PANJAB UNIVERSITY, CHANDIGARH-160014(INDIA)
(Estd. under the Panjab University Act VII of 1947-enacted by the Govt. of India)

FACULTY OF ENGINEERING & TECHNOLOGY

SYLLABI

AND THE

REGULATIONS

FOR

Bachelor of Engineering (Electronics & Communication)
First -Eighth Semesters Examinations,
Batch: 2023-27

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DEPARTMENT: ELECTRONICS AND COMMUNICATION ENGINEERING

VISION:

Electronics & Communication Engineering will contribute to the ever changing industrial requirements, economic growth and global societal needs by enhancing the technical skills and entrepreneurship abilities.

MISSION:

To produce qualified engineers who are competent in the areas of Electronics & Communication Engineering and able to meet the challenges of ever changing industry requirements at global level.

1. To develop strong theoretical concepts complemented with practical trainings.
2. To inculcate innovative skills, research aptitude, team-work, ethical practices in students so as to meet expectations of the industry as well as society.

PROGRAMME: B. E. ECE (UG PROGRAMME)

PROGRAMME EDUCATIONAL OBJECTIVES:

1. To build a strong foundation in scientific and engineering fundamentals necessary to formulate, solve and analyze engineering problems for successful careers to meet the global demands of the society.
2. To develop the ability among students to synthesize data and technical concepts of Electronics and Communication for application to develop core and multidisciplinary projects.
3. To promote awareness among student for the value of lifelong learning and to introduce them to professional ethics and codes of professional practice.

PROGRAMME OUTCOMES:

1. Graduates will demonstrate basic knowledge in Mathematics, Science and Engineering and the ability to solve the complex problems.
2. Graduates will demonstrate an ability to identify and analyze the basic problems in the field of Mathematics, Science and Engineering.
3. The ability to innovate and design an Electronics or Communication system that meets the desired specifications and requirements.
4. Demonstrate an ability to analyze and interpret data using various research methodologies to solve Electronics or Communication Engineering problems and provide significant conclusions.
5. Graduates will be familiar with the usage of modern engineering software tools for analysis of multidisciplinary Engineering problems and their limitations.
6. Develop the confidence to apply engineering solutions in global and societal context.
7. Ability to understand and demonstrate the impact of Engineering and technological solutions for sustainable development of society and environment.
8. Inculcate the understanding of professional and ethical responsibilities.
9. Demonstrate an ability to understand individual role and leadership qualities to lead diverse groups in multidisciplinary fields.

10. Cultivate the ability to communicate effectively in both verbal and written forms among peers and society.
11. Graduate will possess leadership and managerial skills with best professional, economic and ethical concern for managing team or as an individual in multidisciplinary environment.
12. Capable of self-education and clearly understand the value of lifelong learning.

Panjab University, Chandigarh

Scheme of Examination and Syllabi for

B.E. (Electronics and Communications Engineering)

Batch: 2023-27

Year: First **Semester: First**

Course Code	Course Name	Option	Hours per week			Credits	Marks		
			L	T	P		Internal Assessment	University Exam	Total
ASC X01	Applied Chemistry	Theory	4	0	0	4	50	50	100
ASC X51	Applied Chemistry (P)	Practical	0	0	3	1	50	-	50
ASM 101	Calculus	Theory	4	1	0	5	50	50	100
EEC X01	Basic Electrical and Electronics Engineering	Theory	3	0	0	3	50	50	100
EEC X51	Basic Electrical and Electronics Engineering (P)	Practical	0	0	2	1	50	-	50
ESC X04	Engineering Graphics	Theory	1	0	0	1	50	50	100
ESC X54	Engineering Graphics (P)	Practical	0	0	3	1	50	-	50
ESC X01	Programming fundamentals	Theory	3	0	0	3	50	50	100
ESC X51	Programming fundamentals (P)	Practical	0	0	3	1	50	-	50
HSMC X01	Environment Sciences*	Theory	0	0	0	1*	Satisfactory / Unsatisfactory	-	-
			15	**1**	**11**	**20+1***	**450**	**250**	**700**

Year: First **Semester: Second**

Course Code	Course Name	Option	Hours per week			Credits	Marks		
			L	T	P		Internal Assessment	University Exam	Total
	Choice Based Physics Course	Theory	3	1	0	4	50	50	100
	Choice Based Physics Course (P)	Practical	0	0	3	1	50	-	50
ASM 201	Differential Equations and Transforms	Theory	4	1	0	5	50	50	100
HSMC X01	Professional Communication	Theory	2	0	0	2	50	50	100
HSMC X51	Professional Communication (P)	Practical	0	0	2	1	50	-	50
ESC X53/	Workshop/ Fundamentals of Biotechnology[#]	Practical Theory	0 2	0 0	4 0	2	50 50	- 50	50 100
EC 203	Digital Design	Theory	3	0	0	3	50	50	100
EC 253	Digital Design (P)	Practical	0	0	3	1	50	0	50
UHV01	Universal Human Values*	Theory	0	0	0	3*	Satisfactory / Unsatisfactory	-	-
			12 /14	**2**	**12 / 8**	**19+3***	**400**	**200 / 250**	**600/650**

Summer Training:

Subject Code	Subject Name	L-T-P	Contact hrs/week	Credits	Assessment
ST 251	**Product Re-engineering and Innovation**	0-0-20	20	Nil	Satisfactory / Unsatisfactory

Note: The students will undergo a mandatory "Summer Training" of two weeks in their respective departments after their second-semester exams. It will be a non-credited mandatory course, the result of which (satisfactory/unsatisfactory) will be reflected in their second-semester mark sheet.

*Two value-added course namely, Universal Human Values and Environment Sciences with special credits (not to be included in CGPA evaluation) will be offered as self-study courses in BE first year. The results of these subjects as satisfactory/unsatisfactory will be reflected in the mark sheet.

[#]ECE Department will offer any one of the following two subjects Workshop/ Fundamentals of Biotechnology depending upon branch specific requirements.

Year: Second **Semester: Third**

Course Code	Course Name	Scheme of Teaching			Scheme of Examination			
		L-T-P	Contact hrs/week	Credits	Theory			Practical
					Internal Assessment	University Assessment	Total	
MATHS-301	Linear Algebra & Complex Analysis	4-1-0	5	4	50	50	100	---
EC302	Signals and Systems	3-1-0	4	3	50	50	100	---
EC304	Microprocessor and Microcontrollers	4-0-2	6	4+1	50	50	100	50
EC307	Electronic Devices and Circuits	3-1-2	6	3+1	50	50	100	50
EC306	Electronics Measurements & Instrumentation	3-0-2	5	3+1	50	50	100	50
	Elective (from Humanities and Social Sciences)	3-0-0	3	3	50	50	100	---
Total		**20-3-6**	**29**	**23**	**300**	**300**	**600**	**150**

ELECTIVE (from Humanities and Social Sciences)

1. HSS 301: Economics
2. HSS 302: Introduction to Psychology
3. HSS 303: Sociology
4. HSS 306: Entrepreneurship and Project Management

Year: Second **Semester: Fourth**

Course Code	Course Name	Scheme of Teaching			Scheme of Examination			
		L-T-P	Contact hrs/week	Credits	Theory			Practical
					Internal Assessment	University Assessment	Total	
EC401	Communication Engineering	3-0-2	5	3+1	50	50	100	50
EC402	Advanced Microcontrollers & Applications	3-0-2	5	3+1	50	50	100	50
EC406	Analog Electronic Circuits	3-1-2	6	3+1	50	50	100	50
EC407	Probability and Random Processes	3-1-0	4	3	50	50	100	---
EC408	Electromagnetic Theory	3-0-0	3	3	50	50	100	---
EC409	Network Analysis	3-0-2	5	3+1	50	50	100	50
----	Educational Tour	----	**----**	Non-credit	----	----	----	---
Total		**18-2-8**	**28**	**22**	**300**	**300**	**600**	**200**

Year: Third **Semester: Fifth**

Course Code	Course Name	Scheme of Teaching			Scheme of Examination			
		L-T-P	Contact hrs/week	Credits	Theory			Practical
					Internal Assessment	University Assessment	Total	
EC501	VLSI Design	3-1-2	6	3+1	50	50	100	50
EC502	Digital Signal Processing	3-1-2	6	3+1	50	50	100	50
EC503	Antennas & Wave Propagation	3-0-0	3	3	50	50	100	---
EC504	Computer Networks	3-0-0	3	3	50	50	100	---
EC505	Digital System Design	3-1-2	6	3+1	50	50	100	50
	Departmental Elective Course-I	3-0-0	3	3	50	50	100	---
EC514	Summer Training	---	---	Non-Credit	---	---	---	---
Total		**18-3-6**	**27**	**21**	**300**	**300**	**600**	**150**

