kelvin‘sBridge, Kelvin‘s Double Bridge, Measurement of inductance, Capacitance, Maxwell‘s Bridge, Desauty Bridge, Anderson Bridge, Schering Bridge, Wien Bridge, Applications and Limitations.

Unit 5: Instrument Transformers: Current Transformer and Potential Transformer construction, theory, phasor diagram, errors, testing and applications.

Unit 6: Transducers: Transducers Measurement of Temperature, RTDs, LVDT, Strain Gauge, Piezoelectric Transducers, Hall effect sensors.

Unit 7: Electronic Instruments: Electronic Display Device, Digital Voltmeters, CRO,Digital Storage Oscilloscope, measurement of voltage and frequency, Lissajous Patterns.

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

- Compare performance of MC, MI and Dynamometer types of measuring instruments, Energy meters and CRO.
- Determine the circuit parameters using AC and DC bridges.
- Understand the principle and working of various types of Instrument Transformers.
- Select transducers for the measurement of various electrical quantities like temperature, displacement and strain
- Understand operating principles of electronic measuring instruments

TEXT BOOK:

1. A course in Electrical And Electronic measurement and instrumentation : A.K. Sawhney, DhanpatRai Publication.

REFERENCE BOOKS:

1. Electrical Measurements: E.W. Golding, TMH
2. Electrical and Electronic measurement and instrumentation: J.B. Gupta, Kataria and Sons.
3. Electronic instrumentation and measurement technique : W.D. Cooper & A.D. Helfrick
4. Measuring systems: E.O. Doeblin; TMH.

OEL504 Electromechanical Energy Conversion

L T P CR	**Theory**	**:**	**75**
3 0 0 3	**Class Work**	**:**	**25**
	Total	**:**	**100**
	Duration of Exam	**:**	**3 Hrs.**

Course Objectives:

- To provide the knowledge of the Energy balance equation, Principle of Electromechanical Energy Conversion, force & torque equations of singly excited magnetic system as well as dynamic equations.
- To explain construction, theory, working Principle of transformer, O.C., S.C. test, regulation & efficiency, auto-transformer, three phase transformer.
- To explain construction, theory, working principle of d.c. motors and generators, load characteristics, starting & speed control of d.c. motors.
- To explain construction, theory, working principle, phasor diagram, equivalent circuit, phasor diagram, load characteristics, introduction to single phase induction motors, stepper, servo, reluctance and universal motors.

Syllabus

UNIT 1 ELECTROMECHANICAL ENERGY CONVERSION:

Principles Of Force and torque in magnetic field system, energy balance, energy and force in singly excited magnetic field system, concept of co-energy, forces and torques in system with permanent magnets, dynamic equation.

UNIT 2 TRANSFORMERS:

Basic theory, construction , operation at no-load and full-load, equivalent circuit, phasor diagram, O.C. and S.C. tests for parameters determination, efficiency and regulation, auto-transformer, introduction to three-phase transformer ; Current and Potential Transformers : Principle, construction, analysis and applications.

UNIT 3 DC MACHINES:

Basic theory of DC generator, brief idea of construction, emf equation, load characteristics, basic theory of DC motor, concept of back emf, torque and power equations, load characteristics, starting and speed control of DC motors, applications.

UNIT 4 INDUCTION MOTOR:

Basic theory, construction, Phasor diagram, Equivalent circuit, Torque equation, Load characteristics, starting and speed control of induction motor, Introduction to single phase Induction motor and its applications, Fractional H.P. Motors, Introduction to stepper, servo reluctance and universal motors.

UNIT 5 SYNCHRONOUS MACHINES:

Construction and basic theory of synchronous generator, emf equation, model of generator, Phasor diagram, Regulation, Basic theory of synchronous motor, v-curves, synchronous condenser, applications.

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

- Know basics of various types of electric machines, singly excited magnetic field system, dynamic equations.
- Understand theory, various tests, calculate various parameters of transformers.
- Design d.c machine depending on the performance characteristics & use them in various applications.
- Understand the basic principles of Induction machines, synchronous machines and their characteristics.

TEXT BOOK:

1. Electrical Machines: Nagarath and Kothari; TMH

REFERENCE BOOKS:

1. Electrical Machines :P.S. Bimbhra; Khanna
2. Electrical Machines: Mukherjee and Chakravorti; Dhanpat Rai& Sons
3. Electrical Technology (Vol-II) : B.L Theraja; S. Chand.

OEL 506 **Solid & Structures**

L T P CR	**Theory**	**:**	**75**
3 0 0 3	**Class Work**	**:**	**25**
	Total	**:**	**100**
	Duration of Exam	**:**	**3 Hrs.**

Course Objectives

- To study about elastic behavior, stress and strain
- To understand thermal stress, load function and beams
- To familiarize stresses in beams and strain measurements
- To focus on slopes and deflection

Unit I Elastic Plastic Behavior: Introduction to elastic plastic behavior and its effects**.**

Unit II Axial Stress and Strain:

Concept of stress, strain, elasticity and plasticity; one-dimensional stress-strain relationships; Young's modulus of elasticity, shear modulus and Poisson's ratio; two-dimensional elasticity; isotropic and homogeneous materials; ductile and brittle materials; statically determinate and indeterminate problems, compound and composite bars; thermal stresses. Torsion of shafts; buckling of struts, concept of factor of safety.

Unit III Shear Force and Bending Moment Diagrams:

Types of load on beams, classification of beams; axial, shear force and bending moment diagrams: simply supported, overhung and cantilever beams subjected to any combination of point loads, uniformly distributed and varying load and moment, equation of condition, load function equation, qualitative analysis for two-dimensional frames.

Unit IV Bending & Shear Stresses in beams:

Derivation of flexural formula for straight beams, concept of second moment of area, bending stress calculation for beams of simple and built-up sections, Flitched beams. Shear stress formula for beams, shear stress distribution in beams **Transformation of Stress and Strain:** Transformation equations for plane stress and planestrain, Mohr's stress circle, relation between elastic constants, strain measurements, strain rosettes.

Unit V Deformations:

Governing differential equation for deflection of straight beams having constant flexural rigidity, double integration and Macaulay's methods for slopes and deflection, unit load method for deflection of trusses

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

- Evaluate axial stresses and strains in various determinate and indeterminate structural systems.
- Draw Shear Force Diagram and Bending Moment Diagram in various kinds of beams subjected to different kinds of loads.
- Calculate load carrying capacity of columns and struts and their buckling strength.
- Evaluate various kinds of stresses (axial, bending, torsional and shearing) in various structural elements due to different type of external loads.
- Determine deformations and deflections in various kinds of beams and trusses.

Text Books / Reference

- Popov, E.P. and Balan, T.A., Engineering Mechanics of Solids, Prentice Hall of India (2012).
- Singh, D.K., Mechanics of Solids, Pearson Education (2008).
- Shames, I. H. and Pitarresi, J. M., Solid Mechanics, Prentice Hall of India (1996).
- Crandall, S.H., Dahl, N.C. and Lardner, T.J., An Introduction to Mechanics of Solids, McGraw Hill International, Tokyo(1969).

OEL507 **Optimization Techniques**

L T P CR	**Theory**	**:**	**75**
3 0 0 3	**Class Work**	**:**	**25**
	Total	**:**	**100**
	Duration of Exam	**:**	**3 Hrs.**

Course Objectives:

- To familiarize the students about optimization concepts, formulation of engineering problems amenable to optimization.
- To introduce the students about the concepts for determination of maxima minima for functions of several variables.
- To learn the formulation of nonlinear optimization problems with equality & in equality constraints.
- To introduce the students about Uni-dimensional optimization.
- To study the multivariable optimization.
- To introduce the students about Dynamic programming & Geometric programming.

Syllabus

Unit I Introduction

Optimization concepts, Euclidean space, convex functions, gradient vector, Hessian matrix, formulation of engineering problems amenable to optimization, direct approach and indirect methods.

Unit II Classical optimization techniques

Maxima minima for functions of several variables, necessary and sufficient conditions, formulation of nonlinear optimization problems with equality and inequality constraints, solution techniques using Lagrange‟s multiplier and khun-tuckker conditions.

Unit III Dimensional optimization

Elimination methods, interpolation methods.

Unit IV Multivariable optimization

Methods of steepest descent, Newton Raphson methods,Fletcher power method, constrained optimization.

Unit V Various other techniques

Principle of optimality, solution for simple multistage problems, Dynamic Programming

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

- Understand the formulation of engineering problems amable to optimization using direct approach & indirect approach methods.
- Understand the nonlinear optimization problems along with their solution for various techniques.
- Understand elimination methods & interpolation methods used in Uni dimensional methods used in optimization.
- Understand the concepts of hill climbing, newton Raphson methods, Fletcher power method for multivariable optimization.
- Understand the solution for simple multistage problems using Dynamic programming & Geometric programming.

Text Books: S. S. Rao, “Optimization Techniques” , TMH

ESC 01 **Engineering Mechanics**

L T P CR **Theory : 75**

3 0 0 3 **Class Work : 25**

Total : 100

Duration of Exam : 3 Hrs.

Course Objective: -

- To study the introductory treatment of Engineering
- To give a working knowledge of statics with emphasis on force equilibrium and free body diagrams.
- To provide an understanding of the kinds of stress and deformation and how to determine them in a wide range of simple, practical structural problems.
- To give an understanding of the mechanical behavior of materials under various load conditions

Syllabus

Unit 1 Introduction to Engineering Mechanics

Force Systems Basic concepts, Particle equilibrium in 2-D & 3-D; Rigid Body equilibrium; System of Forces, Coplanar Concurrent Forces, Components in Space – Resultant- Moment of Forces and its Application; Couples and Resultant of Force System, Equilibrium of System of Forces, Free body diagrams, Equations of Equilibrium of Coplanar Systems and Spatial Systems; Static Indeterminacy

Unit 2 Friction covering

Types of friction, Limiting friction, Laws of Friction, Static and Dynamic Friction; Motion of Bodies, wedge friction, screw jack & differential screw jack.

Unit 3 Basic Structural Analysis covering

Equilibrium in three dimensions; Method of Sections; Method of Joints; How to determine if a member is in tension or compression; Simple Trusses; Zero force members; Beams & types of beams; Frames & Machines;

Unit 4 Centroid and Centre of Gravity

Centroid of simple figures from first principle, centroid of composite sections; Centre of Gravity and its implications; Area moment of inertia- Definition, Moment of inertia of plane sections from first principles, Theorems of moment of inertia, Moment of

inertia of standard sections and composite sections; Mass moment inertia of circular plate, Cylinder, Cone, Sphere, Hook.

Unit 5 Virtual Work and Energy Method

Virtual displacements, principle of virtual work for particle and ideal system of rigid bodies, degrees of freedom. Active force diagram, systems with friction, mechanical efficiency. Conservative forces and potential energy (elastic and gravitational), energy equation for equilibrium. Applications of energy method for equilibrium. Stability of equilibrium.

Unit 6 Review of particle dynamics

Rectilinear motion; Plane curvilinear motion (rectangular,path, and polar coordinates). 3-D curvilinear motion; Relative and constrained motion; Newton's 2nd law (rectangular, path, and polar coordinates). Work-kinetic energy power, potential energy.Impulse-momentum (linear, angular); Impact (Direct and oblique).

Unit 7 Introduction to Kinetics of Rigid Bodies

Basic terms, general principles indynamics; Types of motion, Instantaneous centre of rotation in plane motion and simple problems; D'Alembert's principle and its applications in plane motion and connected bodies Work energy principle and its application in plane motion of connected bodies; Kinetics of rigid body rotation.

Unit 8 Mechanical Vibrations

Basic terminology, free and forced vibrations, resonance and its effects; Degree of freedom; Derivation for frequency and amplitude of free vibrations without damping and single degree of freedom system, simple problems, types of pendulum, use of simple, compound and torsion pendulums

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

- Use scalar and vector analytical techniques for analyzing forces in statically determinate structures
- Apply fundamental concepts of kinematics and kinetics of particles to the analysis of simple, practical problems
- Apply basic knowledge of maths and physics to solve real-world problems, Understand measurement error, and propagation of error in processed data.

- Extend all of concepts of linear kinetics to systems in general plane motion (applying Euler's Equation and considering energy of a system in general plane motion, and the work of couples and moments of forces)
- Learn to solve dynamics problems. Appraise given information and determine which concepts apply, and choose an appropriate solution strategy; and Attain an introduction to basic machine parts such as pulleys and mass-spring systems.

Text/Reference Books:

1. Irving H. Shames (2006), Engineering Mechanics, 4th Edition, Prentice Hall
2. F. P. Beer and E. R. Johnston (2011), Vector Mechanics for Engineers, Vol I - Statics, Vol II, – Dynamics, 9th Ed, Tata McGraw Hill
3. R. C. Hibbler (2006), Engineering Mechanics: Principles of Statics and Dynamics, Pearson Press.
4. Andy Ruina and RudraPratap (2011), Introduction to Statics and Dynamics, Oxford University Press
5. Shanes and Rao (2006), Engineering Mechanics, Pearson Education,
6. Hibler and Gupta (2010),Engineering Mechanics (Statics, Dynamics) by Pearson Education
7. Reddy Vijaykumar K. and K. Suresh Kumar(2010), Singer’s Engineering Mechanics
8. Bansal R.K.(2010), A Text Book of Engineering Mechanics, Laxmi Publications

CS 504	**Database Management Systems Lab**		
L T P CR	**Theory**	**:**	**35**
0 0 2 1	**Class Work**	**:**	**15**
	Total	**:**	**50**

LIST OF EXPERIMENTS:

1. Creation of a database and writing SQL queries to retrieve information from the database.
2. Performing Insertion, Deletion, Modifying, Altering, Updating and Viewing records based on conditions.
3. Creation of Views, Synonyms, Sequence, Indexes, Save point.
4. Creating an Employee database to set various constraints.
5. Creating relationship between the databases.
6. Study of PL/SQL block.
7. Write a PL/SQL block to satisfy some conditions by accepting input from the user.
8. Write a PL/SQL block that handles all types of exceptions.
9. Creation of Procedures.
10. Creation of database triggers and functions
11. Mini project (Application Development using Oracle/ Mysql)
    a) Inventory Control System.
    b) Material Requirement Processing.
    c) Hospital Management System.
    d) Railway Reservation System.
    e) Personal Information System.
    f) Web Based User Identification System.
    g) Timetable Management System.
    h) Hotel Management System

OUTCOMES:

At the end of the course, the student should be able to:

- Design and implement a database schema for a given problem-domain
- Populate and query a database
- Create and maintain tables using PL/SQL.
- Prepare reports.