Departmental Elective Course-I (For Fifth Sem)		
Sr No.	**Subject**	**Subject Code**
1	Data Structures and Algorithms	EC507
2	Audio and Visual Systems	EC508
3	Bio-medical Electronics	EC509

Year: Third **Semester: Sixth**

Course Code	Course Name	Scheme of Teaching			Scheme of Examination			
		L-T-P	Contact hrs/week	Credits	Theory			Practical
					Internal Assessment	University Assessment	Total	
EC601	Microwave & Radar Engineering	3-1-2	6	3+1	50	50	100	50
EC602	Fiber Optic Communication Systems	3-0-2	5	3+1	50	50	100	50
EC603	Digital Communication	3-1-2	6	3+1	50	50	100	50
EC624	Control Systems	3-1-0	4	3	50	50	100	---
EC625	Power Electronics	3-0-2	5	3+1	50	50	100	50
	Departmental Elective Course-II	3-0-0	3	3	50	50	100	---
EC627	Project-I	0-0-3	3	1	---	---	---	50
Total		**18-3-11**	**32**	**23**	**300**	**300**	**600**	**250**

Departmental Elective Course-II (For Sixth Sem)		
Sr No.	**Subject**	**Subject Code**
1	Information Theory & Coding	EC620
2	Satellite Communications	EC605
3	Data Acquisition and Hardware Interfacing	EC622
4	Speech and Audio Processing	EC626

Year: Fourth **Semester: Seventh**

Course Code	Course Name	Scheme of Teaching			Scheme of Examination			
		L-T-P	Contact hrs/week	Credits	Theory			Practical
					Internal Assessment	University Assessment	Total	
EC710	Wireless & Mobile Communication	3-1-2	6	3+1	50	50	100	50
EC701	Embedded System Design	4-0-2	6	4+1	50	50	100	50
	Departmental Elective Course-III	4-0-0	4	4	50	50	100	---
	Departmental Elective Course-IV	4-0-0	4	4	50	50	100	---
EC721	Seminar-I	0-0-2	2	1	---	---	---	50
EC722	Project-II	0-0-3	3	1	---	---	---	50
EC725	Summer Training	---	---	Non Credit	---	---	---	---
Total		**15-1-9**	**25**	**19**	**200**	**200**	**400**	**200**

Departmental Elective Course-III (For Seventh Sem)		
Sr No.	**Subject**	**Subject Code**
1	Operation Research	EC702
2	Operating Systems	EC711
3	Nano Technology	EC703
4	Adaptive Signal Processing	EC723

Departmental Elective Course-IV (For Seventh Sem)		
Sr No.	**Subject**	**Subject Code**
1	Computer Architecture and Organization	EC704
2	Artificial Intelligence	EC705
3	High Speed Semiconductor Devices& Circuits	EC706

Year: Fourth **Semester: Eighth**

OPTION -1

Course Code	Course Name	Scheme of Teaching			Scheme of Examination			
		L-T-P	Contact hrs/week	Credits	Theory			Practical
					Internal Assessment	University Assessment	Total	
	Departmental Elective Course-V	4-0-2	6	4+1	50	50	100	50
	Departmental Elective Course-VI	4-0-2	6	4+1	50	50	100	50
	Departmental Elective Course-VII	4-0-0	4	4	50	50	100	---
	Departmental elective Course-VIII	4-0-0	4	4	50	50	100	---
Total		**16-0-4**	**20**	**18**	**200**	**200**	**400**	**100**

Departmental Elective Course-V and VI (Any two subjects with Lab)		
Sr No.	**Subject**	**Subject Code**
1	Digital Image Processing	EC808
2	Advanced Digital Communication	EC809
3	Neural Networks & Fuzzy Logic	EC810
4	HDL based Systems	EC802
5	Wireless Sensor Networks	EC815

Departmental Elective Course- VII and VIII (Any two subjects without lab)		
Sr No.	**Subject**	**Subject Code**
1	Optical Networks	EC803
2	MEMS and Microsystems	EC814
3	Imaging and Additive Manufacturing	EC804
4	Advanced Digital Signal Processing	EC801
5	Advanced Mobile Communications	EC805

OPTION – 2

Paper code	Paper title	Duration	Marks Uni. Exam	Int. Marks	Grand Total
EC820	Industrial Training	6 Months	250	250	500
	Total Credits : 18				

In 8th semester, student can exercise **Option 1 or Option 2** according to the following conditions:
A student may opt for one semester training in lieu of subject of 8th semester. The marks for six months training will be equal to the total marks of 8th semester study. A student can opt for six months semester training under following conditions:

a. The students will only be allowed to pursue training in reputed organizations like MNC, Govt. Organizations, R&D institutions, and PSUs.
b. For pursuing this training, student needs the prior approval from the Coordinator/Chairperson of the respective branch/department.

FIRST & SECOND SEMESTER

Course Code	**ASP X01**
Course Title	**Applied Physics**
Type of Course	**Core**
L T P	**3 1 0**
Credits	**4**
Course Assessment Methods End Semester Assessment (University Exam) Continuous Assessment (Minors, Assignments, Quiz)	 **50** **50**
Course Prerequisites	Physics and mathematics at 10+2 level
Course Outcomes (CO)	After the completion of this course the students will be able to 1. Understand the methodology to describe free, damped and forced oscillations and, subsequently, to understand the behavior of these motions qualitatively as well quantitatively. 2. Understand the concepts of electromagnetic waves production and propagations in various mediums. 3. Understand the different types of polarizations, their production methods and applications. 4. Understand the working principle and applications of a laser and optical fibers along with their applications.

SYLLABUS

Note for the examiner: The semester question paper will be of 50 Marks having 7 questions of equal marks. Students are required to attempt 5 questions in all. First question, covering the whole syllabus and having questions of conceptual nature, will be compulsory. Rest of the paper will be divided into two parts having three questions each and the candidate is required to attempt two questions from each section.

Section A

Oscillations: Complete mathematical treatment for mechanical as well as electrical free, damped and forced oscillators. Simple harmonic oscillator: differential and linear equation of motion, Physical characteristics of SHM.
Superposition of two SHMs executing in the same and perpendicular direction of same frequency and different frequencies, Lissajous figures. Superposition of n-SHMs

Damped Oscillations: differential equation of a damped oscillator and different kinds of damping, Methods of describing damping of an oscillator - logarithmic decrement, relaxation time, quality factor.

Forced Oscillations: differential and linear equation of motion, dependence of oscillation parameters on driving frequency, power, bandwidth, Quality factor and amplification of forced oscillator, resonance in forced oscillators, vibration insulator **[CO1]** (13 hours)

Electromagnetic Waves: Introduction to vector calculus, Maxwell equations (derivations and physical significance). Electromagnetic waves in vacuum and conducting medium, Poynting vector and Poynting theorem, Reflection and transmission of electromagnetic waves for oblique and normal incidence. **[CO2]**(11 hours)

Section B

Polarization: Methods of polarization, double refraction, quarter and half wave plates, analysis of polarized light, Fresnel theory for optical activity, polarimeter (biquartz and laurent's half-shade devices), babinet compensator, Kerr effect, applications of polarization in testing of materials, LCDs, 3D movies. **[CO3]**(8 hours)

Lasers and Optical Fibers: Elementary idea of LASER production, spontaneous emission, stimulated emission, Einstein's coefficients, Helium-Neon, Ruby and semiconductor lasers, Applications of lasers in optical communication and storage, defence, geophysical sciences.

Basics of optical fiber - its numerical aperture, coherent and incoherent bundle, step index and graded index fiber, material dispersion, applications of fibers in sensors and communication.[**CO4]**(8 hours)

Reference Books:

1. Physics of Vibrations and Waves (5th Edition, John Wiley & Sons) – H.J.Pain
2. Optics – Ajoy Ghatak
3. Fundamentals of Optics by F. Jenkins and H.E. White
4. Introduction to Electrodynamics, David J. Griffiths

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	3	2	1	1			1	1	2	1		2
CO2	3	2	1	1			1	1	2	1		2
CO3	3	3	1	1			1	1	2	1		2
CO4	3	2	2	1			1	1	2	1		2

Course Code	**ASP X51**
Course Title	**Applied Physics (P)**
Type of Course	**Core**
L T P	**0 0 3**
Credits	**1**
Course Assessment Methods (Continuous and end semester evaluation)	**50**
Course Prerequisites	Physics and mathematics at 10+2 level
Course Outcomes (CO)	After the completion of this course the students will be able to 1. Work with measuring/analysis instruments like vernier caliper, screw gauge, spectrometer, spherometer, cathode ray oscilloscope. 2. Perform data analysis and interpretations such as significant figures, error calculations, graphical representation of the data, calculation of slope and intercept using least square fitting method 3. Understand the concepts of oscillatory motions using the experimental demonstrations. 4. Understand the concepts of optical phenomena by performing related experiments.