ECP 552	**Integrated Circuit Design Lab**			
L T P CR		**Class Work**	**:**	**15**
0 0 2 1		**Theory**	**:**	**35**
		Total	**:**	**50**

List of Experiments

1. To study the Tanner Tools-S-edit, T-spice, W-edit & L-edit
2. To simulate NMOS and PMOS at different Technologies. Obtain the I_D-V_{GS} and I_D-V_{DS} characteristics and extract the various parameters i.e Threshold voltage, Trans-conductance, drain current etc.
3. To study and perform the DC analysis of a CMOS inverter. Analyze the CMOS inverter by varying device ratio, supply voltage etc. and extract the various parameters
4. To study and perform the Transient analysis of a CMOS inverter
5. To study and perform the AC analysis of a CMOS Inverter
6. To Design & Simulate CMOS NAND gate & CMOS NOR gate. Perform transient analysis.
7. Design 1-bit half adder and verify the circuit using transient analysis.
8. Design Full adder and verify the circuit using transient analysis.
9. Design XOR and XNOR gate using dynamic CMOS logic circuits and verify its characteristics.
10. Design and simulate Layout of CMOS inverter and perform post layout analysis
11. Design CMOS transmission gate and perform all the analysis to verify its characteristics.
12. Design a multiplexer using 90 nm technology and perform all the analysis to verify its characteristics

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

- Simulate and generate VTC characteristics of CMOS inverter using Tanner tools.
- Generate the symbol of this inverter which can be used for further application.
- Perform the transient analysis of XOR gate, half adder, full adder, multiplexer and various other digital circuits using Tanner tools.
- Simulate the layout of CMOS inverter

  Write experimental reports and work in a team in professional way

B.TECH 3rd YEAR ELECTRONICS & COMPUTER ENGINEERING

(SEMESTER-VI)

ECP 601	**Mobile Communication**		
L T P CR	**Class Work**	**:**	**25**
3 0 0 3	**Theory**	**:**	**75**
	Total	**:**	**100**
	Duration of Exam	**:**	**3 Hrs.**

Course Objectives:

• To understand the students about various wireless communication systems

• To familiarize the students second generation cellular networks, third generation wireless networks and modern wireless communication systems.

• To introduce the students about cellular mobile systems

• To study the cellular system design fundamentals & Multiple Access Techniques for Wireless Communication

• To focus on the concepts of wireless networking

Syllabus

UNIT1. INTRODUCTION TO WIRELESS COMMUNICATION SYSTEMS: Evolution of mobile radio communications, examples of wireless comm. systems, paging systems, Cordless telephone systems, comparison of various wireless systems.

UNIT2. MODERN WIRELESS COMMUNICATION SYSTEMS: Second generation cellular networks, third generation wireless networks, wireless in local loop, wireless local area networks, Blue tooth and Personal Area networks.

UNIT3. INTRODUCTION TO CELLULAR MOBILE SYSTEMS: Spectrum Allocation, basic Cellular Systems, performance Criteria, Operation of cellular systems, analog cellular systems, digital Cellular Systems. ,architecture of GSM

UNIT4.CELLULAR SYSTEM DESIGN FUNDAMENTALS: Frequency Reuse, channel assignment strategies, handoff Strategies, Interference and system capacity, tracking and grade off service, improving coverage and capacity.

UNIT5.MULTIPLE ACCESS TECHNIQUES FOR WIRELESS COMMUNICATION: Introduction to Multiple Access, FDMA, TDMA, Spread Spectrum multiple Access, space division multiple access**,,**CDMA.

UNIT6. WIRELESS NETWORKING: Difference between wireless and fixed telephone networks, development of wireless networks, fixed network transmission hierarchy, traffic routing in wireless networks, wireless data services, common channel signaling,

ISDN (Integrated Services digital Networks), advanced intelligent networks**,**intelligent cell concept.

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

- Gain knowledge about technologies used in wireless communication.
- Understand need of evolution of mobile radio communication.
- Gain knowledge about GSM Cellular concept.
- Gain knowledge about multiple access techniques and fundamentals of Cellular system design.
- Gain knowledge about Wireless networking and ISDN.

TEXT BOOKS:

1. Wireless Communications: Theodore S. Rappaport; Pearsons.

2. Mobile Cellular Telecommunication: W.C.Y.Lee; McGraw Hill

REFERENCE BOOK:

1. Mobile Communications: Jochen Schiller; Pearson

ECC 04	**Digital Signal Processing**		
L T P CR	**Class Work**	**:**	**25**
3 0 0 3	**Theory**	**:**	**75**
	Total	**:**	**100**
	Duration of Exam	**:**	**3 Hrs.**

Course objectives:

• To study concept of basic signals and implementation of discrete time systems.

• To introduce concept of Z-transform, discrete Fourier Transform and FFT.

• To give exposure to students about design of FIR digital filter.

• To familiarize students with the concept of multirate signal processing and spectral estimation.

Syllabus

Unit 1: Discrete time signals: Sequences, representation of signals on orthogonal basis, Sampling and reconstruction of signals, Discrete systems attributes, Z-Transform, Analysis of LSI systems, frequency Analysis, Inverse Systems, Discrete Fourier Transform (DFT), Fast Fourier Transform Algorithm, Implementation of Discrete Time Systems

Unit 2: Design of FIR Digital filters: Window method, Park-McClellan's method, Design of IIR Digital Filters, Butterworth, Chebyshev and Elliptic Approximations, Low pass, Band pass, Band stop and High pass filters.

Unit 3: Effect of finite register length in FIR filter design, Parametric and non-parametric spectral estimation, Introduction to multirate signal processing, Application of DSP

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

- Represent signals mathematically in continuous and discrete time and frequency domain.
- Get the response of an LSI system to different signals.
- Design different types of digital filters for various applications.
- Understand multirate signal processing

Text/Reference Books:

1. S.K.Mitra, Digital Signal Processing: A computer based approach.TMH.

2. A.V. Oppenheim and Schafer, Discrete Time Signal Processing, Prentice Hall, 1989.

3. John G. Proakis and D.G. Manolakis, Digital Signal Processing: Principles, Algorithms and Applications, Prentice Hall, 1997.

4. L.R. Rabiner and B. Gold, Theory and Application of Digital Signal Processing, Prentice Hall, 1992.
5. J.R. Johnson, Introduction to Digital Signal Processing, Prentice Hall, 1992.
6. D.J.DeFatta, J. G. Lucas andW.S.Hodgkiss, Digital Signal Processing, John Wiley& Sons, 1988.

EC 602	**Computer Networks**			
L T P CR		**Class Work**	**:**	**25**
3 0 0 3		**Theory**	**:**	**75**
		Total	**:**	**100**
		Duration of Exam	**:**	**3 Hrs.**

Course Objectives:

- To give exposure to student that how data is transferred in computers.
- To understand the performance of a network.
- To study the basics of different layers of TCP/ & how information is transferred between them.
- To solve issues occurring at different layers.

Syllabus

Unit 1: Introduction to computer networks and the Internet: Application layer: Principles of network applications, The Web and Hyper Text Transfer Protocol, File transfer, Electronic ail, Domain name system, Peer-to-Peer file sharing, Socket programming, Layering concepts.

Unit 2: Switching in networks: Classification and requirements of switches, a generic switch, Circuit Switching, Time-division switching, Space-division switching, Crossbar switch and evaluation of blocking probability, 2-stage, 3-stage and n-stage networks, Packet switching, Blocking in packet switches, Three generations of packet switches, switch fabric, Buffering, Multicasting, Statistical Multiplexing

Unit 3: Transport layer: Connectionless transport, User Datagram Protocol, Connection oriented transport – Transmission Control Protocol, Remote Procedure Call.

Unit 4: Congestion Control and Resource Allocation: Issues in Resource Allocation, Queuing Disciplines, TCP congestion Control, Congestion Avoidance Mechanisms and Quality of Service.

Unit 5: Network layer: Virtual circuit and Datagram networks, Router, Internet Protocol, Routing algorithms, Broadcast and Multicast routing.

Unit 6: Link layer: ALOHA, Multiple access protocols, IEEE 802 standards, Local Area Networks, addressing, Ethernet, Hubs, Switches.

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

- Understand the concepts of networking thoroughly.
- Design a network for a particular application.
- Analyze the performance of the network.
- Understand various issues at different layers.

Text / Reference books:

1. J.F. Kurose and K. W. Ross, “Computer Networking – A top down approach featuring the Internet”, Pearson Education, 5th Edition

2. L. Peterson and B. Davie, “Computer Networks – A Systems Approach” Elsevier Morgan Kaufmann Publisher, 5th Edition.

3. T. Viswanathan, “Telecommunication Switching System and Networks”, Prentice Hall

4. S. Keshav, “An Engineering Approach to Computer Networking” , Pearson Education

5. B. A. Forouzan, “Data Communications and Networking”, Tata McGraw Hill, 4th Edition

6. Andrew Tanenbaum, “Computer networks”, Prentice Hall

7. D. Comer, “Computer Networks and Internet/TCP-IP”, Prentice Hall

8. William Stallings, “Data and computer communications”, Prentice Hall

MC 04 G	**Message of Bhagwat Gita**		
L T P CR	**Class Work**	**:**	**25**
2 0 0 0	**Theory**	**:**	**75**
	Total	**:**	**100**
	Duration of Exam	**:**	**3 Hrs.**

Pre- Requisite: NIL
Successive: NIL

Course 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.

Course Outcomes (COs): After completing this course the **s**tudent should be able to:
CO1- Realize the relevance of Bhagavad Gita today.
CO2- Relate Yoga to Devotion
CO3-Realize the duties and Responsibilities in the Society.

Course Contents:
Unit1
Introduction: Relevance of Bhagavad Gita Today- Background of Mahabharata.Arjuna Vishada Yoga: Arjuna's Anguish and Confusion- Symbolism of Arjuna's Chariot.Sankhya Yoga: Importance of Self- knowledge- Deathlessness: Indestructibility of Counciousness- Being Established in Wisdom- Qualities of Sthita- Prajna.

Unit 2
Karma Yoga: Yoga of Action- Living in the Present- Dedicated Action without Anxiety over Results- Concept of Swadharma.

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

Gunatraya Vibhaga Yoga: Dynamics of the Three Gunas: Tamas, Rajas, Sattava- Going Beyond the Three Gunas- Description of the Gunatheetha.
Recommended/ Reference Books:

1. Swami Chinmayananda, "The Holy Geeta", Central Chinmaya Mission Trust.
2. Swami Chinmayananda, "A Manual of Self Unfoldment", Central Chinmaya Mission Trust.

PROGRAM ELECTIVE-I

ECPEL 601	**Information Management System**		
L T P CR	**Class Work**	**:**	**25**
3 0 0 3	**Theory**	**:**	**75**
	Total	**:**	**100**
	Duration of Exam	**:**	**3 Hrs.**

Course objectives: Emphasis is on the need of information systems. Main focus is on E-R diagrams, relational database, concepts of normalization and de-normalization and SQL commands.

- To study the need of information systems.
- To understand E-R diagrams and relational database.
- To introduce the concepts of normalization and de-normalization.
- To come up with a detailed understanding of SQL and PL/SQL to implementation database applications

Syllabus

Unit I Introduction

Data, data processing requirement, desirable characteristics of an ideal data processing system, traditional file based system, its drawback, concept of data dependency, Definition of database, database management system, 3-schema architecture, database terminology, benefits of DBMS, Database development process - conceptual data modeling, logical database design, physical database design, database implementation, database maintenance.

Unit II Database Analysis

Conceptual data modeling using E-R data model -entities, attributes, relationships, generalization, specialization, specifying constraints. 5 – 6 practical problems based on E-R data model.

Unit III Relational Database

Relational data model: Introduction to relational database theory: definition of relation, relational model integrity rules, relational algebra and relational calculus.

Unit IV Relational Database Design

Normalization- 1NF, 2NF, 3NF, BCNF, 4NF and 5NF. Concept of De-normalization and practical problems based on these forms.

Unit VI Indexing of Data

Impact of indices on query performance, basic structure of an index, creating indexes with SQL, Types of Indexing and its data structures.

Unit VII Database Implementation

Introduction to SQL, DDL aspect of SQL, DML aspect of SQL – update, insert, delete & various form of SELECT- simple, using special operators, aggregate functions, group by clause, sub query, joins, co-related sub query, union clause, exist operator. PL/SQL - cursor, stored function, stored procedure, triggers, error handling, package.

Course Outcomes (CO): On completion of this course, the students will be able to

1. Analyze the Information Systems as socio-technical systems, its need and advantages as compared to traditional file based systems.
2. Comprehend architecture of DBMS, conceptual data modelling, logical database design and physical database design.
3. Analyze Database design using E-R data model by identifying entities, attributes, relationships, generalization and specialization along with relational algebra.
4. Apply and create Relational Database Design process with Normalization and De-normalization of data.
5. Demonstrate use of SQL and PL/SQL to implementation database applications with usage of DDL aspect of SQL, DML aspect of SQL, aggregate functions, group by clause, sub query, joins, co-related sub query and indexes, cursor, stored function and procedure, triggers etc.

Text Books:

1. H. F. Korth & Silverschatz, A., Database System Concepts, Tata McGraw Hill (2010), 6thed.
2. Elmasri & Navathe, Fundamentals of Database Systems, Addison-Wesley (2011), 6thed.

Reference Books:

1. Hoffer, Prescott, Mcfadden, Modern Database Management, Paperback International (2012), 11th ed.

2. Martin Gruber, Understanding SQL, BPB Publication (1994), Revised ed.

ECPEL 602	**ERP Information System**		
L T P CR	**Class Work**	**:**	**25**
3 0 0 3	**Theory**	**:**	**75**
	Total	**:**	**100**
	Duration of Exam	**:**	**3 Hrs.**

Course Objectives:

- To understand the basic concept of electronic transactions, types of business models and about customer relationship management.
- To study various types of business strategies and marketing strategies.
- To focus on various legal and ethical issues related to electronic transactions and also understating the concepts of IPR.
- To study in detail about various business processes, ERP implementations, various types of information systems, business intelligence and knowledge management.

Unit-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, creating an effective web presence, Marketing on the web: Web marketing strategies, communicating with different market segments, customer behavior and relationship intensity, advertising on the web, e-mail marketing, technology enabled CRM.

Unit-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.

Unit-3: Enterprise resource planning

Business functions, processes & data requirements, development of ERP systems, marketing information systems & sales order process, production & supply chain management information systems, accounting in ERP systems, human resource

processes with ERP, process modeling, process improvement and ERP implementations, Relationship between ecommerce and ERP.

Unit-4 ERP-Information System perspective

Evolution of Application Software Technology Management, EDP, MIS, DSS, OLAP, TPS, KBS, BPR, CRM, Business process re-engineering, Data ware house and Data mining, Business Intelligence and knowledge management.

Course Outcomes:

The students will be able to

- Identify the basic concepts of electronic transactions.
- Understand various types of business models and customer relationship management.
- Comprehend various business strategies and marketing strategies.
- Learn various legal and ethical issues related to electronic transactions.
- Comprehend intellectual property rights and its importance.
- Analyze various business process and ERP implementation.

Reference Books

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

PCC-CS-601	**Intelligent Systems**		
L T P CR	**Class Work**	**:**	**25**
3 0 0 3	**Theory**	**:**	**75**
	Total	**:**	**100**
	Duration of Exam	**:**	**3 Hrs.**

Course Objectives:

- To introduce the concepts of Artificial Intelligence (AI) with emphasis on its use to solve real world problems
- To focus on problems using the traditional algorithmic approach.
- To explore the essential theory behind methodologies
- To develop systems that demonstrate intelligent behaviour

Unit-1:

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

Unit -2:

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

Unit -3:

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

Unit -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.

Unit -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:

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

Reference Books:

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.

PEC-CS-S-601	**Software Engineering**		
L T P CR	**Class Work**	**:**	**25**
3 0 0 3	**Theory**	**:**	**75**
	Total	**:**	**100**
	Duration of Exam	**:**	**3 Hrs.**

Course Objectives:

- 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.
- To make the students understand project management concepts & their metrics.
- To make the students understand requirement engineering and its models (Information, functional, behavioral).
- Making the students understand to develop quality software, its maintenance & introduce about software reliability.

Syllabus

Unit 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.

Unit 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.