List of Experiments: Students need to perform at least six number of experiments selecting about equal number of experiments from **Group A** and **Group B**

Group A: Optics

1. To find the wavelength of sodium light using Fresnel's biprism. **[CO1, CO2, CO4]**
2. (i) To determine the wavelength of He-Ne laser using transmission grating. **[CO1, CO2, CO4]**
   (ii) To determine the slit width using the diffraction pattern.
3. To determine the wavelength of sodium light by Newton's rings method. **[CO1, CO2, CO4]**
4. To determine the wavelength of sodium light using a diffraction grating. **[CO1, CO2, CO4]**
5. To find the specific rotation of sugar solution using a Laurant's Half shade/ Bi-quartz Polarimeter. **[CO1, CO2, CO4]**
6. To find the refractive index of a prism using spectrometer. **[CO1, CO2, CO4]**
7. To determine the wavelength of a laser using Michelson interferometer. **[CO1, CO2, CO4]**

Group B: Oscillations and Waves

8. To determine the velocity of ultrasonic waves in different liquids using ultrasonic interferometer. **[CO1, CO2, CO3]**

9. To study the frequency response and to find resonant frequencies of LCR series and parallel circuits. Also to find the quality factor and bandwidth in LCR. **[CO1, CO2, CO3]**
10. To determine the value of acceleration due to gravity and radius of gyration using bar pendulum. **[CO1, CO2, CO3]**
11. Study of transverse and longitudinal standing waves and the measurement of the frequency of the electrically maintained Tuning fork. **[CO1, CO2, CO3]**
12. To study damping effects in the spring mass system. **[CO1, CO2, CO3]**
13. To study Lissajous figures obtained by superposition of oscillations with different frequencies and phases. **[CO1, CO2, CO3]**

Reference Books: (To understand the concepts of experiments and related theories)

1. B. Sc. Practical Physics by C. L. Arora
2. Physics of Vibrations and Waves (5th Edition, John Wiley & Sons) – H.J.Pain
3. Optics – Ajoy Ghatak
4. Fundamentals of Optics by F. Jenkins and H.E. White

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	3	2	1	1			1	1	2	1		2
CO2	3	2	1	1			1	1	2	1		2
CO3	3	3	1	1			1	1	2	1		2
CO4	3	2	1	1			1	1	2	1		2

Course Code	**ASP X02**
Course Title	**Quantum Physics**
Type of Course	**Core**
L T P	**3 1 0**
Credits	**4**
Course Assessment Methods End Semester Assessment (University Exam) Continuous Assessment (Minors, Assignments, Quiz)	 **50** **50**
Course Prerequisites	Physics and mathematics at 10+2 level
Course Outcomes (CO)	After the completion of this course the students will be able to 1. Understand the basics of the special theory of relativity and its applications. Students will be familiarized with various relativistic effects like Lorentz transformations, simultaneity, length contraction, time dilation, Doppler effect, addition of velocities, variation of mass with velocity and mass-energy relation. 2. To understand historical development of quantum mechanics and to understand the central concepts and principles in quantum mechanics, such as the Schrodinger equation, the wave function and its interpretation. 3. To apply Schrödinger theory to various systems and solve Schrodinger equation for simple potentials such as potential step, infinite and finite potential well, potential barrier and its tunneling, linear harmonic oscillator (one-dimensional) and 3-D rigid box. 4. Apply quantum mechanical concepts to understand the origin of some of the properties exhibited by solids like energy bands in solids and specific heat of solids.

SYLLABUS

Note for the examiner: The semester question paper will be of 50 Marks having 7 questions of equal marks. Students are required to attempt 5 questions in all. First question, covering the whole syllabus and having questions of conceptual nature, will be compulsory. Rest of the paper will be divided into two parts having three questions each and the candidate is required to attempt two questions from each section.

Section A

Unit I: Special Theory of Relativity

Inertial and non-inertial frames of reference, Galilean transformation, Michelson Morley Experiment, Postulates of special theory of relativity, Lorentz transformation, Simultaneity, Length contraction, Time dilation, Doppler effect, Addition of velocities, variation of mass with velocity, mass-energy relation, Relativistic momentum, Minkowski space

(Section 1.1 to 1.5, 1.7 to 1.9 of Book 1) [**CO1] (8 hrs)**

Unit II: Origin and Postulates of Quantum Mechanics

Quantum theory of light, Blackbody Radiation, Photoelectric effect, Compton effect, X-rays production, spectrum & diffraction (Bragg's law), pair production, photons & gravity, Gravitational Red Shift, Black holes, de-Broglie hypothesis, particle diffraction, uncertainty principle and its applications

Postulates of quantum mechanics, wave function, Born interpretation and normalization, Schrodinger theory, Time-dependent and Time-independent Schrodinger equation, Operators (Adjoint operator, Identity operator, Hermitian operator, unitary operator etc.), expectation values, Ehrenfest theorem

(Sections 2.1-2.10, 3.1-3.5, 3.7-3.10, 5.1-5.7 of Book 1) [**CO2] (16 hrs)**

Section B

Unit III: Applications of Quantum Mechanics

Particle in a box (infinite potential well), Potential step, Finite Potential Well and Barrier, Tunneling, Linear harmonic oscillator (one-dimensional), 3-D rigid box and degeneracy

(Sections 5.8 – 5.11 of Book 1) [**CO3] (8 hrs)**

Unit IV: Application of Quantum Mechanics to Crystalline Solids

Free Electron theory of Metals (Classical and Sommerfield), Bloch's theorem for particles in a periodic potential, Kronig-Penney Model and origin of energy bands, conductors, insulators and semiconductors, Fermi level, density of states, Effective mass, Specific heat of solids.

(Sections 6.35-6.38, 6.40, 6.41, 7.1-7.5 of book 4 and Section 1 of Chapter 10 of Book 3)

[**CO4] (10 hrs**)

References:

1. Concepts of Modern Physics, by Arthur Beiser (McGraw-Hill)
2. Quantum Physics of Atoms, Molecules, Solids, Nuclei and Particles by Eisberg and Resnick
3. Introduction to Solids by Leonid V. Azaroff
4. Elementary Solid state Physics by M.Ali Omar (Pearson Education)
5. Solid State Physics, by C. Kittel (Wiley Eastern)
6. Solid State Physics, by S.O. Pillai (New Age International)

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	3	2	1	1			1	1	2	1		2
CO2	3	2	1	1			1	1	2	1		2
CO3	3	3	1	1			1	1	2	1		2
CO4	3	2	2	1			1	1	2	1		2

Course Code	**ASP X52**
Course Title	**Quantum Physics (P)**
Type of Course	**Core**
L T P	**0 0 3**
Credits	**1**
Course Assessment Methods (Continuous and end semester evaluation)	**50**
Course Prerequisites	Physics and mathematics at 10+2 level
Course Outcomes (CO)	After the completion of this course the students will be able to 1. Understand the construction and working of ● Measuring devices like vernier Calipers, screw gauge, spherometer etc. ● Electric devices like ammeter, voltmeter, galvanometer, gaussmeter etc.(Both analog and digital) 2. Perform experiments using specialized tools and techniques to probe the phenomena of quantum mechanics like uncertainty priniciple, discretisation of energy etc. and to verify the laws of probability and quantum statistics. 3. Experimentally determine quantum parameters like energy band gap, excitation energy, hydrogen spectrum wavelengths in visible region, Planck's constant etc. 4. Carry out the error analysis of their results and provide theoretical explanations of their results.