Unit 3: Requirements, Analysis And Specification

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

Unit 4: System Design

Design principles, the design process; Design concepts: Abstraction, refinement, modularity, software architecture, control hierarchy, structural partitioning, data structure, software

procedure, information hiding; Effective modular design: Functional independence, Cohesion, Coupling;

Unit 5: Software Testing and Maintenance

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

Unit 6: Software Quality Models and Standards

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

Course Outcomes: The student will be able to

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

Reference Books:

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

PEC-CS-A-602	**Computer Graphics**		
L T P CR	**Class Work**	**:**	**25**
3 0 0 3	**Theory**	**:**	**75**
	Total	**:**	**100**
	Duration of Exam	**:**	**3 Hrs.**

Course Objectives:

- Understand the basics of computer graphics, different graphics systems and applications of computer graphics.
- 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.
- Learning to use composite geometric transformations on graphical objects in 2D and 3D.
- 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.
- Study different techniques that help to remove the surfaces outside the view of user by understanding the concept of rendering.

Unit 1 Introduction to Computer Graphics

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.

Unit 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.

Unit 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.

Unit 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

Unit 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:

- Understand the basics of computer graphics, different graphics systems and applications of computer graphics.
- Implement the various algorithms for scan conversion and filling of basic objects and their comparative analysis.
- Apply geometric transformations on graphics objects and their application in composite form in 2D and 3D.
- 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.
- Apply different hidden surface removal algorithms to eliminate the surface outside the view world.

Reference Books

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.

Program Elective-II

ECPEL 603	**Microwave Engineering**		
L T P CR	**Class Work**	**:**	**25**
3 0 0 3	**Theory**	**:**	**75**
	Total	**:**	**100**
	Duration of Exam	**:**	**3 Hrs.**

Course Objectives:

•To study the concepts of waveguide

•To introduce the students about various types of Microwave Components

•To familiarize the students about various types of Microwave tubes and solid-state devices

•To study the various types of microwave measurements.

Syllabus

UNIT1 Waveguides

Introduction, comparison with transmission lines, propagation in TE & TM mode, rectangular wave guide, TEM mode in rectangular wave guide, characteristic impedance, introduction to circular waveguides and planar transmission lines.

UNIT2 Microwave Components

Directional couplers, tees, hybrid ring, S-parameters, attenuators, cavity resonators, mixers & detectors, matched Load, phase shifter, wave meter, and Ferrite devices: Isolators, circulators.

UNIT3 Microwave Tubes

Limitation of conventional tubes; Construction, operation and properties of Klystron amplifier, reflex Klystron, magnetron, TWT, BWO, crossed field amplifiers.

UNIT4 Microwave Solid State Devices

Varactor diode, Tunnel diode, Schottky diode, GUNN diode, IMPATT, TRAPATT and PIN diodes. MASER, parametric amplifiers.

UNIT5 Microwave Measurements

Power measurement using calorimeter & bolometers, measurement of SWR, frequency, wavelength and impedance. Microwave bridges.

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

•Understand the design and working of waveguide

•Describe and analyse the different microwave components.

•Describe and analyse the microwave tubes and the working of solid state devices.

•Understand of Microwave Measurement techniques.

TEXT BOOKS:

1. Microwave devices and circuits: Samuel Liao;PHI
2. Microwave devices & Radar Engg :M .Kulkarni;Umesh

REFERENCE BOOK:

1. Microwaves and Radar : A.K. Maini; Khanna

ECPEL 604	**Antenna and Wave Propagation**		
L T P CR	**Class Work**	**:**	**25**
3 0 0 3	**Theory**	**:**	**75**
	Total	**:**	**100**
	Duration of Exam	**:**	**3 Hrs.**

Course Objectives:

- To familiarize basic concepts and parameter of Antenna.
- To introduce Design and Analysis of various types of antennas.
- To introduce various types of practical Antennas viz microwave antenna, horn antenna, helical antenna, log periodic antenna, Loop antenna, broadband antenna.
- To design of broadside and end fire array, pattern multiplication, array tapering techniques, super directive array.
- To focus on various types of wave propagations.

Syllabus

UNIT1. INTRODUCTION:

Physical concept of Radiation in single wire, two wire, and dipole, Current Distribution on a thin wire antenna

UNIT2. ANTENNA PARAMETERS:

Radiation Pattern, Radiation Power Density, Radiation intensity, Directivity, Gain, Antenna efficiency, Beamwidth, Bandwidth ,Polarisation, Antenna Input Impedance, Elementary idea about self and mutual impedance, Radiation efficiency, Effective aperture, Antenna Temperature

UNIT3. ELEMENTAL LINEAR ANTENNA:

Retarded potential, Infinitesimal dipole, Current distribution of short dipole and half wave dipole, Far-field, Radiating near-field and reactive near-field region, Monopole and Half wave dipole

UNIT 4: PRACTICAL ANTENNA:

Microwave Antenna‘s-Antennas with parabolic reflectors, Horn Antenna's, Lens Antenna's, folded dipole - Yagi-uda Antenna, Helical Antenna, Discone antenna, Log-periodic Antenna, Loop antenna, Principle of Broad Band Antenna

UNIT5. ANTENNA ARRAY:

Array of two point sources, Array factor, n-element linear array with uniform amplitude and spacing, Analysis of Broadside array, Ordinary end-fire array, n-element linear array with non-uniform spacing, ,Analysis of Binomial and Dolph-Tschebyscheff array, Scanning Array, Superdirective array

UNIT6. PROPAGATION:

Ground waves, Space waves, effect of Earth, Duct formation, ionosphere, and sky waves.

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

- Understand the basics and parameter of antenna radiation
- Understand the design and analyses of linear and practical antenna
- Understand the design and analyses of antenna array
- Understand the wave propagation methods

TEXT BOOKS:

1. Antennas by J.D.Kraus, TMH Publications.
2. Antenna & Wave Propagation by K.D Prasad. Satya Publication

REFERENCES BOOKS :

1. Antenna & Radio wave propagation by CoIlin,TMH Publication
2. Electromagnetic Waves & Radiating Systems by Jordan &Balman, PHI Publications

PEC-CS-S-703	**Internet of Things**			
L T P CR		**Class Work**	**:**	**25**
3 0 0 3		**Theory**	**:**	**75**
		Total	**:**	**100**
		Duration of Exam	**:**	**3 Hrs.**

Course Objectives:

- To learn the basics of IOT.
- To analyze basic protocols of wireless and MAC.
- To familiarize with web of things.
- To get basic knowledge of resource management.

SYLLABUS

Unit 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).

Unit 2: NETWORK AND COMMUNICATION ASPECTS Wireless medium access issues, MAC protocol survey, Survey routing protocols, Sensor deployment & Node discovery, Data aggregation & dissemination.

Unit 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

Unit 4: RESOURCE MANAGEMENT IN IOT Domain specific applications of IoT, Home automation, Industry applications, Surveillance applications, Other IoT applications Clustering, Synchronization, Software agents.

Course Outcomes: On successful completion of the course, the student will:

1. Understand the concepts of Internet of Things
2. Analyze basic protocols network
3. Understand the concepts of Web of Things
4. 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"

ECPEL 605	**Remote Sensing**		
L T P CR	**Class Work**	**:**	**25**
3 0 0 3	**Theory**	**:**	**75**
	Total	**:**	**100**
	Duration of Exam	**:**	**3 Hrs.**

Course Objectives:

- To study basic concepts, components of Remote sensing, especially emphasis on radiation.
- To understand the concept of EMR interaction with atmosphere and earth materials
- To study about optical and microwave remote sensing.
- To provide an exposure to GIS and its practical applications

Syllabus

Unit I Remote Sensing:

Definition – Components of Remote Sensing – Energy, Sensor, Interacting Body - Active and Passive Remote Sensing – Platforms – Aerial and Space Platforms – Balloons, Helicopters, Aircraft and Satellites – Synoptivity and Repetivity – Electro Magnetic Radiation (EMR) – EMR spectrum – Visible, Infra-Red (IR), Near IR, Middle IR, Thermal IR and Microwave – Black Body Radiation - Planck's law – Stefan-Boltzmann law.

Unit-II EMR interaction with atmosphere and earth materials

Atmospheric characteristics – Scattering of EMR – Raleigh, Mie, Non-selective and Raman Scattering – EMR Interaction with Water vapour and ozone – Atmospheric Windows – Significance of Atmospheric windows – EMR interaction with Earth Surface Materials – Radiance, Irradiance, Incident, Reflected, Absorbed and Transmitted Energy Reflectance – Specular and Diffuse Reflection Surfaces- Spectral Signature – Spectral Signature curves – EMR interaction with water, soil and Earth Surface: Imaging spectrometry and spectral characteristics.

Unit-III Optical and microwave remote sensing

Satellites - Classification – Based on Orbits and Purpose – Satellite Sensors - Resolution – Description of Multi Spectral Scanning – Along and Across Track Scanners Description of Sensors in Landsat, SPOT, IRS series – Current Satellites - Radar – Speckle Back Scattering –

Side Looking Airborne Radar – Synthetic Aperture Radar – Radiometer – Geometrical characteristics ; Sonar remote sensing systems.

Unit-IV Geographic information system

GIS – Components of GIS – Hardware, Software and Organizational Context – Data – Spatial and Non-Spatial – Maps – Types of Maps – Projection – Types of Projection - Data Input – Digitizer, Scanner – Editing – Raster and Vector data structures – Comparison of Raster and Vector data structure – Analysis using Raster and Vector data – Retrieval, Reclassification, Overlaying, Buffering – Data Output – Printers and Plotters

Course Outcomes: On successful completion of the course, the student will:

- Understand the concepts, principles and applications of remote sensing.
- Analyze the EMR interaction
- Understand the applications of optical and microwave remote sensing, particularly the geometric and radiometric principles.
- Learn about GIS and its applications.

Text books

1) M.G. Srinivas (Edited by), Remote Sensing Applications, Narosa Publishing House, 2001. (Units 1 & 2).

2) Anji Reddy, Remote Sensing and Geographical Information Systems, BS Publications 2001 (Units 3, 4 & 5).

Reference Books

1) Jensen, J.R., Remote sensing of the environment, Prentice Hall, 2000.

2) Kang-Tsung Chang, ”Introduction to Geographic Information Systems”, TMH, 2002

3) Lille sand T.M. and Kiefer R.W., “Remote Sensing and Image Interpretation”, John Wiley and Sons, Inc, New York, 1987.

4) Burrough P A, “Principle of GIS for land resource assessment”, Oxford MischaelHord, "Remote Sensing Methods and Applications", John Wiley & Sons, New York, 1986.

5) Singal, "Remote Sensing", Tata McGraw-Hill, New Delhi, 1990.

OPEN ELECTIVE-II

OEL 601	**Virtual Instruments Design**		
L T P CR	**Class Work**	**:**	**25**
3 0 0 3	**Theory**	**:**	**75**
	Total	**:**	**100**
	Duration of Exam	**:**	**3 Hrs.**

Course Objectives:

- To introduce to the students about the interfacing techniques of various transducers.
- To expose the students to different signal conditioning circuits.
- To impart knowledge on the hardware required to build Virtual Instrument.
- To impart knowledge to build GUI for Virtual Instrument.

Syllabus

Unit 1: Transducer Interfacing: Interfacing techniques for the following transducers, Potentiometers, Temperature sensors, Thermocouple, RTD, Thermistors, Load cells, High and low range tension, Low and mid-range precision, Torque Sensors, Pressure sensors, Vibration Sensors, Acoustic Sensors, Automotive Sensors, Displacement sensors, Biomedical transducers.

Unit 2: Signal Conditioning: Filtering, Cold Junction Compensation, Amplification, Instrumentation Amplifier, Linearization, Circuit Protection, Ground loops, CMRR, Noise Reduction and Isolation, Attenuation, Multiplexing, Digital signal conditioning, IEEE1451 standards, Transducer Electronic Data Sheet (TEDS)

Unit 3: Data Acquisition and Hardware Selection: Overview of DAQ architecture, Analog IO & Digital IO, Finite and continuous buffered acquisition, Data acquisition with C language, Industrial Communication buses, Wireless network standards, Micro-controller selection parameters for a virtual instrument, CPU, code space (ROM), data space (RAM) requirements.

Unit 4: Real-Time OS for Small Devices: Small device real-time concepts, Resources, Sequential programming, Multitasking, RTOS, Kernels, Timing loops, Synchronization and scheduling, Fixed point analysis, Building embedded real-time application for small devices.

Unit 5: Graphical User Interface for Virtual Instrument: Building an embedded Virtual Instrument GUI, Text and Number display, GUI Windows management, Simulation, Display drivers, Creating and distributing applications, Examples of Virtual Instrument design using GUI in any of the applications like consumer goods, robotics, machine vision, and process control automation.

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

• Interface the target transducer to the signal conditioning board.

• Condition the acquired signal from the transducer to standard data formats.

• Select the most appropriate hardware for the virtual instrument to be built.

• Implement the real-time OS for the selected micro-controller and the GUI interface for the virtual instrument.

Text Books:

1. Daniel H. Sheingold, Transducer Interfacing Handbook – A Guide to Analog Signal Conditioning, Analog Devices Inc. 1980.

2. Kevin James, PC Interfacing and Data Acquisition - Techniques for Measurement, Instrumentation and Control, Newnes, 2000.

3. Timothy Wilmshurst, Designing Embedded Systems with PIC Microcontrollers- Principles and Applications, Elsevier, 2007.

PEC-ME-461	**Quality Management**		
L T P CR	**Class Work**	**:**	**25**
3 0 0 3	**Theory**	**:**	**75**
	Total	**:**	**100**
	Duration of Exam	**:**	**3 Hrs.**

Course Objectives:

To understand the principles of Quality management and application to the functioning of an Organization

Course contents

Unit-I: Quality Concepts: Evolution of Quality Control, concept change, TQM Modern concept, Quality concept in design, Review of design, Evolution of proto type. Control on Purchased Product: Procurement of various products, evaluation of supplies, capacity verification, Development of sources, procurement procedure. Manufacturing Quality: Methods and techniques for manufacture, inspection and control of product, quality in sales and services, guarantee, analysis of claims.

UNIT-II: Quality Management: Organization structure and design, quality function, decentralization, designing and fitting, organization for different type products and company, economics of quality value and contribution, quality cost, optimizing quality cost, seduction program. Human Factor in quality Attitude of top management, cooperation of groups, operators

attitude, responsibility, causes of apparatus error and corrective methods.

UNIT-III: Control Charts, Theory of control charts, measurement range, construction and analysis

of R charts, process capability study, use of control charts. Attributes of Control Chart, Defects, construction and analysis of charts, improvement by control chart, variable sample size, construction and analysis of C charts.

UNIT -IV: Defect's diagnosis and prevention defect study, identification and analysis of defects, correcting measure, factors affecting reliability, MTTF, calculation of reliability, building reliability in the product, evaluation of reliability, interpretation of test results, reliability control, maintainability, zero defects, quality circle.

UNIT –V: ISO-9000 and its concept of Quality Management, ISO 9000 series, Taguchi method, JIT in some details.

Course Outcomes: (Cos) At the end of the course, the student shall be able to:

Upon completion of this course, the students will get

1. Understand of Principle of Management

2. Develop skill of Planning

3. Explore purpose of Organizing

4. Know Controlling strategies.

Text / Reference Books:

1. Lt. Gen. H. Lal, ―Total Quality Management‖, Eastern Limited, 1990.

2. Greg Bounds, ―Beyond Total Quality Management‖, McGraw Hill, 1994.

3. Menon, H.G, ―TQM in New Product manufacturing‖, McGraw Hill 1992.

OEC-CS-601(I)	**Soft Skill & Interpersonal Communication**		
L T P CR	**Class Work**	**:**	**25**
3 0 0 3	**Theory**	**:**	**75**
	Total	**:**	**100**
	Duration of Exam	**:**	**3 Hrs.**

Course Objectives:

- To create awareness among the stock holders of the corporate world
- To understand interactive and need based modules
- To focus on various challenges of communication as well as behavioral skills faced by individuals at workplace and organizations
- To bridge the gaps through effective skills of interviews, group discussions, meeting management etc.

Syllabus

Unit 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.

Unit 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.

Unit 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

Unit 4: PRESENTATION AND INTERVIEW

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

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

Course Outcome: At the end of the course, the student shall be able to:

- To understand various challenges of communication as well as behavioral skills faced byindividuals at workplace and organizations
- To bridge the gaps through effective skills of interviews, group discussions, meeting management etc.
- Understand the importance of writing skills.

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.

OEL 606	**Principles of Control System**		
L T P CR	**Class Work**	**:**	**25**
3 0 0 3	**Theory**	**:**	**75**
	Total	**:**	**100**
	Duration of Exam	**:**	**3 Hrs.**

Course objectives

- To develop the theoretical aspects of Control systems and feedbacks.
- To provide essential knowledge to understand AC, DC servo meters.
- To analyze steady state analysis of control systems.
- To study the concepts of root locus and adding of zeros and poles
- To understand the frequency response analysis and specifications of control systems with transfer function.

Syllabus

UNIT1. INTRODUCTORY CONCEPTS:

System/Plant model, types of models, illustrative examples of plants and their inputs and outputs, servomechanism, regulating system, Synchros, AC and DC techo-generators, servomotors, stepper motors, & their applications, magnetic amplifier.linear time-invariant (LTI) system, time-varying system, causal system, open loop control system, closed loop control system, illustrative examples of open-loop and feedback control systems, continuous time and sampled data control systems. Effects of feedback on sensitivity (to parameter variations), stability, external disturbance (noise), overall gain etc. Introductory remarks about non-linear control systems.

UNIT2. MATHEMATICAL MODELLING:

Concept of transfer function, relationship between transfer function and impulse response, order of a system, block diagram algebra, signal flow graphs : Mason‘s gain formula & its application, characteristic equation, derivation of transfer functions of electrical and electromechanical systems. Transfer functions of cascaded and non-loading cascaded elements. Introduction to state variable analysis and design.

UNIT3. TIME DOMAIN ANALYSIS:

Typical test signals, time response of first order systems to various standard inputs, time response of 2nd order system to step input, relationship between location of roots of characteristics equation, w and wn, time domain specifications of a general and an under-damped 2nd order system, steady state error and error constants.Effect of adding pole-zero to a system,controllers.

UNIT 4: STABILITY IN TIME DOMAIN:

Necessary and sufficient conditions for stability, Hurwitz stability criterion, Routh stability criterion and relative stability, Root Locus technique for stability.

UNIT5. FREQUENCY DOMAIN ANALYSIS:

Relationship between frequency response and time-response for 2nd order system, polar, Nyquist, Bode plots, stability, Gain-margin and Phase Margin, relative stability, frequency response specifications.

UNIT6. COMPENSATION:

Necessity of compensation, compensation networks, application of lag and lead compensation.

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

- Determine transfer function models of electrical, mechanical and electromechanical systems analogy.
- Represent a set of algebraic equations by block diagram and signal flow graphs, determine specified transfer functions from block diagrams and graphical methods and to evaluate robustness/sensitivity of systems with and without feedback.
- Relate transient performance parameters, overshoot, ride time, peak time and settling time, to poles and zeros of transfer function for continuous systems, evaluate steady state error from transfer functions.
- Determine the stability of system by different time domain and frequency domain methods.

TEXT BOOKS:

1. Control System Engineering : I.J.Nagrath&M.Gopal; New Age
2. Modern Control Engg :K.Ogata; PHI.

REFERENCE BOOKS:

1. Automatic Control Systems: B.C.Kuo, PHI.
2. Control Systems - Principles &Design :Madan Gopal; Tata McGraw Hill.
3. Modern Control Engineering. R.C.Dorl & Bishop; Addison-Wesley

PEC-CS-D601	**Data Mining**		
L T P CR	**Class Work**	**:**	**25**
3 0 0 3	**Theory**	**:**	**75**
	Total	**:**	**100**
	Duration of Exam	**:**	**3 Hrs.**

Course Objectives:

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

Unit-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

Unit--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,

Unit--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.

Unit--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.

Unit--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:

- The students will be able to understand basic concepts of data warehouse and data mining, techniques and applications
- The students will be able to understand the techniques to extract patterns from transactional database using Association and Apriori algorithms
- The students will be able to understand different clustering techniques and will be able to cluster data sets
- The students will be able to classify data set into different classes and acquire the knowledge to make predications based on classified data

Reference Books

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.

ECC 53	**Digital Signal Processing Lab**		
L T P CR	**Class Work**	**:**	**15**
0 0 2 1	**Theory**	**:**	**35**
	Total	**:**	**50**

List of Experiments

Perform the experiments using MATLAB:

1. To represent basic signals (Unit step, unit impulse, ramp, exponential, sine and cosine).
2. To develop program for discrete convolution.
3. To develop program for discrete correlation.
4. To develop program for amplitude modulation.
5. To understand noise effected signal & get filter signal.
6. To understand stability test.
7. To understand sampling theorem.
8. To design analog filter(low-pass, high pass, band-pass, band-stop).
9. To design digital IIR filters(low-pass, high pass, band-pass, band-stop).
10. To design FIR filters using windows technique.
11. To design a program to compare direct realization values of IIR digital filter
12. To develop a program for computing parallel realization values of IIR digital filter.
13. To develop a program for computing cascade realization values of IIR digital filter
14. To develop a program for computing inverse Z-transform of a rational transfer function.
15. To understand DFT & IDFT.

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

- Implement various elementary signal function modules, standard sequences and computer the spectrums of various signals.
- Write a program for various operations of time signals using MATLAB.
- Write a program for the analysis of frequency response of LTI system.
- Implement the various types of filters.
- Implement the various structures of FIR & IIR filters.
- Write a program for calculating Z transform, inverse Z transform & its properties.

ECP 651	**Mobile Communication Lab**		
L T P CR	**Class Work**	**:**	**15**
0 0 2 1	**Theory**	**:**	**35**
	Total	**:**	**50**
	Duration of Exam	**:**	**3 Hrs.**

List of Experiments

1. Study & use of AT commands.

2. Study of voice call using AT command.

3. Sending message using AT command.

4. Study theory of direct sequence spread spectrum modulation & demodulation.

5. Generation of DSSS modulated signal.

6. Demodulation of DSSS modulated signal.

7. Introduction to parts of mobile phone

8. Measurement of test point voltages of mobile

9. Study & Observe waveforms at different test points of mobile

10. Study of switch faults

11. Study & use Video calling

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

- Understand the basics of AT commands.
- Understand the basics of direct sequence spread spectrum modulation & demodulation.
- Understand the basics of DSSS modulated signal.
- Understand the basics of switch faults and video calling.

EC 652	**Computer Networks Lab**			
L T P CR		**Class Work**	**:**	**15**
0 0 2 1		**Theory**	**:**	**35**
		Total	**:**	**50**
		Duration of Exam	**:**	**3 Hrs.**

List of Experiments

The socket programming can be done on Unix/Linux operating or/and Windows. Socket programming, and the language can be C/VC++ and/or Java

1. Write a program to implement parity check.
2. Write a program to implement hamming code.
3. Write a program to implement two dimensional parity checks.
4. Write a program to determine the type of IP Address.
5. Write a program to implement slotted aloha.
6. Write a program to make an FTP Client.
7. Write a program to implement an adhock network.
8. To make cross and normal cable connection.
9. To implement a socket address.
10. To implement a LAN.

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

- Understand & write the program to implement Parity Check, Hamming Code & Two Dimensional Parity Checks.
- Understand and write the program to determine the type of IP address & implement slotted aloha.
- Understand & write the program to implement an adhock network, socket address & local area network.
- Understand to make cross and normal cable connection.
- Understand & write the program to make an FTP client.
- Write experimental reports and work in a team in professional way.

B.TECH 4th YEAR ELECTRONICS & COMPUTER ENGINEERING

(SEMESTER -VII)

Program Electives-III

ECPEL 701	**Computer Vision**		
L T P CR	**Theory**	**:**	**75**
3 0 0 3	**Class Work**	**:**	**25**
	Total	**:**	**100**
	Duration of Exam	**:**	**3 Hrs.**

Course Objectives:

- To develop an understanding of the fundamentals of image formation, camera imaging geometry, feature detection and matching, multiview geometry including stereo, motion estimation and tracking, and classification.
- To gain an insight into the image formation and analysis, as well as the ability to extract information much above the pixel level.
- To acquire skills that can be applied while operating on images in a context-aware manner or where images from multiple scenarios need to be combined or organized

Unit 1: Digital Image Formation and low-level processing: Overview and State-of-the-art, Fundamentals of Image Formation, Transformation: Orthogonal, Euclidean, Affine, Projective, etc; Fourier Transform, Convolution and Filtering, Image Enhancement, Restoration, Histogram Processing.

Unit 2: Depth estimation and Multi-camera views: Perspective, Binocular Stereopsis: Camera and Epipolar Geometry; Homography, Rectification, DLT, RANSAC, 3-D reconstruction framework; Auto-calibration.

Unit 3: Feature Extraction: Edges - Canny, LOG, DOG; Line detectors (Hough Transform), Corners - Harris and Hessian Affine, Orientation Histogram, SIFT, SURF, HOG, GLOH, Scale-Space Analysis- Image Pyramids and Gaussian derivative filters, Gabor Filters and DWT.

Unit 4: Image Segmentation: Region Growing, Edge Based approaches to segmentation, Graph-Cut, Mean-Shift, MRFs, Texture Segmentation; Object detection.

Unit 5: Pattern Analysis: Clustering: K-Means, K-Medoids, Mixture of Gaussians, Classification: Discriminant Function, Supervised, Un-supervised, Semi-supervised; Classifiers: Bayes, KNN, ANN models; Dimensionality Reduction: PCA, LDA, ICA; Non-parametric methods.

Unit 6: Motion Analysis: Background Subtraction and Modelling, Optical Flow, KLT, Spatiotemporal Analysis, Dynamic Stereo; Motion parameter estimation.

Unit 7: Shape from X: Light at Surfaces; Phong Model; Reflectance Map; Albedo estimation; Photometric Stereo; Use of Surface Smoothness Constraint; Shape from Texture, color, motion and edges.

Course Outcomes:

After completion of course, students would be able to:

- Identify and describe fundamentals of image formation, camera imaging geometry, feature detection and matching, multi view geometry including stereo, motion estimation and tracking, and classification.
- Gain an insight into the image formation and analysis, as well as the ability to extract information much above the pixel level.
- Evaluate and compare images in a context-aware manner or where images from multiple scenarios need to be combined or organized.

Text/ References Books:

- Richard Szeliski, “Computer Vision: Algorithms and Applications,” Springer Verlag London Limited.
- D. A. Forsyth, J. Ponce, “Computer Vision: A Modern Approach,”Pearson Education.
- Richard Hartley and Andrew Zisserman, “Multiple View Geometry in Computer Vision,” Cambridge University Press.
- K. Fukunaga; “Introduction to Statistical Pattern Recognition,” Second Edition, Academic Press, Morgan Kaufmann.

ECPEL 702	**Data Analytics and Visualization**		
L T P CR	**Theory**	**:**	**75**
3 0 0 3	**Class Work**	**:**	**25**
	Total	**:**	**100**
	Duration of Exam	**:**	**3 Hrs.**

Course Objectives

- To understand data representation and description
- To introduce data analytics and pipeline
- To learn data mining techniques
- To analyze how to effectively visualize results

Syllabus

Unit 1 Data Representation

Data Objects and Attribute Types: Nominal, Binary, Ordinal, Numeric, Discrete and Continuous, Types of data: Record, Temporal, Spatial Temporal, Graph, Unstructured and Semi structured data, Basic Statistical Descriptions of Data.

Unit 2 Introduction to Data Analysis

Probability and Random Variables, Correlation, Regression.

Unit 3 Data Analysis Pipeline

Data pre-processing- Attribute values, Attribute transformation, Sampling, Dimensionality reduction: PCA, Eigen faces, Multidimensional Scaling, Non-linear Methods, Graph-based Semi-supervised Learning, Representation Learning Feature subset selection, Distance and Similarity calculation.

Unit 4 Data Mining Techniques for Analysis

Classification: Decision tree induction, Bayes classification, Rule-based classification, Support Vector Machines, Classification Using Frequent Patterns, k-Nearest-Neighbor, Fuzzy-set approach Classifier, Clustering: K-Means, k-Medoids, Agglomerative versus Divisive Hierarchical Clustering Distance Measures in Algorithmic Methods, Mean-shift Clustering

Unit 5 Visualization

Traditional Visualization, Multivariate Data Visualization, Principles of Perception, Color, Design, and Evaluation, Text Data Visualization, Network Data Visualization, Temporal Data Visualization and visualization Case Studies.

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

- Analyze and extract features of complex datasets.
- Evaluate and visualize inter-dependencies among variables in dataset.
- Apply techniques for classification and clustering in datasets.
- Develop and validate models for real life datasets.

Text Books:

1. Han, J., Kamber, M. and Pei, J., Data Mining Concepts and Techniques, Morgan Kaufmann (2011) 3rd Edition

2. Peng, D., R., R Programming for Data Science, Lulu.com (2012).

Reference Books:

1. Hastie, T., Tibshirani, R. and Friedman, J., The Elements of Statistical Learning, Springer (2009) 2nd Edition.

2. Simon, P., The Visual Organization: Data Visualization, Big Data, and the Quest for Better Decisions, John Wiley & Sons (2014).

ECPEL703	**Cloud Computing and Security**		
L T P CR	**Theory**	**:**	**75**
3 0 0 3	**Class Work**	**:**	**25**
	Total	**:**	**100**
	Duration of Exam	**:**	**3 Hrs.**

Course Objectives

- To provide comprehensive knowledge of fundamental concepts and of cloud computing.
- To provide an understanding of Service models, deployment models, Virtualization.
- To get the knowledge about the programming and software environments of Cloud
- To shed light on the security issues in Cloud.

Syllabus

Unit 1: Overview of Distributed Computing, Cluster Computing and Grid Computing, Technologies for Network based systems, Software environments for Distributed Systems and Clouds, Overview of Services and Service oriented Architecture.

Unit 2: Virtual Machines and Virtualization, Implementation levels of Virtualization, Virtualization structures/tools and Mechanisms, Virtualization of CPU, Memory and I/O Devices, Storage Virtualization.

Unit 3: Cloud Computing, Properties, challenges, Service models, IaaS, PaaS and SaaS Deployment models, Service Composition and orchestration, Architecture design of Compute and Storage cloud, Public Cloud Platforms, Inter Cloud Resource Management.

Unit 4: Cloud Programming and Software Environments, Parallel and Distributed Programming paradigms, Programming on AWS, Azure and GAE, Cloud software environments Eucalyptus, Open Stack, Open Nebula.

Unit 5: Cloud Security, Infrastructure security, Data security, Identity and access management Privacy, Audit and Compliance.