List of Experiments

1. To study the quantized energy level of the first excited state in the Argon using the Frank-Hertz setup. **[CO2, CO3, CO4]**
2. To find the value of Planck's constant and evaluate the work function of cathode material by used of photoelectric cell. **[CO1, CO2, CO3, CO4]**
3. To study various characteristics of photo-voltaic cell: (a) Voltage-current characteristics, (b) loading characteristics, (c) power-resistance characteristics and (d) inverse square law behavior of the photo-current with distance of source of light from photo-voltaic cell **[CO1, CO2, CO4]**
4. To study the response of a photo-resistor to varying intensity of light falling on it and deduce spectral sensitivity of its semiconductor material. **[CO1, CO3, CO4]**
5. To study the Balmer Series of Hydrogen spectrum using diffraction grating and calculate Rydberg constant. **[CO1, CO3, CO4]**
6. To evaluate charge on an oil drop using Millikan's oil drop method. **[CO1, CO2, CO4]**
7. To verify Rutherford's alpha scattering formula using a mechanical model. **[CO1, CO2, CO4]**
8. To calculate charge to mass ratio of an electron using Thompsonś method. **[CO1, CO2, CO4**]
9. To determine Hall coefficient of a given semiconductor material and evaluate charge carrier type, density and mobility of charge carriers. **[CO1, CO3, CO4]**
10. To study temperature dependence of resistivity of a semiconductor using four probe method and determine the energy band gap of a given semiconductor. **[CO1, CO3, CO4]**

11. To determine the velocity of ultrasonic waves in different liquids using ultrasonic interferometer. **[CO1, CO2, CO4]**

12. To study probability theory using coins. **[CO1, CO2, CO4]**

13. To study probability and statistics using two dice. **[CO1, CO2, CO4**]

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	3	2	1	1			1	1	2	1		2
CO2	3	2	1	1			1	1	2	1		2
CO3	3	3	1	1			1	1	2	1		2
CO4	3	2	1	1			1	1	2	1		2

Course Code	**ASP X03**
Course Title	**Physics of Materials**
Type of Course	**Core**
L T P	**3 1 0**
Credits	**4**
Course Assessment Methods End Semester Assessment (University Exam) Continuous Assessment (Minors, Assignments, Quiz)	 **50** **50**
Course Prerequisites	Physics and mathematics at 10+2 level
Course Outcomes (CO)	After the completion of this course the students will be able to 1. Qualitatively describe the bonding in materials and its effect on material properties. 2. Know about various crystal structures and defects and to correlate these to material properties. Students will be able to identify common defects in a material, different types of dislocation, their movement within the crystal leading to plastic deformation and strengthening mechanisms in materials. 3. Identify diffusion processes and their applications and know about elastic, an elastic and viscoelastic behavior of materials. 4. Understand fracture mechanics, factors that affect fatigue life and generalized creep behavior. 5. Understand phase diagrams, phase transformations, the importance of phase transformations for controlling microstructure and properties in engineering alloys. Students will also be able to understand solid state reactions and kinetic limitations in phase transformations.

SYLLABUS

Note for the examiner: The semester question paper will be of 50 Marks having 7 questions of equal marks. Students are required to attempt 5 questions in all. First question, covering the whole syllabus and having questions of conceptual nature, will be compulsory. Rest of the paper will be divided into two parts having three questions each and the candidate is required to attempt two questions from each section.

SECTION - A

Crystal structure: Bonding forces and energies, Primary and Secondary bonds, Space Lattices, Symmetries in a cubic lattice, Crystal Structures (cubic and hexagonal cells), Assignment of coordinates, directions and planes in crystals, Linear, Planar and Space densities in crystals, close packed morphology (Hexagonal and cubic close packing), single and polycrystalline structures, interstitial spaces (trigonal, tetrahedral and octahedral voids)

Structure of ceramics (NaCl, Zinc blende, silica and silicates, diamond crystal, Graphite, Fullerenes and carbon nanotubes)

Structure of polymers, crystallinity of long chain polymers

Crystal Structure analysis, X-ray diffraction and Bragg's law, Experimental methods for study of X-ray diffraction pattern, Crystal Defects (Point, line, surface and volume imperfections)

[CO1, CO2] (14 hours)

Diffusion: Diffusion mechanisms, steady state diffusion, non-steady state diffusion, factors affecting diffusion, applications based on diffusion (corrosion resistance of Duralumin, carburization of steel, decarburization of steel, doping of semiconductors) **[CO3] (3 hours)**

Elastic, Anelastic and Viscoelastic Behaviour: Elastic behaviour and its atomic model, rubber like elasticity, anelastic behaviour, relaxation processes, viscoelastic behaviour. **[CO3] (3 hours)**

SECTION - B

Plastic Deformations and strengthening mechanisms : Tensile properties (Yield strength, Tensile Strength, Ductility, Resilience, Toughness), Dislocations and plastic deformation, characteristics of dislocations, slip systems, slip in single crystals and polycrystalline materials, mechanisms of strengthening in metals (grain size reduction, solid-solution strengthening, strain hardening), recovery, recrystallization and grain growth. **[CO3] (5 hours)**

Fracture, Fatigue and Creep : Fracture (Ductile and brittle fractures), principles of fracture mechanics, fracture toughness, ductile to brittle transitions Cyclic stresses, S-N curve, crack initiation and propagation, factors that affect fatigue life, environmental effects, generalized creep behavior, stress and temperature effect. **[CO4] (5 hours)**

Phase Diagrams : One-Component (or Unary) Phase Diagrams, Binary Isomorphous Systems, Interpretation of Phase Diagrams, Development of Microstructure in Isomorphous Alloys, Mechanical Properties of Isomorphous Alloys ,Binary Eutectic Systems, Development of Microstructure in Eutectic Alloy, Equilibrium Diagrams Having Intermediate Phases or Compounds, Eutectic and Peritectic Reactions, the Iron-Carbon system. **[CO5] (6 hours)**

Phase Transformations: Kinetics of phase transformation, kinetics of solid state reactions, Isothermal transformation diagrams, continuous cooling transformation, temper embrittlement

[CO5] (4 hours)

RECOMMENDED BOOKS			
S.No.	**NAME**	**AUTHORS**	**PUBLISHER**
1.	Material science and engineering – An Introduction	William D Callister	6Th edition, John Willey and Sons.
2.	Material Science and Engineering – A First Course	V. Raghvan	4th edition, Eastern economy edition
3.	Solid State Physics	S. O. Pillai	New Age International
4.	Introduction to Solids	Leonid V Azaroff	Tata McGraw Hill, 3rd edition.

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	3	2	1	1	1				1			1
CO2	3	2	1	1	2				1			2
CO3	3	2	2	1	2							2
CO4	3	2	1	2	1	2	1					2
CO5	3	2	2	2	1	2	1					2

Course code	**ASP X53**
Course Title	**Physics of Materials (P)**
Type of Course	**Core**
L T P	**0 0 3**
Credits	**1**
Course Assessment Methods (Continuous and end semester evaluation)	**50**
Course Prerequisites	Physics and mathematics at 10+2 level
Course Outcomes (CO)	After the completion of this course the students will be able to 1. Understand the construction and working of ● Measuring devices like vernier Calipers, screw gauge, spherometer etc. ● Electric devices like ammeter, voltmeter, galvanometer, gaussmeter etc.(Both analog and digital) 2. Identify and differentiate the materials based on their electrical, magnetic, thermal and optical properties. 3. Experimentally determine parameters like Elastic constatnt, thermal conductivity, electrical resistivity, Hall coefficient, Curie temperature, retentivity and coercivity etc. of various materials. 4. Carry out the error analysis of their results. 5. Provide a theoretical explanations of their results and make a complete and cogent report of their findings.

List of Experiments

1. To study the quantized energy of the first excited state in Argon using the Frank-Hertz Set-up. **[CO1, CO2, CO3, CO4, CO5]**
2. To find the value of Planck's constant and evaluate the work function of cathode material by use of photoelectric cell.**[CO1, CO2, CO3, CO4, CO5]**
3. To study various characteristics of photovoltaic cell: (a) Voltage-current characteristics (b) loading characteristics (c) power-resistance characteristics and (d) inverse squarelaw behavior of photocurrent with distance of source of light from photovoltaic cell.**[CO1, CO2, CO3, CO4, CO5]**
4. To study the response of a photoresistor to varying intensity of light falling on it and deduce spectral sensitivity of its semiconductor material.**[CO1, CO2, CO3, CO4, CO5]**
5. To determine Hall coefficient of a semiconductor material and then evaluate the type, density and mobility of charge carrier in a given semiconductor material.**[CO1, CO2, CO3, CO4, CO5]**

6. To study the hysteresis loop of magnetic material (iron, nickel and steel) and determine its retentivity, coercivity and energy dissipated per unit volume per cycle of hysteresis.**[CO1, CO2, CO3, CO4, CO5]**
7. To study temperature dependence of resistivity of a semiconductor material using four probe method and further deduce the band gap of this semiconductor.**[CO1, CO2, CO3, CO4, CO5]**
8. To determine the Curie temperature of a ferroelectric material by measuring dielectric constant as a function of temperature.**[CO1, CO2, CO3, CO4, CO5]**
9. To determine thermal conductivity of bad conductor by using guarded plate method (Lee's disc method).**[CO1, CO2, CO3, CO4, CO5]**
10. To study the diamagnetic, paramagnetic and ferromagnetic behaviour of magnetic materials.**[CO1, CO2, CO3, CO4, CO5]**

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	3	2	1	1			1	1	2	1		2
CO2	3	2	1	1			1	1	2	1		2
CO3	3	3	1	1			1	1	2	1		2
CO4	3	2	1	1			1	1	2	1		2
CO5	3	1	1	1			1	1	2	1		2

Course Code	**ASC X01**
Course Title	**Applied Chemistry**
Type of Course	**Core**
L T P	**4 0 0**
Credits	**4**
Course Assessment Methods End Semester Assessment(University Exam) Continuous Assessment (Minors, Assignments, Quiz)	 50 50
Course Prerequisites	Chemistry at 10+2 level
Course Objectives (CO)	To teach the fundamentals of basic chemical sciences essential for the development of new technologies to all branches of engineering.
Course Outcome	1. The geometry and bonding in homonuclear, heteronuclear molecules and coordination compounds. Splitting of d-orbital in octahedral, tetrahedral and square planar field along with different properties of the coordination compounds. 2. How the molecules are arranged in three dimensional structure and how it leads to the phenomena of various types of isomerism. 3. The basic principles of spectroscopy and its use to determine the chemical structure. 4. The different thermodynamic laws, heat changes and energy calculations. 5. The role and mechanism of various heterogeneous and homogeneous catalysts in increasing reactions rate of many synthetically important chemical reactions. 6. The sustainable technology in design and synthesis of polymers for its variety of applications.