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

• Articulate the virtualization concepts

• Identify the architecture, service models and deployment models of Cloud

• Master the programming aspects of Cloud

• Determine security issues in cloud

Text Books

1. Kai Hwang, Geoffrey C, Fox and Jack J, Dongarra, “Distributed and Cloud Computing from Parallel Processing to the Internet of Things”, Morgan Kaufmann, Elsevier, 2012.

Reference Books

1. Barrie Sosinsky, “Cloud Computing Bible” John Wiley & Sons, 2010.

2. Tim Mather, SubraKumaraswamy, and ShahedLatif, “Cloud Security and Privacy An Enterprise Perspective on Risks and Compliance”, O'Reilly 2009.

PEC-CS-A-702	**Web & Internet Technology**		
L T P CR	**Theory**	**:**	**75**
3 0 0 3	**Class Work**	**:**	**25**
	Total	**:**	**100**
	Duration of Exam	**:**	**3 Hrs.**

Course Objectives:

- 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.
- To familiarize the student with the fundamental language of internet i.e. HTML
- To teach the student aware of the concepts of cascading style sheets
- To teach the student the students the basics of client side and Server side scripting

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

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

Reference Books

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.

PEC-CS-D-702(II)	**Information Retrieval**		
L T P CR	**Theory**	**:**	**75**
3 0 0 3	**Class Work**	**:**	**25**
	Total	**:**	**100**
	Duration of Exam	**:**	**3 Hrs.**

Course Objectives:

- To build an understanding of the fundamental concepts of Information Retrieval
- To understand the elements of Web Search Engines and Crawlers
- 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
- To understand dictionary compression and posting list compression and to introduce the scoring , tf-idf weighting and vector space model for scoring

Syllabus

MODULE-1: INTRODUCTION TO INFORMATION RETRIEVAL

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

MODULE-2: SEARCH ENGINES

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

MODULE-3: CRAWL SAND FEEDS

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

MODULE-4: INDEX CONSTRUCTION AND COMPRESSION

Hardware basics, Blocked sort-based indexing, Single-pass in-memory indexing, Distributed indexing, Dynamic indexing Index compression: Statistical properties of terms in information retrieval, Heaps' law: Estimating the number of terms, Zipf's law: Modeling the distribution of terms, Dictionary compression, Dictionary as a string, Blocked storage, Postings file compression

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

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

Course Outcomes:

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

- Understand basic Information Retrieval Systems and learn how Boolean queries are processed.
- 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
- 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
- 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

Reference Books

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/).

Program Electives-IV

ECEL704	**Optical Fiber Communication**		
L T P CR	**Theory**	**:**	**75**
3 0 0 3	**Class Work**	**:**	**25**
	Total	**:**	**100**
	Duration of Exam	**:**	**3 Hrs.**

Course Objectives:

- Introduce the concept of optical fiber communication, different models of optics.
- Introduce the concept of optical fiber characteristics (dispersion and attenuation) and
- understand fabrication of fibers and measurement techniques.
- Focus on the concept of optical sources (LED and LASER), photo detector, Optical switches and Optical amplifiers.
- Provide the basic concept of WDM, DWDM system and nonlinear effect on optical fibers.

Syllabus

Unit 1 Introduction to vector nature of light, propagation of light, propagation of light in a cylindrical dielectric rod, Ray model, wave model.

Unit 2 Different types of optical fibers, Modal analysis of a step index fiber, Signal degradation on optical fiber due to dispersion and attenuation, Fabrication of fibers and measurement techniques like OTDR.

Unit 3 Optical sources- LEDs and Lasers, Photo-detectors, pin-diodes, APDs, detector responsivity, noise, optical receivers, Optical link design, BER calculation, quantum limit, power penalties.

Unit 4 Optical switches-coupled mode analysis of directional couplers, electro-optic switches.

Unit 5 Optical amplifiers-EDFA, Raman amplifier.

Unit 6 WDM and DWDM systems, Principles of WDM networks.

Unit 7 Nonlinear effects in fiber optic links, Concept of self-phase modulation, group velocity dispersion and solution based communication.

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

- Understand the principles fiber-optic communication, the components and the bandwidth advantages.
- Understand the properties of the optical fibers and optical components.
- Understand operation of lasers, LEDs, and detectors.
- Analyze system performance of optical communication systems.

- Design optical networks and understand non-linear effects in optical fibers.

Text/Reference Books

1. J. Keiser, Fibre Optic communication, McGraw-Hill, 5th Ed. 2013 (Indian Edition).

2. T. Tamir, Integrated optics, (Topics in Applied Physics Vol.7), Springer-Verlag, 1975.

3. J. Gowar, Optical communication systems, Prentice Hall India, 1987.

4. S.E. Miller and A.G. Chynoweth, eds., Optical fibres telecommunications, Academic Press, 1979.

5. G. Agrawal, Nonlinear fibre optics, Academic Press, 2nd Ed. 1994.

6. G. Agrawal, Fiber optic Communication Systems, John Wiley and sons, New York, 1997.

7. F.C. Allard, Fiber Optics Handbook for engineers and scientists, McGraw Hill, New York (1990)

ECPEL704 Neural Networks and Soft Computing

L T P CR	**Theory**	**:**	**75**
3 0 0 3	**Class Work**	**:**	**25**
	Total	**:**	**100**
	Duration of Exam	**:**	**3 Hrs.**

Course Objectives:

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

Syllabus

Unit 1: Introduction to Soft Computing: Evolution of Computing: Soft Computing Constituents, From Conventional AI to Computational Intelligence: Machine Learning Basics.

Unit 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.

Unit 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

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

Unit 5: MATLAB: Study of neural network tool box and fuzzy logic tool box, Simple implementation of Artificial Neural Network and Fuzzy Logic.

Course Outcomes:

After completion of course, students would be able to:

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

Text/References Books:

1. George J. Klirand BoYuan,"Fuzzy Sets and Fuzzy Logic: Theory and Applications", PHI
2. Satish Kumar,"Neural Networks: A classroom approach" Tata McGrawHill.
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

ECPEL 705	**Wireless Sensor Networks and Applications**		
L T P CR	**Theory**	**:**	**75**
3 0 0 3	**Class Work**	**:**	**25**
	Total	**:**	**100**
	Duration of Exam	**:**	**3 Hrs.**

Course Objectives:

- To introduce designing of wireless sensor network applications.
- To familiarize the various research areas in wireless sensor networks.
- To study various MAC protocol used in WSN.
- To teach students how to explore new protocols for WSN.

Syllabus

Unit I: Characteristics Of WSN

Characteristic requirements for WSN - Challenges for WSNs – WSN vs Adhoc Networks - Sensor node architecture – Commercially available sensor nodes –Imote, IRIS, Mica Mote, EYES nodes, BTnodes, TelosB, Sunspot -Physical layer and transceiver design considerations in WSNs, Energy usage profile, Choice of modulation scheme, Dynamic modulation scaling, Antenna considerations.

Unit II: Medium Access Control Protocols

Fundamentals of MAC protocols - Low duty cycle protocols and wakeup concepts - Contention based protocols - Schedule-based protocols - SMAC - BMAC - Traffic-adaptive medium access protocol (TRAMA) - The IEEE 802.15.4 MAC protocol.

Unit III: Routing and Data Gathering Protocols

Routing Challenges and Design Issues in Wireless Sensor Networks, Flooding and gossiping – Data centric Routing – SPIN – Directed Diffusion – Energy aware routing - Gradient-based routing - Rumor Routing – COUGAR – ACQUIRE – Hierarchical Routing - LEACH, PEGASIS – Location Based Routing – GF, GAF, GEAR, GPSR – Real Time routing Protocols – TEEN, APTEEN, SPEED, RAP - Data aggregation - data aggregation operations - Aggregate Queries in Sensor Networks - Aggregation Techniques – TAG, Tiny DB.

Unit IV: Embedded Operating Systems

Operating Systems for Wireless Sensor Networks – Introduction - Operating System Design Issues - Examples of Operating Systems – TinyOS – Mate – MagnetOS – MANTIS - OSPM - EYES OS – SenOS – EMERALDS – PicOS – Introduction to Tiny OS – NesC – Interfaces and Modules- Configurations and Wiring - Generic Components -Programming in Tiny OS using NesC, Emulator TOSSIM.

Unit V: Applications of WSN

WSN Applications - Home Control - Building Automation - Industrial Automation - Medical Applications - Reconfigurable Sensor Networks - Highway Monitoring - Military Applications - Civil and Environmental Engineering Applications - Wildfire Instrumentation - Habitat Monitoring - Nanoscopic Sensor Applications – Case Study: IEEE 802.15.4 LR-WPANs Standard - Target detection and tracking - Contour/edge detection - Field sampling.

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

- Design wireless sensor networks for a given application
- Understand emerging research areas in the field of sensor networks
- Understand MAC protocols used for different communication standards used in WSN Explore new protocols for WSN

TEXT BOOKS

1.Kazem Sohraby, Daniel Minoli and Taieb Znati, "Wireless Sensor Networks Technology, Protocols, and Applications", John Wiley & Sons, 2007.

2.Holger Karl and Andreas Willig, "Protocols and Architectures for Wireless Sensor Networks", John Wiley & Sons, Ltd, 2005.

REFERENCE BOOKS

1.K. Akkaya and M. Younis, "A survey of routing protocols in wireless sensor networks", Elsevier Ad Hoc Network Journal, Vol. 3, no. 3, pp. 325--349

2.Philip Levis, " TinyOS Programming" 3.Anna Ha´c, "Wireless Sensor Network Designs", John Wiley & Sons Ltd,

ECPEL706	**Cognitive Radio**		
L T P CR	**Theory**	**:**	**75**
3 0 0 3	**Class Work**	**:**	**25**
	Total	**:**	**100**
	Duration of Exam	**:**	**3 Hrs.**

Course Objectives:

- Know the basics of the software defined radios.
- Learn the design of the wireless networks based on the cognitive radios
- Understand the concepts of wireless networks and next generation networks

Syllabus

Unit 1: Definitions and potential benefits, software radio architecture evolution, technology tradeoffs and architecture implications.

Unit 2: Essential functions of the software radio, basic SDR, hardware architecture, Computational processing resources, software architecture, top level component interfaces, interface topologies among plug and play modules.

Unit 3: Marking radio self-aware, cognitive techniques – position awareness, environment awareness in cognitive radios, optimization of radio resources, Artificial Intelligence Techniques.

Unit 4: Cognitive Radio – functions, components and design rules, Cognition cycle – orient, plan, decide and act phases, Inference Hierarchy, Architecture maps, Building the Cognitive Radio Architecture on Software defined Radio Architecture.

Unit 5: The XG Network architecture, spectrum sensing, spectrum management, spectrum mobility, spectrum sharing, upper layer issues, cross – layer design.

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

- Describe the basics of the software defined radios
- Design the wireless networks based on the cognitive radios
- Explain the concepts behind the wireless networks and next generation networks

Text/Reference Books:

1. Joseph Mitola III,"Software Radio Architecture: Object-Oriented Approaches to Wireless System Engineering", John Wiley & Sons Ltd. 2000.
2. Thomas W.Rondeau, Charles W. Bostain, "Artificial Intelligence in Wireless communication", ARTECH HOUSE .2009.
3. Bruce A. Fette, "Cognitive Radio Technology", Elsevier, 2009.
4. Ian F. Akyildiz, Won – Yeol Lee, Mehmet C. Vuran, Shantidev Mohanty, "Next generation / dynamic spectrum access / cognitive radio wireless networks: A Survey" Elsevier Computer Networks, May 2006.

ECPEL 707	**Digital Image Processing and Analysis**		
L T P CR	**Theory**	**:**	**75**
3 0 0 3	**Class Work**	**:**	**25**
	Total	**:**	**100**
	Duration of Exam	**:**	**3 Hrs.**

Course Objectives:

- To introduce the students with the fundamentals of digital image processing techniques as well as image transform and their properties.
- To introduce about various techniques of Image Enhancements and restoration.
- To give exposure to students regarding color image processing.
- To introduce the students about various techniques of Image Compression and segmentation.

Syllabus

Unit 1: Digital Image Fundamentals: Elements of digital image processing, Visual perception, image sampling and quantization, basic relationships between pixels-neighbourhood, adjacency, connectivity, distance measures.

Unit 2: Image Transforms: Two dimensions DFT and its inverse, properties of DFT, Fast fourier transform, Discrete cosine transform, Hadmard transform, Walsh transform, Haar transform.

Unit 3: 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, frequency domain filters, low-pass and high-pass.

Unit 4: Color Image Processing: Color models–RGB, YUV, HSI; Color transformations–formulation, color complements, color slicing, tone and color corrections; Color image smoothing and sharpening.

Unit 5: Image Restoration: Degradation model, digitalization of circulate and block circulate metrics, Algebraic approved inverse filtering, wiener filter, constrained least square restoration, Interactive restoration in spatial domain.

Unit 6: Image Segmentation: Detection of discontinuities, point detection, Line detection, Edge detection, edge linking and boundary detection, thresholding – global and adaptive, region-based segmentation.

Unit 7: Image Compression: Lossless and lossy compression, Huffman coding, Run length coding, Arithmetic coding, Still image compression standards, JPEG and JPEG-2000.

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

- Mathematically represent the various types of images and analyze them.
- Understand the concepts of digital Image processing fundamentals and image transforms and their properties.
- Process these images for the enhancement of certain properties or for optimized use of the resources.
- Develop algorithms for image compression and coding.

Text Books:

1. Anil K Jain, "Fundamentals of Digital Image Processing", PHI Edition 1997.
2. Keenneth R Castleman, “Digital Image Processing", Pearson

Reference Books:

1. Rafael C. Gonzalez and Richard E. Woods, "Digital Image Processing",
2. Pearson Chanda& Majumder, "Digital Image Processing &Analysis", PHI

ECPEL 708	**Information & Coding Theory**		
L T P CR	**Theory**	**:**	**75**
3 0 0 3	**Class Work**	**:**	**25**
	Total	**:**	**100**
	Duration of Exam	**:**	**3 Hrs.**

Course Objectives:

- To study the concept of information, measurement and entropy.
- To impart the knowledge to analyse different types of channels and their capacity.
- To understand the concept of Gaussian channel and Gaussian theorem.
- To familiarize the different types of encoders for source coding.

Syllabus

Unit-I Information Theory

Definition of Information, Entropy, Mutual Information, Properties of Mutual Information, Fundamental Inequality, I.T. Inequality, Divergence, Properties of Divergence, Divergence Inequality, Relationship between entropy and mutual information, Chain Rules for entropy, relative entropy and mutual information. Channel Capacity: Uniform Dispersive Channel, Uniform Focusing Channel, Strongly Symmetric Channel, Binary Symmetric Channel, Binary Erasure Channel. Channel Capacity of the all these channels, Channel Coding Theorem, Shannon-Hartley Theorem. Data Compression: Kraft inequality, Huffman codes, Shannon-Fano coding, Arithmetic Coding

Unit-II Linear Block Codes

Systematic linear codes and optimum decoding for the binary symmetric channel;Generator and Parity Check matrices, Syndrome decoding on symmetric channels; Hamming codes; Weight enumerators and the MacWilliams identities; Perfect codes. Cyclic Codes,BCH codes; Reed-Solomon codes, Justeen codes, MDS codes, Alterant, Goppa and generalized BCH codes; Spectral properties of cyclic codes

Unit-III Decoding of BCH codes

Berlekamp's decoding algorithm, Massey's minimum shift register synthesis technique and its relation to Berlekamp's algorithm. A fast Berlekamp – Massey algorithm. Convolution codes Wozencraft's sequential decoding algorithm, Fann's algorithm and other sequential decoding algorithms; Viterbi decoding algorithm, Turbo Codes, Concatenated Codes.

Course Outcomes

- Understand the concept of information, measurement and entropy.
- Learn different types of channels and their capacity.
- Grasp the various algorithms used for coding

Books Recommended

1. F.J. MacWilliams and N.J.A. Slone, The theory of error correcting codes,North Holland, 1977.

2. R.E. Balahut, Theory and practice of error control codes, Addison Wesley, 1983.

3. Thomas M. Cover, Joy A. Thomas, “Elements of Information Theory”, Wiley Publishers.

4. Ranjan Bose,” Information Theory Coding, Cryptography”, TMH Publication.

Program Elective-V

ECPEL 709	**Machine Learning**		
L T P CR	**Theory**	**:**	**75**
3 0 0 3	**Class Work**	**:**	**25**
	Total	**:**	**100**
	Duration of Exam	**:**	**3 Hrs.**

Course objectives:

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

Syllabus

Unit I Introduction

Well-Posed learning problems, Basic concepts, Designing a learning system, Issues in machine learning. Types of machine learning: Learning associations, Supervised learning (Classification and Regression Trees, Support vector machines), Unsupervised learning (Clustering), Instance-based learning (K-nearest Neighbor, Locally weighted regression, Radial Basis Function), Reinforcement learning (Learning Task, Q-learning, Value function approximation, Temporal difference learning).

Unit II Decision Tree Learning

Decision tree representation, appropriate problems for decision tree learning, Univariate Trees (Classification and Regression), Multivariate Trees, Basic Decision Tree Learning algorithms, Hypothesis space search in decision tree learning, Inductive bias in decision tree learning, Issues in decision tree learning. Bayesian Learning: Bayes theorem and concept learning, Bayes optimal classifier, Gibbs algorithms, Naive Bayes Classifier, Bayesian belief networks, The EM algorithm.

Unit III Artificial Neural Network

Neural network representation, Neural Networks as a paradigm for parallel processing, Linear discrimination, Pairwise separation, Gradient Descent, Logistic discrimination, Perceptron, Training a perceptron, Multilayer perceptron, Back propagation Algorithm. Recurrent Networks, dynamically modifying network structure.

Unit IV Genetic Algorithms

Basic concepts, Hypothesis space search, Genetic programming, Models of evolution and

learning, Parallelizing Genetic Algorithms.

Unit V Inductive and Analytical Learning

Learning rule sets, Comparison between inductive and analytical learning, Analytical learning with perfect domain theories: Prolog-EBG. Inductive Analytical approaches to learning, Using prior knowledge to initialize hypothesis (KBANN Algorithm), to alter search objective (Tangent Prop and EBNN Algorithm), to augment search operators (FOCL Algorithm).

Unit VI Design and Analysis of Machine Learning Experiments

Guidelines for machine learning experiments, Factors, Response, and Strategy of experimentation, Cross-Validation and Resampling methods, measuring classifier performance, Hypothesis testing, assessing a classification algorithm's performance, Comparing two classification algorithms, Comparing multiple algorithms: Analysis of variance, Comparison over multiple datasets.

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

1. Analyze methods and theories in the field of machine learning and provide an introduction to the basic principles, techniques, and applications of machine learning, classification tasks, decision tree learning.
2. Apply decision tree learning, Bayesian learning and artificial neural network in real world problems.
3. Understand the use of genetic algorithms and genetic programming.
4. Apply inductive and analytical learning with related domain theories.
5. Compare different learning models and algorithms and utilize existing machine learning algorithms to design new algorithms.

Text Books/ Reference Books:

1. Mitchell M., T., Machine Learning, McGraw Hill (1997) 1stEdition.
2. Alpaydin E., Introduction to Machine Learning, MIT Press (2014) 3rdEdition.
3. Bishop M., C., Pattern Recognition and Machine Learning, Springer-Verlag (2011) 2ndEdition.
4. Michie D., Spiegelhalter J. D., Taylor C. C., Campbell, J., Machine Learning, Neural and Statistical Classification. Overseas Press (1994).

ECEL 706	**Mixed Signal Design**		
L T P CR	**Theory**	**:**	**75**
3 0 0 3	**Class Work**	**:**	**25**
	Total	**:**	**100**
	Duration of Exam	**:**	**3 Hrs.**

Course Objectives:

- To familiarize the concept of signal processing of analog & digital signals.
- To introduce the concept of switched capacitor filters & its application in various areas
- To familiarize the various conversion techniques.
- To introduce the concept of data transmission on integrated circuits.

Syllabus

Unit 1: Analog and discrete-time signal processing, introduction to sampling theory, Analog continuous time filters, passive and active filters, Basics of analog discrete-time filters and Z transform.

Unit 2: Switched, capacitor filters, Non-idealities in switched-capacitor filters, Switched-capacitor filter architectures, Switched-capacitor filter applications.

Unit 3: Basics of data converters, Successive approximation ADCs, Dual slope ADCs, Flash ADCs, Pipeline ADCs, Hybrid ADC structures, High-resolution ADCs, DACs.

Unit 4: Mixed-signal layout, Interconnects and data transmission, Voltage-mode signaling and data transmission, Current-mode signaling and data transmission.

Unit 5: Design Introduction to frequency synthesizers and synchronization, Basics of PLL, Analog PLLs, Digital PLLs, DLLs.

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

- Understand the practical situations where mixed signal analysis is required.
- Analyze and handle the inter-conversions between signals.
- Design systems involving mixed signals
- Design various type of high speed & low power interconnects & frequency synthesizers.

Text/Reference Books:

1. R. Jacob Baker, CMOS mixed-signal circuit design, Wiley India, IEEE press, reprint 2008.
2. 2. Behzad Razavi , Design of analog CMOS integrated circuits, McGraw-Hill, 2003.

3. R. Jacob Baker, CMOS circuit design, layout and simulation, Revised second edition, IEEE press, 2008.
4. Rudy V. dePlassche, CMOS Integrated ADCs and DACs, Springer, Indian edition, 2005.
5. Arthur B. Williams, Electronic Filter Design Handbook, McGraw-Hill, 1981.
6. R. Schauman, Design of analog filters by, Prentice-Hall 1990 (or newer additions).
7. M. Burns et al., An introduction to mixed-signal IC test and measurement by, Oxford university press, first Indian edition, 2008.

ECPEL 710	**Mobile Application Development**		
L T P CR	**Theory**	**:**	**75**
3 0 0 3	**Class Work**	**:**	**25**
	Total	**:**	**100**
	Duration of Exam	**:**	**3 Hrs.**

Course Objectives:

- Introduction and characteristics of mobile applications.
- Application models of mobile application frameworks.
- Managing application data and User-interface design for mobile applications.
- Integrating with cloud services.
- Integrating networking, the OS and hardware into mobile-applications.
- Addressing enterprise requirements in mobile applications – performance, scalability, modifiability, availability and security.
- Testing methodologies for mobile applications– Publishing, deployment, maintenance and management.

Syllabus

Unit 1: Introduction to Mobile Computing, Introduction to Android Development Environment, Mobile devices vs. desktop devices, ARM and intel architectures, Power Management, Screen resolution, Touch interfaces, Application deployment, App Store, Google Play, Windows Store, Development environments: XCode, Eclipse, VS2012, PhoneGAP, etc.; Native vs. web applications. Factors in Developing Mobile Applications: Mobile Software Engineering, Frameworks and Tools, Generic UI Development, Android User; Graphics and Multimedia: Performance and Multithreading, Graphics and UI Performance, Android Graphics, Mobile Agents and Peer-to-Peer Architecture, Android Multimedia..

Unit 2: Comparing and contrasting architectures of all three – Android, iOS and Windows, Underlying OS, Kernel structure and native level programming. Approaches to power management, Security. Android/iOS/Win 8 Survival and basic apps: Building a simple "Hello World" App in all three applications, App-structure, built-in Controls, file access, basic graphics. Platforms and Additional Issues: Development Process, Architecture, Design, Technology Selection, Mobile App Development Hurdles, Testing.

Unit 3: DB access, network access, contacts/photos/etc. Underneath the frameworks: Native level programming on Android, Low-level programming on (jailbroken) iOS, Windows low level APIs. Intents and Services: Android Intents and Services, Characteristics of Mobile Applications, Successful Mobile Development; Storing and Retrieving Data:

Synchronization and Replication of Mobile Data, Getting the Model Right, Android Storing and Retrieving Data, working with a Content Provider; Putting It All Together: Packaging and Deploying, Performance Best Practices, Android Field Service App.

Unit 4: Power Management: Wake locks and assertions, Low-level OS support, Writing power-smart applications. Augmented Reality via GPS and other sensors: GPS, Accelerometer, Camera. Mobile device security, in depth: Mobile malware, Device protections, iOS "Jailbreaking", Android "rooting" and Windows' "defenestration"; Security and Hacking: Active Transactions, More on Security, Hacking Android.

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

- Understand technology and business trends impacting mobile applications
- Be competent with the characterization and architecture of mobile applications.
- Understand enterprise scale requirements of mobile applications.
- Design and develop mobile applications using one application development framework.

Text/Reference Books:

1. Bill Phillips, Chris Stewart, Brian Hardy, and Kristin Marsicano, Android Programming: The Big Nerd Ranch Guide, Big Nerd Ranch LLC, 2nd edition, 2015.
2. Valentino Lee, Heather Schneider, and Robbie Schell, Mobile Applications: Architecture, Design and Development, Prentice Hall, 2004.
3. Tomasz Nurkiewicz and Ben Christensen, Reactive Programming with RxJava, O'Reilly Media, 2016.
4. Brian Fling, Mobile Design and Development, O'Reilly Media, Inc., 2009.
5. Maximiliano Firtman, Programming the Mobile Web, O'Reilly Media, Inc., 2nd ed., 2013.
6. Cristian Crumlish and Erin Malone, Designing Social Interfaces, 2nd ed., O'Reilly Media, Inc., 2014.

PCC-CS-404	**Design & Analysis of Algorithms**		
L T P CR	**Theory**	**:**	**75**
3 0 0 3	**Class Work**	**:**	**25**
	Total	**:**	**100**
	Duration of Exam	**:**	**3 Hrs.**

Course Objectives:

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

MODULE-1: INTRODUCTION

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

MODULE-2: FUNDAMENTAL ALGORITHMIC STRATEGIES

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

MODULE-3:GRAPH AND TREE TRAVERSAL ALGORITHMS

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

MODULE-4:TRACTABLE AND INTRACTABLE PROBLEMS

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

MODULE-5:ADVANCED TOPICS

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

Course Outcomes:

- For a given algorithms analyze worst-case running times of algorithms based on asymptotic analysis and justify the correctness of algorithms.
- Describe the greedy paradigm and explain when an algorithmic design situation calls for it. For a given problem develop the greedy algorithms.
- 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.
- 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.
- For a given model engineering problem model it using graph and write the corresponding algorithm to solve the problems.

Reference Books

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.

ECPEL 711	**Graph Theory and Applications**		
L T P CR	**Theory**	**:**	**75**
3 0 0 3	**Class Work**	**:**	**25**
	Total	**:**	**100**
	Duration of Exam	**:**	**3 Hrs.**

Course Objectives:

- To introduce different types of graphs
- To enable the students to find different types of paths and circuits in the graph.
- To understand about trees and fundamental circuits.
- To understand about different representations of graphs.
- To focus on different types of problems related to graphs and its applications

Unit I Introduction

Graph, Finite and infinite graph, incidence and degree, Isolated vertex, Pendent vertex and null graph, Isomorphism, Sub graph, Walks, Paths and circuits, Euler circuit and path, Hamilton path and circuit, Euler formula, Homeomorphic graph, Bipartite graph, Edge connectivity, Computer representation of graph, Digraph.

Unit II Tree and Fundamental Circuits

Tree, Distance and center in a tree, Binary tree, spanning tree, Finding all spanning tree of a graph, Minimum spanning tree.

Unit III Graph and Tree Algorithms

Shortest path algorithms, shortest path between all pairs of vertices, Depth first search and breadth first of a graph, Huffman coding, Cuts set and cut vertices, Warshall's algorithm, topological sorting.

Unit IV Planar and Dual Graph

Planner graph, Kuratowski's theorem, Representation of planar graph, five-color theorem, Geometric dual.

Unit V Coloring of Graphs

Chromatic number, Vertex coloring, Edge coloring, Chromatic partitioning, Chromatic polynomial, covering.

Unit VI Application of Graphs and Trees

Konigsberg bridge problem, Utilities problem, Electrical network problem, Seating problem, Chinese postman problem, shortest path problem, Job sequence problem, Travelling salesman problem, Ranking the participant in a tournament, Graph in switching and coding theory, Time table and exam scheduling, Applications of tree and graph in computer science.

Course learning outcomes: Upon completion of the course, the students will be able to:

- Understand the basic concepts of graphs, directed graphs, and weighted graphs and able to present a graph by matrices.
- Understand the properties of trees and able to find a minimal spanning tree for a given weighted graph.
- Understand Eulerian and Hamiltonian graphs.
- Apply shortest path algorithm to solve Chinese Postman Problem.
- Apply the knowledge of graphs to solve the real-life problem.

Recommended Books

1. Deo, N., Graph Theory with Application to Engineering with Computer Science, PHI, New Delhi (2007)

2. West, D. B., Introduction to Graph Theory, Pearson Education, London (2008)

3. Bondy, J. A. and Murty, U.S.R., Graph Theory with Applications, North Holland Publication, London (2000) 4. Rosen, K. H., Discrete Mathematics and its Applications, Tata-McGraw Hill, New Delhi (2007)

HSMC 01	**Effective Technical Communication**		
L T P CR	**Theory**	**:**	**75**
3 0 0 3	**Class Work**	**:**	**25**
	Total	**:**	**100**
	Duration of Exam	**:**	**3 Hrs.**

Course Objectives

• To provide with the confidence to use written communication in your work and personal experience beyond college,

• To acquaint students with the concept of a writer-reader relationship and identify the need for active participation from both writer and reader,

• To teach the skills needed to successfully communicate in a modern world through written materials.

Unit 1: 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.

Unit 2: Module 2: Technical Writing, Grammar and Editing, Technical writing process, forms of discourse, Writing drafts and revising, Collaborative writing, creating indexes, technical writing style and language. Basics of grammar, study of advanced grammar, editing strategies to achieve appropriate technical style. Introduction to advanced technical communication, Usability, Human factors, Managing technical communication projects, time estimation, Single sourcing, Localization.

Unit 3: 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

Unit 4: 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.

Unit 5: 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

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

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).

Open Electives-III

OEC-CS-602(I)	**Human Resource Management**		
L T P CR	**Theory**	**:**	**75**
3 0 0 3	**Class Work**	**:**	**25**
	Total	**:**	**100**
	Duration of Exam	**:**	**3 Hrs.**

Course Objective:

- To focus on human resource management concepts and their roles
- To understand recruitment process, appraisal and counseling
- To create an understanding of the various policies of training
- To familiarize human resource management practices

Syllabus

Unit I: 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.

Unit 2: HR Sourcing and Recruitment; Selection: process, Placement; Induction and Socialization. Job Analysis: job Description and job Specification; Job Design: approaches and methods; Job Evaluation-concept &methods; Performance Management System: appraisal and counseling.

Unit 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.

Unit 4: Industrial Relations and Grievance Handling; Employee welfare; Dispute Resolution; International Human Resource Management; Contemporary Issues in HRM: knowledge Management, HR Audit &Accounting, HR in virtual organizations, ethics &corporate social responsibility.