Note for the examiner: The end semester question paper will be of 50 Marks having 7 questions of equal marks. Students are required to attempt 5 questions in all. First question, covering the whole syllabus and having questions of conceptual nature, will be compulsory. Rest of the paper will be divided into two parts having three questions each and the candidate is required to attempt two questions from each section.

SYLLABUS

SECTION - A

Chemical Bonding

Molecular orbital theory and its applications to the formation of homonuclear (H_2, N_2) and heteronuclear diatomic molecules (NO, CO, CN), Valence bond theory as applicable to coordination compounds and its limitations. Crystal Field Theory, Splitting of octahedral, tetrahedral and square planner complexes, crystal field stabilization energies of octahedral and tetrahedral complexes and its application. **[CO 1] (6 hours)**

Stereochemistry of Organic Compounds

Concept of isomerism. Types of isomerism. Optical isomerism–enantiomers, optical activity, properties of enantiomers, diastereomers, meso compounds, resolution of enantiomers, inversion, retention and racemization, R & S systems of nomenclature. Geometric isomerism– determination of configuration of geometric isomers, E & Z system of nomenclature Conformational isomerism – conformational analysis of ethane and n-butane; conformations of cyclohexane, Newman projection. **[CO 2] (8 hours)**

Spectroscopy

Spectroscopy: UV- Introduction, Lambert-Beer's Law, selection rules, electronic transitions, Application to simple organic molecules (auxochrome, chromophore), effect of conjugation and solvent on transition of organic molecules, Woodward-Fieser Rules for calculating λmax for dienes. Infrared Spectroscop- Introduction, Principle of IR spectroscopy-Fundamental vibrations, Application to simple organic molecules (effect of masses of atoms, bond strength, nature of substituent, hydrogen bonding on IR frequency), sample preparation for IR. **[CO 3] (9 hours)**

SECTION - B

Thermodynamics (10 hrs)

Review of objectives and limitations of chemical thermodynamics, State functions, Thermodynamic equilibrium, work, heat, internal energy, enthalpy, heat capacity. Zeroth law of thermodynamics, First law of thermodynamics Reversible, isothermal and adiabatic expansion & compression of an ideal gas. Irreversible isothermal and adiabatic expansion of an ideal gas. Carnot cycle and efficiency of reversible engines, Enthalpy change and its measurement. Flame temperature, Second and third law of thermodynamics. Concept of entropy. Gibb's and Helmholtz equations. Simple numericals for calculating w, q, ΔE, ΔH and entropy. **[CO 4] (10 hours)**

Catalysis (6 hrs)

Catalysis and general characteristics of a catalytic reactions, Homogeneous catalysis, Heterogenous catalysis, Acid base catalysis and Enzyme catalysis – Michealis Menten equations, Application of catalysis for industrially important processes – Hydrogenation (Wilkinson's catalyst), Hydroformylation, Acetic acid process, Wacker process. **[CO 5] (6 hours)**

Polymers (6 hrs)

General introduction, classification of polymers, Mechanism of addition and condensation polymerization, Idea of number average and weight average molecular masses of polymers, Properties and uses of polystyrene, polyester, polyamide, epoxy, phenol-formaldehyde and silicon resins. **[CO 6] (6 hours)**

Books suggested:

RECOMMENDED BOOKS			
S.No.	**NAME**	**AUTHOR(S)**	**PUBLISHER**
1.	Atkin's Physical Chemistry	Peter Atkins, Julio de Paula	7th Ed., Oxford University Press

2	Concise Inorganic Chemistry	J D Lee	5th Edition, Chapman & Hall, 2003
3	Organic Chemistry	Joseph M. Hornback	Brooke Cole Publishing Company U.S.A.
4	A Textbook of Engineering Chemistry	Shashi Chawla	Dhanpat Rai & Co. Pvt. Ltd., Delhi (2008)
5	Principles of Physical Chemistry	Puri, Sharma and Pathania	W.H. Freeman & Co. 2008.
6	Introductory Polymer Chemistry	G.S.Mishra	John Wiley & Sons, New York, 1993
7	Introduction to spectroscopy	D. S. Pavia, G.M. Lasmpman and G.S. Kriz	4th Edition, Thomson learning, Indian Edition 2012.
8	Basic Inorganic Chemistry.	F.A. Cotton, G. Wilkinson and P.L. Gaus	3rd Ed., John Wiley & Sons
9	Inorganic Chemistry- Principles of structure and reactivity	James E. Huheey, Ellen A. Keiter and Richard L. Keiter	4th Ed. Pearson Edu. Asia
10	Organic Chemistry	S. M. Mukherji, S. P. Singh & R. P. Kapoor	1st Edition, Vol. 2, 1985, New Age International Pvt. Ltd

Course Outcomes (COs)	**PO1**	**PO 2**	**PO3**	**PO 4**	**PO5**	**PO 6**	**PO 7**	**PO 8**	**PO 9**	**PO1 0**	**PO1 1**	**PO1 2**
CO1	3	2	1				2					1
CO2	3	2										1
CO3	3		2				1					1
CO4	3	2		2								1
CO5	2											1
CO6	3	2										1

Course Code	**ASC X51**
Course Title	**Applied Chemistry (P)**
Type of Course	**Core**
L T P	**0 0 3**
Credits	**1**
Course Objectives	To teach the fundamentals of chemical sciences essential for the development of new technologies to all branches of engineering.
Course Prerequisites	Chemistry at 10+2 level
Course Assessment Methods Practical (Continuous and end semester evaluation)	50
Course Outcome :	**After completion of this course, students will be able to learn about** 1. Students will learn how to determine the concentration of chloride ion, concentrations of calcium ions, magnesium ions, copper ions in water even at the microscale level or at the industrial scale, and measurement of dissolved oxygen content required for the biological activity of water bodies using volumetric titrations. 2. Students will understand the principles of spectroscopy and learn how to apply them for the determination of concentration of unknown samples. 3. Students will learn and become familiar with the principles of thermochemistry and learn how to apply them to measure the heat of chemical reactions. 4. Students will be able to perform conductometric titrations and will learn how to determine the strength of acid/base by knowing the conductance value. 5. Students will learn how to set up an organic/inorganic reaction in the laboratory and will be able to perform reactions such as saponification of oil. 6. Students will also acquire a brief knowledge about the relationship between the molecular structure and material behavior of the polymer in the context of its appliance. 7. Students will learn the basic principles of thin layer chromatography and how it is used in separation of individual components from mixtures in chemical/biochemical samples.

Instruction for Students: The candidate will be attending a laboratory session of three hours weekly and has to perform any eight experiments.

List of Experiments:

1. Verify Lambert Beer's law using spectrophotometer and CoCl2 or K2Cr2O7 solution. **CO1**
2. To determine the strength of an acid solution by using a conductivity meter. **CO4**
3. Determination of saponification number of oil. **CO5**
4. Preparation of a phenol formaldehyde resin. **CO6**
5. Experiments on TLC (determination of Rf values and identification of various compounds). **CO7**
6. To determine the heat of neutralization of reaction. **CO3**
7. Determination of total hardness of a water sample. **CO1**
8. Determination of copper. **CO1**
9. Determination of chloride ion and dissolved O2 in water. **CO1**
10. Preparation of an inorganic complex/organic compound.**CO5**

Books Recommended:

1. A. I. Vogel : A textbook of Quantitative Inorganic Analysis, 2000, Published by Longman Gp. Ltd, 4th edition.
2. Shashi Chawla: Essentials of Experimental Engineering Chemistry. Published by Dhanpat Rai & Co. Delhi (2001).
3. Vogel's text book of quantitative chemical analysis, 6^{th} Ed by J. Mendham, R. C. Denny, J. D. Barnes and M. J. K. Thomas, Pearson Education.