Course Outcome: After the completion of this course the students will be able to

- Understand the basics of HRM with roles and responsibilities of a HR manager.
- Meet HR challenges in present scenario
- Facilitate them in employing, maintaining and promoting a motivated force in an organization.
- Aware about contemporary issues of human resource management.

Text/Reference Books:

- K. Aswathapa, “Human resource Management”: Text and cases, 6th edition, Tata McGraw Hill, New Delhi.
- Uday Kumar Haldar&JuthikaSarkar, “Human resource Management”, New Delhi, Oxford University Press.
- De Cenvo, Da & Robbins S.P. , “Fundamentals of Human Resource Management”, 9th edition, New York, John Wiley & Sons.
- Gary Dessler, “Human Resource Management”, 11th edition, New Delhi: Pearson Prentice Hall.
- Tanuja Agarwala, “Strategic Human resource Management”, Oxford University Press

OEC-CS-701(I)	**Financial Management**		
L T P CR	**Theory**	**:**	**75**
3 0 0 3	**Class Work**	**:**	**25**
	Total	**:**	**100**
	Duration of Exam	**:**	**3 Hrs.**

Course Objective:

- To develop understanding among the students regarding nature of finance
- Its interaction with other Management functions
- Concept of capital structure decisions
- Awareness of working capital management concept.

Unit 1: Financial management: Scope finance functions and its organisation, objectives of financial management, time value of money, sources of long term finance.

Unit 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.

Unit 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.

Unit 4: Working Capital: Meaning, need, determinants, estimation of working capital need, management of cash, inventory and receivables.

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

- Understand regarding the key decisions like Investment, Financing and dividend Decisions of financial Management.
- Understand the usage and applications of leverages in financial decisions.
- Use their best knowledge in finance towards the value creation for the organization.
- 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

ECEL 604	**Scientific Computing**		
L T P CR	**Theory**	**:**	**75**
3 0 0 3	**Class Work**	**:**	**25**
	Total	**:**	**100**
	Duration of Exam	**:**	**3 Hrs.**

Course Objectives:

- To understand the significance of computing methods, their strengths and application areas.
- To perform the computations on various data using appropriate computation tools.
- To focus on various methods for Numerical Integration and Differentiation.

Syllabus

Unit 1: Introduction: Sources of Approximations, Data Error and Computational, Truncation Error and Rounding Error, Absolute Error and Relative Error, Sensitivity and Conditioning, Backward Error Analysis, Stability and Accuracy

Unit 2: Computer Arithmetic: Floating Point Numbers, Normalization, Properties of Floating Point System, Rounding, Machine Precision, Subnormal and Gradual Underflow, Exceptional Values, Floating-Point Arithmetic, Cancellation

Unit 3: System of linear equations: Linear Systems, Solving Linear Systems, Gaussian elimination, Pivoting, Gauss-Jordan, Norms and Condition Numbers, Symmetric Positive Definite Systems and Indefinite System, Iterative Methods for Linear Systems

Unit 4: Linear least squares: Data Fitting, Linear Least Squares, Normal Equations Method, Orthogonalization Methods, QR factorization, Gram-Schmidt Orthogonalization, Rank Deficiency, and Column Pivoting

Unit 5: Eigen values and singular values: Eigen values and Eigenvectors, Methods for Computing All Eigen values, Jacobi Method, Methods for Computing Selected Eigenvalues, Singular Values Decomposition, Application of SVD

Unit 6: Nonlinear equations: Fixed Point Iteration, Newton's Method, Inverse Interpolation Method Optimization, One-Dimensional Optimization, Multidimensional Unconstrained Optimization, Nonlinear Least Squares

Unit 7: Interpolation: Purpose for Interpolation, Choice of Interpolating, Function, Polynomial Interpolation, Piecewise Polynomial Interpolation

Unit 8: Numerical Integration And Differentiation: Quadrature Rule, Newton-Cotes Rule, Gaussian Quadrature Rule, Finite Difference Approximation, Initial Value Problems for

ODES, Euler's Method, Taylor Series Method, Runga-Kutta Method, Extrapolation Methods, Boundary Value Problems For ODES, Finite Difference Methods, Finite Element Method, Eigenvalue Problems, Partial Differential Equations, Time Dependent Problems, Time Independent Problems, Solution for Sparse Linear Systems, Iterative Methods, Fast Fourier Transform, FFT Algorithm, Limitations, DFT, Fast polynomial Multiplication, Wavelets, Random Numbers And Simulation, Stochastic Simulation, Random Number Generators, Quasi-Random Sequences

Course Outcomes:

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

- Understand the significance of computing methods, their strengths and application areas.
- Perform the computations on various data using appropriate computation tools.
- Apply various methods of Numerical Integration And Differentiation on different types of problems.

Text/ Reference Books:

- Heath Michael T., "Scientific Computing: An Introductory Survey" , McGraw-Hill, 2nd Ed., 2002.
- Press William H., Saul A. Teukolsky, Vetterling William T and Brian P. Flannery, "Numerical Recipes: The Art of Scientific Computing", Cambridge University Press, 3rd Ed., 2007.
- Xin-she Yang (Ed.)., "Introduction To Computational Mathematics", World Scientific Publishing Co., 2nd Ed., 2008.
- Kiryanov D. and Kiryanova E., "Computational Science", Infinity Science Press, 1st Ed., 2006.
- Quarteroni, Alfio, Saleri, Fausto, Gervasio and Paola, "Scientific Computing With MATLAB And Octave", Springer, 3rd Ed., 2010.

OEL709	**Industrial Safety Engineering**		
L T P CR	**Theory**	**:**	**75**
3 0 0 3	**Class Work**	**:**	**25**
	Total	**:**	**100**
	Duration of Exam	**:**	**3 Hrs.**

Course Objectives:

• To introduce about the principles of safety management.

• To introduce the factors causing accidents and their prevention.

• To impart the knowledge of material handling and realization of chemical hazards.

• To give exposure to students regarding factory act 1948.

Syllabus

Unit 1: Evolution of modern safety concept, safety policy, Safety Organization, Safety Committee, budgeting for safety.

Unit 2: Safety training, creating awareness, awards, celebrations, safety posters, safety displays, safety pledge, safety incentive scheme, safety campaign

Unit 3: Concept of an accident, reportable and non reportable accidents, reporting to statutory authorities, principles of accident prevention, accident investigation and analysis, records for accidents, departmental accident reports, documentation of accidents, unsafe act and condition, domino sequence, supervisory role, cost of accident.

Unit 4: Machine Guarding, Guarding of hazards, Machine Guarding types and its application, Safety in welding and Gas cutting, Safety in Manual and Mechanical material handling, Safety in use of electricity Toxicity, TLV, Types of Chemical Hazards, Occupational diseases caused by dust, fumes, gases, smoke and solvent hazards, control measures

Unit 5: Fire triangle, Types of fire, first aid fire-fighting equipment, flammability limit, PG safety Overview of factories act 1948, OHSAS 18000.

Course Outcomes:

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

- Apply principles of safety management, its functions and technique in any organization.
- Classify and categorize the factors contributing to accident.
- Apply material handling and machine guarding principles in industrial applications.
- Realize chemical hazards, toxicity, fire and explosion in the work place and involve to take various control measures to prevent hazards.

- Follow OHSAS 18000 standards.

Text/Reference Books:

1. Accident Prevention Manual for Industrial Operations", N.S.C.Chicago, 1982
2. Blake R.B., "Industrial Safety" Prentice Hall, Inc., New Jersey, 1973
3. Heinrich H.W. "Industrial Accident Prevention" McGraw-Hill Company, New York, 1980.
4. Krishnan N.V. "Safety Management in Industry" Jaico Publishing House, Bombay, 1997.
5. John Ridley, "Safety at Work", Butterworth & Co., London, 1983

Power Electronics

ECEL 503	**Theory**	**:**	**75**
L T P CR	**Class Work**	**:**	**25**
3 0 0 3	**Total**	**:**	**100**
	Duration of Exam	**:**	**3 Hrs.**

Course Objectives:

- To introduce the students about various types of power devices & their characteristics.
- To introduce the students about controlled rectifiers, choppers & inverters.
- To impart the knowledge regarding the analysis of inverters.
- To impart the knowledge regarding switching power supplies & their applications.

Syllabus

Unit 1: Characteristics of Semiconductor Power Devices: Thyristor, power MOSFET and IGBT Treatment should consist of structure, Characteristics, operation, ratings, protections and thermal considerations. Brief introduction to power devices viz, TRIAC, MOS controlled thyristor (MCT), Power Integrated Circuit (PIC) (Smart Power), Triggering/Driver, commutation and snubber circuits for thyristor, power MOSFETs and IGBTs (discrete and IC based), Concept of fast recovery and schottky diodes as freewheeling and feedback diode.

Unit 2: Controlled Rectifiers: Single phase, Study of semi and full bridge converters for R, RL, RLE and level loads. Analysis of load voltage and input current, Derivations of load form factor and ripple factor, Effect of source impedance, Input current Fourier series analysis of input current to derive input supply power factor, displacement factor and harmonic factor.

Unit 3: Choppers: Quadrant operations of Type A, Type B, Type C, Type D and type E choppers,

Control techniques for choppers, TRC and CLC, Detailed analysis of Type A chopper, Step up chopper, Multiphase Chopper.

Unit 4: Single-phase inverters: Principle of operation of full bridge square wave, quasi-square wave, PWM inverters and comparison of their performance. Driver circuits for above inverters and mathematical analysis of output (Fourier series) voltage and harmonic control at output of inverter (Fourier analysis of output voltage). Filters at the output of inverters, Single phase current source inverter.

Unit 5: Switching Power Supplies: Analysis of fly back, forward converters for SMPS, resonant converters need, concept of soft switching, switching trajectory and SOAR, Load resonant converter series loaded half bridge DC-DC converter. Applications: Power line disturbances, EMI/EMC, power conditioners, Block diagram and configuration of UPS, salient

features of UPS, selection of battery and charger ratings, sizing of UPS, Separately excited DC motor drive, P M Stepper motor Drive.

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

- Build and test circuits using power devices such as SCR.
- Analyze and design controlled rectifier, DC to DC converters, DC to AC inverters.
- Learn how to analyze these inverters and some basic applications.
- Design SMPS and UPS.

Text /Reference Books:

1. Muhammad H. Rashid, ―Power electronics‖ Prentice Hall of India.
2. Ned Mohan, Robbins, ―Power electronics‖, edition III, John Wiley and sons.
3. P.C. Sen., ―Modern Power Electronics‖, edition II, Chand& Co.
4. V.R.Moorthi, ―Power Electronics‖, Oxford University Press.
5. Cyril W., Lander,‖ Power Electronics‖, edition III, McGraw Hill.
6. G K Dubey, S R Doradla,: Thyristorised Power Controllers‖, New Age International Publishers. SCR manual from GE, USA.

PEC-CS-T-702 **Game Theory**

L T P CR	**Theory**	**: 75**
3 0 0 3	**Class Work**	**: 25**
	Total	**: 100**
	Duration of Exam	**: 3 Hrs.**

Course Objectives:

- 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
- To enable the students to choose different types and forms of the games depending upon the need and impact on the performance.
- To enable the students to explore learning mechanisms in an environment of perfect/incomplete information and to understand the need of repeated game.
- To enable the students to design mechanisms using game theory to understand and analyze real life situations such as market behavior, decentralized network model.

Syllabus

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:

- Understand the use of game theory in economics, political science, sociology, engineering apart from disciplines like mathematics and biology.
- Use different types and forms of the games and choose the type depending upon the need.
- Apply learning mechanisms in an environment of perfect/incomplete information and understand the need of repeated game.
- Design mechanisms using game theory to understand and analyze real life situations such as market behaviour, decentralized network model.

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.

PCC-CS-502 **Formal Languages, Automata and Compiler Design**

L T P CR	**Theory**	**:**	**75**
3 0 0 3	**Class Work**	**:**	**25**
	Total	**:**	**100**
	Duration of Exam	**:**	**3 Hrs.**

Course Objectives

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

Syllabus

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:

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

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.Harry R. Lewis and Christos H. Papadimitriou, Elements of the Theory of Computation, Pearson Education Asia.

3. A.V. Aho, M.S. Lam, R. Sethi, and J.D. Ullman, Compilers:Principles, Techniques, and Tools, Pearson Education, 2007 (second ed.).

4. K.D. Cooper, and L. Torczon, Engineering a Compiler, Elsevier, 2004.

OEL707	**Operation Research**		
L T P CR	**Theory**	**:**	**75**
3 0 0 3	**Class Work**	**:**	**25**
	Total	**:**	**100**
	Duration of Exam	**:**	**3 Hrs.**

Course Objectives:

- To introduce the students about Different types of o.r. models.
- To introduce the students about Linear Programming problem-Formulation and graphical solution.
- To introduce the students about Dual simplex method. Sensitivity analysis.
- To introduce the students about Network minimisation, shortest route problem, Critical path calculations.
- To introduce the students about Dynamic Programming and examples of D.P.models.

Syllabus

Unit 1: Different types of o.r. models, their construction and general methods of solution. inear Programming problem-Formulation and graphical solution. The standard form of the L.P.model. The simplex method, The dual of L.P.P, Primal-dual relationship, Dual simplex method, Sensitivity analysis, Transportation problem, its solution and applications, The assignment model, Travelling salesman problem.

Unit 2: Network minimization, Shortest route problem, Maximum flow problem, Project of scheduling by PERT, CPM.

Unit 3: Critical path calculations, Construction of the time chart and resource leveling, Integer programming-examples, method of and algorithms, cutting plane algorithm only.

Unit 4: Dynamic Programming, Examples of D.P.models, Bellman_s Principle of optimality and method of recursive optimization, simple problems only involving upto one constraint.

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

- Understand about Different types of o.r. models, LP model and Dual Simplex Method
- Understand about Network minimization, shortest route problem, Maximum flow
- problem and project of scheduling by PERT, CPM
- Understand about Critical path calculations
- Understand about Dynamic Programming and examples of D.P.models

TEXT BOOKS:

1. Taha H.A Operations Research-An Introduction, PHI

2. Wanger H.M, Principles of Operation Research, PHI

OEL708	**Advanced Digital System Design**		
L T P CR	**Theory**	**:**	**75**
3 0 0 3	**Class Work**	**:**	**25**
	Total	**:**	**100**
	Duration of Exam	**:**	**3 Hrs.**

Course Objectives

- To familiarize the various hardware description languages.
- To understand the various types of ASICs its design how & various programmable logic device.
- To understand the concepts of FPGA & implementation of digital logic on programmable logic devices.
- To introduce the concept of logic synthesis in VLSI design

Syllabus

Unit 1: Introduction to hardware description languages: Introduction to VHDL and Verilog, types of modelling: dataflow modelling, behavioural modelling, structural modelling, Simulation & Synthesis of various digital circuits.

Unit 2: Introduction to ASICs: Introduction to ASICs, ASIC design flow, types of ASICs, full custom ASIC's, standard cell-based ASIC's, Gate array-based ASIC's, channelled gate array, structured gate arrays, programmable logic devices, introduction to programmable logic, fixed versus programmable logic, programmable logic devices, types of programmable logic devices, PROMs, PLA, PAL, CPLD & FPGA.

Unit 3: FPGA & its Architecture: Introduction to FPGA, evolution of programmable devices conceptual diagram of a typical FPGA, Logic blocks, interconnection resources, FPGA versus ASIC, applications of FPGA, FPGA design flow, and implementation process. Various classes of FPGAs, symmetrical array, row-based, hierarchical PLD, sea-of-gates. Programming technologies, static RAM programming technology, anti-fuse programming technology, EPROM and EEPROM programming technology.