Course Outcomes (COs)	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO 10	PO 11	PO 12
CO1	2	2		1		1	2					1
CO2	3	2		1	3	1	1					1
CO3	3			1		1	1					1
CO4	3	2		1		1	1					1
CO5	2			1		1	1					1
CO6	3	2		1		1	1					1

Course Code	**ASM 101**
Course Title	**Calculus**
Type of Course	**Core**
L T P	**4 1 0**
Credits	**5**
Course Assessment Methods End Semester Assessment(University Exam) Continuous Assessment (Minors, Assignments, Quiz)	 50 50
Course Prerequisites	Mathematics at 10+2 level
Course Objectives (CO)	1. To understand the behaviour of infinite series and its use. 2. To learn the concepts of functions of two and more than two variables and their applications. 3. To learn the methods to evaluate multiple integrals and their applications to various problems. 4. To understand the concepts of Vector calculus and their use in engineering problems.
Course Outcome	1. The students are able to test the behaviour of infinite series. 2. Ability to analyze functions of more than two variables and their applications. 3. Ability to evaluate multiple integrals and apply them to practical problems. 4. Ability to apply vector calculus to engineering problems.

SYLLABUS

Note for the examiner: The semester question paper will be of 50 Marks having 7 questions of equal marks. Students are required to attempt 5 questions in all. First question, covering the whole syllabus and having questions of conceptual nature, will be compulsory. Rest of the paper will be divided into two parts having three questions each and the candidate is required to attempt two questions from each section.

SECTION-A

FUNCTIONS OF ONE VARIABLE

Sequences and Series: Sequences, Limits of sequences, Infinite series, series of positive terms, Integral test, Comparison test, Ratio test, Root test. Alternating series, Absolute and Conditional Convergence, Leibnitz test. Power series: radius of convergence of power series, Taylor's and Maclaurin's Series. (Scope as in Chapter 10, Sections 10.1 – 10.9 of Reference 1).

Integral Calculus: Length of curves, Volume (disk and washer method) and surface areas of revolution (Scope as in Chapter 6, 6.1, 6.3, 6.4 of Reference 1).

DIFFERENTIAL CALCULUS OF FUNCTIONS OF TWO AND THREE VARIABLES

Concept of limit and continuity of a function of two and three variables, Partial derivatives, total derivative, composite function, differentiation of an implicit function, chain rule, Taylor's theorem (statement only), Maxima and minima of a function of two and three variables, Lagrange's method of multipliers (Scope as in Chapter 14, Sections 14.1-14.4, 14.6-14.10 of Reference 1).

SECTION-B

INTEGRAL CALCULUS OF FUNCTIONS OF TWO AND THREE VARIABLES

Double and triple integrals, Change of order of integration, Applications to area and volumes. (Scope as in Chapter 15, Sections 15.1-15.5, 15.7-15.8 of Reference 1).

VECTOR DIFFERENTIAL CALCULUS

Vector-valued functions and space curves and their tangents, integration, arc lengths, unit tangent vector, Curvature and torsion of a curve, Gradient of a Scalar field, Directional Derivative (Scope as in Chapter 13, Sections 13.1-13.5 Chapter 14, Section 14.5 of Reference 1).

VECTOR INTEGRAL CALCULUS

Line integrals, Vector fields, Work, Circulation and Flux, Path Independence, Potential functions and Conservative fields, Green's theorem in the plane, Surface Areas and Surface Integrals, Stoke's Theorem, Gauss Divergence Theorem (Statements only) (Scope as in Chapter 16 of Reference 1).

RECOMMENDED BOOKS			
S. No.	**NAME**	**AUTHORS**	**PUBLISHER**
1.	Calculus	Maurice D. Weir, Joel Hass, Frank R. Giordano, Thomas	12th edition, Pearson Education.
2.	Advanced Engineering Mathematics	E. Kreyszig.	8th edition , John Wiley.
3.	Advanced Engineering Mathematics	Michael D. Greenberg	2nd edition, Pearson Education.
4.	Advanced Engineering Mathematics	Wylie and Barrett	Tata McGraw Hill
5.	Higher Engineering Mathematics	B. V. Ramana	Tata McGraw Hill.

CO	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**
CO1	2	3	2	3								1
CO2	3	2	2	2								1
CO3	3	2	3	3								1
CO4	2	3	2	2								1

Course Code	**ASM 201**
Course Title	Differential Equations and Transforms
Type of Course	**Core**
L T P	**4 1 0**
Credits	**5**
Course Assessment Methods End Semester Assessment(University Exam) Continuous Assessment (Minors, Assignments, Quiz)	 50 50
Course Prerequisites	Mathematics at 10+2 level
Course Outcome	1. The student will learn to solve Ordinary Differential equations and their applications to engineering problems. 2. The students will be able to apply the tools of Laplace Transforms to model engineering problems and solve the resulting differential equations. 3. Students will understand the nature and behaviour of trigonometric (Fourier) series and apply it to solve boundary value problems. 4. Students will be able to understand the formulation of partial differential equations and its solution techniques.

SYLLABUS

Note for the examiner: The semester question paper will be of 50 Marks having 7 questions of equal marks. Students are required to attempt 5 questions in all. First question, covering the whole syllabus and having questions of conceptual nature, will be compulsory. Rest of the paper will be divided into two parts having three questions each and the candidate is required to attempt two questions from each section.

SECTION – A

ORDINARY DIFFERENTIAL EQUATIONS

Review of geometrical meaning of the differential equation, directional fields, exact differential equations(scope as in chapter 8, sections 8.1 – 8.10 of reference 5), solution of differential equations with constant coefficients; methods of differential operators (scope as in chapter 9, sections 9.1 – 9.5 of reference 5). Non-homogeneous equations of second order with constant coefficients: Solution by method of variation of parameters, reduction by order (scope as in chapter 9, section 9.7, 9.10 of reference 5). Power series method of solution (scope as in chapter 10, section 10.2 of reference 5)

Laplace Transforms

Laplace transform, Inverse transforms, shifting, transform of derivatives and integrals. Unit step function, second shifting theorem, Dirac's Delta function. Differentiation and integration of transforms. Convolution Theorem on Laplace Transforms. Application of Laplace transforms to solve ordinary differential equations with initial conditions (Scope as in Chapter 6, Sections 6.1 – 6.6 of Reference 2).

SECTION – B

Fourier Series and Transforms: Periodic functions, Fourier series, Even and odd series, half range expansions, Complex Fourier Series, Approximation by trigonometric polynomials. Fourier integrals, Fourier Cosine and Sine transforms, Fourier Transforms (Scope as in Chapter 11, Sections 11.1 – 11.2, 11.4-11.5, 11.7 – 11.9 of Reference 2).

Partial Differential Equations: Partial differential equations of first order, origin, solution of linear partial differential equations of first order, Integral surfaces passing through a given curve (Scope as in Chapter 2, Sections 1, 2, 4, 5 of Reference 1).

Boundary Value Problems: D'Alembert's solution of wave equation, separation of variables: one dimension heat and wave equation (Scope as in Chapter 12, Sections 12.1, 12.3 – 12.4, 12.6, 12.9 of Reference 2).

RECOMMENDED BOOKS			
S.No.	**NAME**	**AUTHORS**	**PUBLISHER**
1.	Elements of Partial Differential Equations	Ian N. Sneedon	McGraw Hill,Singapore 1957.
2.	Advanced Engineering Mathematics	E. Kreyszig.	10th edition , John Wiley.
3.	Advanced Engineering Mathematics	Michael D. Greenberg	2nd edition, Pearson Education.
4.	Advanced Engineering Mathematics	Wylie and Barrett	Tata McGraw Hill
5.	Higher Engineering Mathematics	B.V.Ramana	Tata McGraw Hill.
6.	Advanced Engineering Mathematics	R. K. Jain, S. R. K. Iyenger	Narosa Publications
7.	Theory and problems of Differential Equations	Frank Ayers	Shuam outline series, McGraw-Hill, Singapore, 1957

CO	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**
CO1	3	2	2	3								1
CO2	2	3	2	2								1
CO3	2	2	3	2								1
CO4	2	2	3	2								1

Course Code	**HSMC X01**
Course Title	**Professional Communication**
Type of Course	**Core**
L T P	**2 0 0**
Credits	**2**
Course Assessment Methods End Semester Assessment (University Exam) Continuous Assessment (Minors, Assignments, Quiz)	 **50** **50**
Course Prerequisites	Basic knowledge of English Language and Grammar
Course Outcomes (CO)	After the completion of this course the students will be able to 1. Understand sentence formation in English language and based on the context, to express oneself in formal and informal communication. 2. Understand and develop the four fundamental skills namely speaking , writing , listening and reading skills in English language. 3. Understand as to how communication takes place in organizations. Understand various documents used in official communication in different situations. 4. Understand as to how to use the latest channels to build a stronger and effective communication system. Understand the importance and components of Non-verbal communication and how to handle Cross-culture communication.

Syllabus

Note for the examiner: The semester question paper will be of 50 Marks having 7 questions of equal marks. Students are required to attempt 5 questions in all. First question, covering the whole syllabus and having questions of conceptual nature, will be compulsory. Rest of the paper will be divided into two parts having three questions each and the candidate is required to attempt two questions from each section.

Section A

English Grammar : Subject-verb agreement , Noun-pronoun agreement , Misplaced modifiers , Articles , Prepositions , Tenses, One word substitutes , Idioms and Phrases , Active-Passive , Synonyms –Antonyms

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 , Paragraph , Essay and Letter writing.

[CO 1] (11 hours)

Communication details : Four Fundamental communication methods namely Writing, Speaking, Listening and Reading ,7 Cs of Communication , Barriers to Communication
[CO 2] (3 hours)

Section B

Communication in Organizations : Formal- Informal Communication, Communication Networks, Intra and Inter Firm Communication
Communication methods : Reports and their types , Layout of a report , writing a report, Office notice , Memo ,Business proposals, Minutes of meeting
[CO 3] (6 hours)

Modes of Communication: Emerging channels of communication , Telephone and Email Etiquettes, Non-Verbal Communication, Cross culture communication, Formal Presentations
[CO 4] (3 hours)

Reference Books

1. Practical English Usage. Michael Swan. OUP. 1995.
2. Remedial English Grammar. F.T. Wood. Macmillan.2007
3. On Writing Well. William Zinsser. Harper Resource Book. 2001
4. Study Writing. Liz Hamp-Lyons and Ben Heasly. Cambridge University Press. 2006.
5. Communication Skills. Sanjay Kumar and PushpLata. Oxford University Press. 2011.
6. Exercises in Spoken English. Parts. I-III. CIEFL, Hyderabad. Oxford University Press

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

Course Code	**HSMC X51**
Course Title	**Professional Communication**
Type of Course	**Core**
L T P	**0 0 2**
Credits	**1**
Course Assessment Methods (Continuous and end semester evaluation)	**50**
Course Prerequisites	Basic knowledge of English Language and Grammar
Course Outcomes (CO)	After the completion of this course the students will be able to: 1. Develop their English speaking skills and will learn how to speak clearly and effectively. 2. Overcome stage fear and communicate with people without hesitation. 3. Handle communication in various formal and informal settings 4. Handle communication as team member. Listen and understand.

Practical Oral Communication
(This unit involves interactive practice sessions in Language Lab)

1. Telling something about oneself [CO1 , CO2, CO3]
2. Story Telling and Event [CO1 , CO2]
3. Listening Comprehension [CO4]
4. Pronunciation, Intonation, Stress and Rhythm [CO1, CO2, CO3]
5. Common Everyday Situations: Conversations and Dialogues [CO1, CO2,CO3]
6. Communication at Workplace [CO3 , CO4]
7. Facing an Interview [CO1, CO2]
8. Formal Presentations [CO1, CO2, CO3, CO4]

Reference Books

1. Communication Skills. Sanjay Kumar and PushpLata. Oxford University Press. 2011.

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

Course Code	**ESC X53**
Course Title	**Workshop (P)**
Course Type	Core
Course LTP	004
Course Credits	2
Course Assessment ● Continuous	50 (Practical Performance, Report Writing, and Viva Voce)
Course Prerequisites	
Course Objectives	1. Know different machines, tools and equipment, Identify different Engineering materials, metals and non-metals. 2. Understand different Mechanisms, Use of Machines, Tools and Equipment. 3. Knowledge of basic Manufacturing Processes in Electronics, Electrical, Machine, Welding, Fitting, Sheet Metal.Smithy, Foundry and Carpentry Workshops.
Course Outcomes	1. Identification of hand tools. 2. Introduction of machines. 3. Application of hand tools in engineering practices. 4. Application of machines in different manufacturing processes. 5. Introduction of safety precautions/health hazards/environment effect in engineering. 6. On hand training of tools and machines.

List of Experiments:

1. **Welding Shop:**
   Joining Processes, Welding and its Classification, Welding Processes, Fusion Welding, Pressure Welding, Electric Arc Welding, Gas Welding, Resistance Welding, Metal Inert gas Welding, Welding Joints, Welding Positions, Welding defects, Welding Applications, Basic welding design and Procedures, identification of materials,
   Jobs: Butt Joint in Flat Position using SMAW, Lap Joint using Spot Welding, Edge Joint in Horizontal Position using SMAW, Tee Joint in Flat position using SMAW, Corner Joint in vertical position using SMAW.
   Defect Identification and marking, Edge preparation and Fillet making, Tacking, Distortion identification.

2. **Electronics Shop:**

   To know about Soldering mechanism and techniques, Familiarity with Electronic Components / symbols, Testing of electronic components, Application of Soldering, Circuit Assembly

   Jobs : Practice of Soldering and desoldering, Identification and testing of a) passive electronic components b) Active electronic components, Assembly of Regulated Power supply circuit/Soldering of Full wave rectifier..

3. **Electrical Shop:**

   Introduction of Various Electric wirings, Wiring Systems, Electrical wiring material and fitting, different type of cables, Conduit pipe and its fitting, inspection points, switches of all types, Distribution boards, M.C.B's etc., Electric Shock and its management. Electric Tools: Conversance with various tools and to carry out the following: Measurement of wire sizes using SWG and micrometer

   Identification of Phase and neutral in single phase supply

   Jobs: To control a lamp with a single way switch.To control a lamp from two different places,To assemble a fluorescent lamp with its accessories

   To control a lamp, fan and a three pin socket in parallel connection with single way switches

4. **Fitting Shop:**

   Introduction of Fitting, different type of operations, Tools, materials, precision instruments like Vernier caliper and Micrometer etc, Safety precautions and Practical demonstration of tools and equipments

   Jobs: To make a square from MS Flat, Punching, Cutting, Filling techniques and practice, Tapping, Counter Drilling.

5. **Smithy Shop:**

   Introduction of Smithy and Forging process, Tools and Equipment, Operations, Heat Treatment processes, Advantages, Dis-advantages, Defects and Safety precautions.

   Jobs: Drawing and Upsetting Practice using Open Hearth Furnace, Cold working process practice, Heat Treatment \: Annealing and hardening process

6. **Machine Shop:**

   Application, Function and different parts, Operations of Lathe, Type of Cutting Tools and their materials, Drill machine Types, applications and Functions. Hacksaw machines and functions, Work Holding devices and tools, chucks, Vices, machine Vices, V Block, Measuring Instruments uses, Shaper and Milling machine Applications.

   Jobs: To perform Marking, Facing, Turning, Taper Turing, Grooving, Knurling, parting, Drilling, Reaming operations on lathe machine, Hacksawing practice on Power hacksaw, Shaping operation practice on Shaper.

7. **Carpentry Shop:**

   Classification of Tree, Timber. Advantages and uses of Timber, Seasoning of Wood, Tools Used, Defects and Prevention of Wood,

Jobs: Tee Joint, Cross Joint, Tenon Joint, L Shape Joint, Practice of Wood Working Lathe, Practice on multi-purpose Planer.

8. **Foundry Shop:**
Introduction to Foundry, Advantages and Disadvantages of castings process, Introduction to pattern and various hand tools, Ingredients of Green sands, Various Hand Molding processes, Introduction to Casting Defects.
Jobs: Identification and uses of hand tools, Preparation of Green sand in Muller, Preparation of Sand Mould of Single piece solid pattern, Split pattern, Preparation of Green sand Core, casting of a Mould and study its defects.

Textbooks:

Title	Author	Publisher
Introduction to Basic Manufacturing Processes and Workshop Technology	Rajender Singh	New Age International Publication
Workshop Technology Part 1-3	Chapman	CBS Publishers

	PO 1	PO2	PO3	PO4	PO5	PO 6	PO7	PO8	PO 9	PO10	PO 11	PO 12	PSO 1	PSO 2
CO1	3	-	1	2	3	3	1	2	3	1	1	3	3	3
CO2	1	2	1	1	-	2	1	2	2	2	2	3	3	3
CO3	3	-	1	2	3	3	1	2	3	1	1	3	3	3
CO4	1	2	1	1	-	2	1	2	2	2	2	3	3	3
CO5	3	1	1	2	3	3	-	3	3	2	-	3	-	2
CO6	3	3	2	2	3	3	2	3	3	2	3	3	3	3

Course Title	**Basic Electrical and Electronics Engineering**
Course Code	**EEC X01**
Type of Course	Core
L T P	3 0 0
Credits	3
Course Assessment Methods End Semester Assessment (University Exam.) Continuous Assessment (Sessional, Assignments, Quiz)	 50 50
Course Objectives	1. To understand basic theorems and concept of DC/AC supply in electrical circuits. 2. To understand the basics of transformers. 3. To understand the basic concepts of semiconductor diodes. 4. To understand the basic concepts of Bipolar Junction Transistors.
Course Outcome (s)	Students will be able to 1. Solve electric circuits using theorems and analyse AC electrical circuits. 2. Explain the basics of transformers in electric systems. 3. Explain the working principle and characteristics of semiconductor diodes. 4. Explain the working principle and characteristics of Bipolar Junction Transistors.