Unit 5: Logic synthesis: Fundamentals, logic synthesis, physical design compilation, simulation, implementation. Floor planning and placement, Commercial EDA tools for synthesis.

Course Outcomes:

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

• To understand the VHDL language & its programming.

• To understand the concept of ASIC & FPGA, various types of FPGAS & its architecture.

• To understand physical design algorithms and EDA tools.

References

- Bob Zeidman, “Designing with FPGAs & CPLDs”, CMP Books

OEL711	**Transportation Engineering**		
L T P CR	**Theory**	**:**	**75**
3 0 0 3	**Class Work**	**:**	**25**
	Total	**:**	**100**
	Duration of Exam	**:**	**3 Hrs.**

Course Objectives:

- To carry out surveys involved in planning and highway alignment.
- To design the geometric elements of highways and expressways
- To carry out traffic studies and implement traffic regulation and control measures and intersection design
- To characterize pavement materials and design flexible and rigid pavements as per IRC

Syllabus

Unit 1:Highway development and planning: Classification of roads, road development in India, Current road projects in India; highway alignment and project preparation.

Unit 2: Geometric design of highways: Introduction; highway cross section elements; sight distance, design of horizontal alignment; design of vertical alignment; design of intersections, problems.

Unit 3: Traffic engineering & control: Traffic Characteristics, traffic engineering studies, traffic flow and capacity, traffic regulation and control; design of road intersections; design of parking facilities; highway lighting; problems.

Unit 4: Pavement materials: Materials used in Highway Construction- Soils, Stone aggregates, bituminous binders, bituminous paving mixes; Portland cement and cement concrete: desirable properties, tests, requirements for different types of pavements. Problems.

Unit 5: Design of pavements: Introduction; flexible pavements, factors affecting design and performance; stresses in flexible pavements; design of flexible pavements as per IRC; rigid pavements- components and functions; factors affecting design and performance of CC pavements; stresses in rigid pavements; design of concrete pavements as per IRC; problems.

Course Outcome:

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

- Carry out surveys involved in planning and highway alignment.

- Design the geometric elements of highways and expressways
- Carry out traffic studies and implement traffic regulation and control measures and intersection design
- Characterize pavement materials and design flexible and rigid pavements as per IRC

Text/Reference Books:

1. Khanna, S.K., Justo, C.E.G and Veeraragavan, A, 'Highway Engineering', Revised 10th Edition, Nem Chand & Bros, 2017

2. Kadiyalai, L.R., ' Traffic Engineering and Transport Planning', Khanna Publishers.

3. ParthaChakraborty, ' Principles Of Transportation Engineering, PHI Learning,

4. Fred L. Mannering, Scott S. Washburn, Walter P. Kilareski,'Principles of Highway Engineering and Traffic Analysis', 4th Edition, John Wiley

5. Srinivasa Kumar, R, Textbook of Highway Engineering, Universities Press, 2011.

6. Paul H. Wright and Karen K. Dixon, Highway Engineering, 7th Edition, Wiley Student Edition, 2009.

OEL712	**Banking System & Taxation**		
L T P CR	**Theory**	**:**	**75**
3 0 0 3	**Class Work**	**:**	**25**
	Total	**:**	**100**
	Duration of Exam	**:**	**3 Hrs.**

Course Objective:

- To impart the knowledge about the banks and its role
- To emphasize on financial inclusion and contemporary issues in banking
- To provide an overview of taxation and computation
- To understand tax planning in operational as well as strategic terms.

Syllabus

Unit I : Banking industry: Meaning, evolution, types, role, and overview ; Priority sector lending: targets, issues problems; Financial inclusion: Agriculture/SMEs/SHGs/SSI .; new products and services, credit cards/Home loans/Personal loans ancillary Services, Remittances safe deposit lockers

Unit II: Contemporary issues in banking: NPA, E banking, universal banking, Electronic products, Electronic payment system, Electronic fund transfer system: RTGS,NEFT, SWIFT etc. current trends and global developments.

Unit-III: Basic Concepts of Income Tax; Computation of Income under Different Heads of Income, Set off and Carry forward of Losses, Deductions and Exemptions; Additional Tax on Undistributed Profits.

Unit-IV: Meaning and Scope of Tax Planning, Difference between Tax planning Tax Evasion and Tax Avoidance. Filling of Returns and Assessments, Penalties and Prosecutions, Appeals and Revisions.

Course Outcome:

- The course creates understanding among the students regarding the concept of taxation, different heads of income.
- The students will understand the difference between tax evasion and avoidance.
- The students will be able to have a clear view of current scenario of banking Industry.
- The beneficiaries will have a view about contemporary issues in banking.

Reference Books:

1. Principles and practices of banking by Indian institute if Banking and finance, Macmillan

Publication
2. Singhania, V K. and Singhania, Monica, Students‟ Guide to Income Tax, Taxmann.
3. Shekhar, K.C. and Shekhar, Lekshmy**,** Banking Theories and practices, Vikas Publication
4. Money, Banking and international Trade, KPM Sundram, Sultan Chand and sons
5. Financial Intermediation, Indian Institute of Banking and Finance
6. Insurance and Banking , Gupta P.K. Himalaya Publications
7. Iyengar, A C. Sampat, Law of Income Tax, Bharat House.
8. Ahuja, G & Gupta, Ravi, Simplified Approach to Corporate Tax Planning and Management, Bharat Law House private limited

Annexure-A

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

Implementation of Credit Transfer/Mobility Policy of online courses

Reference: Gazette of India (Extraordinary) Part-III, Section-4 No. 295, UGC **(Credit Framework for Online Learning Courses through SWAYAM) Regulation, 2016,** dated 19/07/2016.

With reference to 12th Academic Council Meeting dated 03/05/2017 (Agenda Item No. AC/11/12), wherein MOOCs were adopted in the CBCS scheme, In continuation to that, following modalities are proposed to introduce the credit transfer policy in academic curriculum for the Massive Open Online Courses (MOOC's) offered through SWAYAM (Study Webs of Active-Learning for Young Aspiring Minds) Portal.

A. General Guidelines

1. The SWAYAM shall notify in June and November every year, the list of the online learning Courses going to be offered in the forthcoming Semester on its website https://swayam.gov.in.
2. All the UTDs/Affiliated Colleges shall, within 4 weeks from the date of notification by SWAYAM, consider through their Chairperson/Principal the online learning courses being offered through the SWAYAM platform; and keeping in view their academic requirements, decide upon the courses which it shall permit for credit transfer and keeping in view the following points:

    a) There is non-availability of suitable teaching staff for running a course in the Department.
    b) The facilities for offering the elective papers (courses), sought for by the students are not on offer/scheme in the Institution, but are available on the SWAYAM platform.
    c) The courses offered on SWAYAM would supplement the teaching-learning process in the Institution.
    d) Online courses through SWAYAM should not be more than 20% of

total courses offered in a particular semester of a programme.

3. The courses offered in a particular semester will be compiled by Digital India Cell as decided and forwarded by concerned UTDs and affiliated colleges in the prescribed format to digitalindia.ymca@gmail.com and compiled set will be put up in Academic Council for approval.
4. Student can opt for 12-16 weeks course equivalent to 3-6 credits under mentorship of faculty (MHRD MOOC's guidelines 11.1(J) issued by the MHRD vide its orders dated 11/03/2016).
5. Every student being offered a particular paper (course) would be required to register for the MOOCs for that course/paper on SWAYAM through University's/Affiliated College's SWAYAM-NPTEL Local Chapter.
6. The UTD/College may designate a faculty member as course coordinator/mentor to guide the students (at least 20 students) throughout the course with 2 hours per week contribution and with mentor addition on the Local Chapter. The mentor Chairperson/Principal will ensure the provision of facilities for smooth running of the course viz. Internet facility and proper venue in the department/college.
7. Digital India Cell of the University will be the Nodal point for keeping track of MOOCs enrolments in the University and the concerned chairpersons/principals are expected to aware their students/faculty about the online courses.
8. Importance of online learning and credit transfer policy must be shared with the students at entry level by the concerned department/college. Same may be incorporated during induction program for newly admitted students.
9. The departmental/college MOOC coordinators appointed by chairpersons of concerned departments/Principals of affiliated colleges will be responsible for identification of relevant MOOCs in the UTDs/Colleges and smooth conduction during the course.

B. Credit Transfer/Mobility of MOOCs

1. The parent Institution (offering the Course) shall give the equivalent credit weightage to the students for the credits earned through online learning courses through SWAYAM platform in the credit plan of the program.
2. Following pattern will be followed for distribution of credits and will be applicable to all students from Jan 2018 onwards:
3.

Program	Duration	Minimum Credits to be earned*
B.Tech	Semester I to VIII	3
M.Tech/MBA/M.Sc./MA	Semester I to IV	3
BBA/BCA/B.Sc./BA	Semester I to VI	3

***All students of UTDs/Affiliated colleges of all courses have to mandatorily earn minimum prescribed credits.**

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).

4. A student will be eligible to get Under-Graduate/Post-Graduate degree (B.Tech/M.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
M.Tech	Semester I to IV	6	8.0

*Inclusive of *Minimum credits to be earned* mentioned in clause B(2) above.

5. The earned credits shall be accepted and transferred to the total credits of the concerned students by the University for Completion of his/her degree. Credits earned through MOOCs will be incorporated in the mark sheet issued to the student by Controller of Examination.
6. Credits for MOOC's will be verified by the concerned department/college and will be forwarded to Controller of Examination for further processing.
7. The courses where model curriculum of AICTE is not applicable, pattern laid down as in B(2) will be followed.

NOTE:

1. These guidelines will be applicable to all Affiliating institutions under University along with all UTDs. Affiliating colleges will establish their own Local Chapter on SWAYAM and follow the same process.
2. For further clarifications, Notifications "Credit Framework for Online Learning Courses through SWAYAM" (UGC Regulations dated 19/07/2016) and "MHRD MOOC's guidelines" (MHRD guidelines dated 11/03/2016) may be referred.

MAPPING OF THE SUBJECTS WITH THE FOLLOWING

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Course name	Course code	Employability	Entrepreneurship	Skill Development
Physics (Waves and Optics)	BSC101C			√
Mathematics-I (Calculus and Linear Algebra)	BSC103 D			√
Engineering Graphics & Design	ESC102	√		√
Programming for Problem solving	ESC103			√
Workshop- I	ESC104	√		√
Physics(Waves and Optics) Lab	BSC104C			√
Programming for Problem solving Lab	ESC105	√		√
Mathematics-II	BSC106 D			√
Basic Electrical Engineering	ESC101			√
Chemistry	BSC 102			√
Workshop- II	ESC106	√		√
English	HSMC101			√
Basic Electrical Engineering Lab	ESC107	√		√
Chemistry Lab	BSC 105			√
English Lab	HSMC102			√
Digital Electronics & Computer Organization	ECP301	√	√	√
Semiconductor	ECP302	√		√

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Devices				
Object Oriented Programming using C++	ECP303	√	√	√
Analog Communication	ECP304	√		√
Circuit Analysis and Synthesis	ECP305	√		√
Mathematics-III	BS301	√		√
Indian Constitution/ Essence of Indian Traditional Knowledge	MC01/ MC02	√		√
Object Oriented Programming using C++ Lab	ECP351	√	√	√
Digital Electronics Lab	ECP352	√	√	√
Analog Communication Lab	ECP353	√	√	√
Electronics Project Workshop-I	ESP303	√		√
Digital Communication	ECP401	√		√
Analog Electronics Circuits	ECP402	√		√
Microprocessors & Its Application	ECP403	√		√
Data Structure using Python	ECP404	√	√	√

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Digital System Design & Applications	ECP405	√	√	√
Theory of Signal & System	ECP406	√		√
Biology	BSC01			√
DSD Lab	ECP451	√		√
Analog Electronic Circuit Lab	ECP452	√		√
Microprocessors & its Application Lab	ECP453	√		√
Data Structure using Python Lab	ECP454	√	√	
Electronics Project Workshop-II	ESP402	√		√
Embedded System Design	ECP501	√	√	√
Database Management Systems	CS-501	√		√
Operating System	PCC-CS-403	√		√
Integrated Circuit Design	ECP502	√		√
Environmental Sciences	MC03	√		√
Database Management Systems Lab	CS 504	√	√	√
Integrated Circuit Design Lab	ECP 552	√		√

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Project Workshop-III	ESP 555	√		√
Smart Materials and Systems	OEL501	√		√
Electrical Measurement and Instrumentation	OEL502	√		√
Electromechanical Energy Conversion	OEL504	√		√
Solid & Structures	OEL 506	√		√
Optimization Techniques	OEL 507	√		√
Engineering Mechanics	ESC 01	√		√
Mobile Communication	ECP 601	√		√
Digital Signal Processing	ECC 04	√		√
Computer Networks	EC 602	√		√
Digital Signal Processing Lab	ECC 53	√	√	√
Mobile Communication Lab	ECP 651	√	√	√
Computer Networks Lab	EC 652	√	√	√
Project Workshop-IV	ESP 655	√		√
Information Management System	ECPEL601	√		√

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ERP Information System	ECPEL602	√		√
Intelligent Systems	PCC-CS-601	√		√
Software Engineering	PEC-CS-S-601	√		√
Computer Graphics	PEC-CS-A-602	√		√
Microwave Engineering	ECPEL603	√		√
Antenna and wave propagation	ECPEL604	√		√
Internet of Things	PEC-CS-S-703	√		√
Remote Sensing	ECPEL 605	√		√
Virtual Instruments Design	OEL601	√		√
Quality Management	PEC-ME-461	√		√
Soft Skills and Interpersonal Communication	OEC-CS-601(I)	√		√
Principles of Control System	OEL 606	√		√
Data Mining	PEC-CS-D601	√		√
Effective Technical Communication	HSMC01	√		√
Major Project	ECP751	√	√	√
Project Workshop-V	ESP752	√		√
Computer Vision	ECPEL701	√		√
Data Analytics	ECPEL702	√		√

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and Visualization				
Cloud Computing and Security	ECPEL703	√		√
Web & Internet Technology	PEC-CS-A-702	√		√
Information Retrieval	PEC-CS-D-702(II)	√		√
Optical Fiber Communication	ECEL704	√		√
Neural Networks and Soft Computing	ECPEL704	√		√
Wireless Sensor Networks and Applications	ECPEL 705	√		√
Cognitive Radio	ECPEL706	√		√
Digital Image Processing and Analysis	ECPEL 707	√		√
Information & Coding Theory	ECPEL 708	√		√
Machine Learning	ECPEL 709	√		√
Mixed Signal Design	ECEL 706	√		√
Mobile Application Development	ECPEL710	√	√	√
Design & Analysis of Algorithms	PCC-CS-404	√		√
Graph Theory and Applications	ECPEL 711	√		√
Human Resource	OEC-CS-602 (I)	√		√

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Management				
Financial Management	OEC-CS-701(I)	√		√
Scientific Computing	ECEL 604	√		√
Industrial Safety Engineering	OEL709	√		√
Power Electronics	ECEL 503	√		√
Game Theory	PEC-CS-T-702	√		√
Formal Languages, Automata and Compiler Design	PCC-CS-502	√		√
Operation Research	OEL 707	√		√
Advanced Digital System Design	OEL 708	√		√
Transportation Engineering	OEL 711	√		√
Banking System & Taxation	OEL 712	√		√
Industrial Training	ECP801	√	√	√

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