SYLLABUS

Note for Examiner- Examiner will set 7 questions of equal marks. First question will cover whole syllabus, having 10 conceptual questions of 1 mark each or 5 questions of 2 mark each and is compulsory. Rest of the paper will be divided into two parts having three questions each and the candidate is required to attempt at least two questions from each part.

PART-A

DC circuits: Voltage and current sources, KCL, KVL, Network analysis by mesh and node analysis, Superposition theorem, Thevenin's theorem, Norton's theorem, Maximum-power transfer theorem (numerical based on these theorem). (7 hours)

AC Fundamentals: Average and RMS values of alternating quantities, solution and phasor diagram of single phase ac circuits with sinusoidal source excitation, voltages and currents in star and delta connected systems, power in a three phase system, solution of three phase balanced circuits, power and power factor measurement by two watt-meters method.

(8 hours)

Transformers: Introduction, Basic Principle, EMF equation, losses, efficiency and condition for maximum efficiency, voltage regulation, open circuit and short circuit tests. (7 hours)

PART-B

Semiconductor Diodes: Ideal Diode, Semiconductor materials, Energy Levels, Extrinsic materials: n and p type, Semiconductor diode: working principle, silicon semiconductor diode characteristics, Zener region and Zener diode, Si vs Ge diode characteristics, effect of temperature on the characteristics, Light Emitting Diode (working principle). (8 hours)

Diode Applications: Load Line Analysis, Series Diode Configurations with DC inputs, Parallel and Series-Parallel configurations, AND/OR gates, Sinusoidal inputs: Half wave and full wave rectifications, Clipper and clampers. (7 hours)

Bipolar Junction Transistors: Transistor construction and operation, Common-Base configuration: working principle, characteristics and applications, Common-Emitter configuration: working principle, characteristics and applications, Common-Collector configuration: working principle, characteristics and applications (8 hours)

Recommended Books:			
S. No.	Name	Author	Publisher
1	Basic Electrical Engineering	T.K. Nagsarkar and M.S. Sakhija	Oxford University Press, 2004
2	Electric and Electronics Technology	Edward Hughes	Pearson Education Publication
3	Electronics Devices and Circuit Theory	Robert Boylestad, Louis Nashelsky	Pearson Education Publication

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO 1	PSO2	PSO3
1	3	3	1	1	1	0	0	0	1	2	2	0	3	1	1
2	3	3	1	1	1	0	0	0	1	2	2	0	3	1	1
3	3	3	1	1	1	0	0	0	1	2	2	0	3	1	1
4	3	3	1	1	1	0	0	0	1	2	2	0	3	1	1

Course Title	**Basic Electrical and Electronics Engineering (P)**
Course Code	**EEC X51**
Type of Course	Core
L T P	0 0 2
Credits	1
Course Assessment Methods Practical (Continuous and end semester evaluation)	50
Course Objectives	1. To understand basic theorems and concept of DC/AC supply in electrical circuits. 2. To understand the basics of transformers. 3. To understand the basic concepts of semiconductor diodes. 4. To understand the basic concepts of Bipolar Junction Transistors.
Course Outcomes	Students will be able to 1. Solve electric circuits using theorems and solve AC electrical circuits. 2. Perform the basic tests of transformers in electric systems. 3. Find characteristics of semiconductor diodes. 4. Find characteristics of Bipolar Junction Transistors.

Note: Any eight experiments are to be done.

1. Measure resistance and inductive reactance of a choke coil, make a series RLC circuit using the choke coil and obtain its phasor diagram.
2. To prove Superposition and Maximum Power Transfer theorem.
3. To prove Thevenin's and Norton's theorem.
4. To find out the relationship between line current & phase current, between line voltage & phase voltage for star and delta connected loads supplied from balanced three phase supply.
5. Perform Open circuit and short circuit tests on a single phase transformer and to draw its equivalent circuit.
6. To study the V-I characteristics of a semiconductor diode.
7. To study the characteristics of a Zener diode.
8. To study the characteristics of Common-Base configuration of a BJT.
9. To study the characteristics of Common-Emitter configuration of a BJT.
10. To study the characteristics of Common-Collector configuration of a BJT.

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO 10	PO 11	PO 12	PSO 1	PSO2	PSO3

1	2	1	3	1	1	1	1	1	3	2	1	2	3	0	1
2	2	1	3	1	1	1	1	1	3	2	1	2	3	0	1
3	2	1	3	1	1	1	1	1	3	2	1	2	3	0	1
4	2	1	3	1	1	1	1	1	3	2	1	2	3	0	1

Course Code	**ESC X01**
Course Title	Programming Fundamentals
Type of Course	Core
L T P	3 0 0
Credits	3
Course Assessment Methods End Semester Assessment (University Exam.) Continuous Assessment (Sessional, Assignments, Quiz)	 50 50
Course Prerequisites	None
Course Outcomes (CO)	1. To develop simple algorithms for solving arithmetic and logical problems. 2. To translate the algorithms to programs using C language and their execution. 3. To implement conditional branching, iteration and recursion. 4. To demonstrate the decomposition of a problem into functions and synthesize a complete program. 5. To examine the use of arrays, pointers and structures for various problems. 6. To implement programs for use of various file handling operations.

SYLLABUS

Note for Examiner- Examiner will set 7 questions of equal marks. First question will cover whole syllabus, having 10 conceptual questions of 1 mark each or 5 questions of 2 mark each and is compulsory. Rest of the paper will be divided into two parts having three questions each and the candidate is required to attempt at least two questions from each part.

SECTION-A

Unit–1: Introduction to Programming [06]

Introduction to components of a computer system: Memory, processor, I/O devices, storage, operating system, concept of assembler, compiler, interpreter, loader and linker.

Concept of algorithm: Representation of an algorithm, flowchart, Pseudocode with examples, converting algorithms to programs.

Programming Basics: Structure of C program, writing and executing the first C program, Syntax and logical errors in compilation, object and executable code. Components of C language, standard I/O in C, data types, variables and constants, memory storage, storage classes.

Unit –2: Expressions and Statements [10]

Expressions and their evaluation: Operands and Operators, formation of expressions

using arithmetic, relational, logical and bitwise operators, precedence and associativity rules , mixed operands, type conversion and evaluation of expressions.
Statements: Simple and compound statements, Conditional Branching: if and switch statements, nested if-else, dangling else problem, use of break and default with switch. Iteration and loops: use of while, do while and for loops, nested loops, use of break and continue statements.

Unit– 3: Arrays & Basic Algorithms [07]
Arrays: Array notation and representation, manipulating array elements, using multi-dimensional arrays, character arrays and strings.
Basic Algorithms: Searching and Sorting Algorithms (Bubble, Insertion and Selection), finding roots of equations, notion of order of complexity through example programs.

SECTION-B

Unit–4: Functions [09]
Introduction, advantages of modularizing a program into functions, types of functions, passing parameters to functions: call by value, call by reference, passing arrays to functions, recursion with example programs.

Unit – 5: Structures , Union, Enums and Bit-fields [06]
Defining, declaring and usage of structures, unions and their arrays, passing structures and unions to functions, introduction to enums and bit-fields.

Unit – 6: Pointers and File handling [07]
Pointers: Introduction, declaration, applications, dynamic memory allocation (malloc, calloc, realloc, free), use of pointers in self-referential structures.
File handling: File I/O functions, standard C pre-processors, defining and calling macros, command-line arguments.

TEXT BOOKS

S. No.	NAME	AUTHOR(S)	PUBLISHER
1.	Schaum's Outline of Programming with C	Byron Gottfried	McGraw-Hill
2	Programming in C: A practical approach	Dr. Ajay Mittal	Pearson Education, 2010
3	The C programming	Kernighan Brain W. and Ritchie Dennis M	Pearson Education
4	Computer Basics and C Programming	V. Rajaraman	PHI Learning, 2015
5	Computer Concepts and Programming in C	E Balaguruswamy	McGraw Hill

6	Computer Science- A Structured Approach Programming Using C	Behrouz A.Forouzan, Richard F. Gilberg, Thomson, Third Edition	Cengage Learning - 2007

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	2	2	1	1	1	1	1		1			1	1	-
CO2	2	2	1	1	1			1	1				1	-
CO3	2	1	2	1								2		
CO4	3	3	1	1				2				1	1	1
CO5	3	2	2	1					1				1	1
CO6	2	3	1	1	1			1	1			2	1	1

Course Code	**ESC X51**
Course Title	Programming Fundamentals **(Practical)**
Type of Course	Core
L T P	0 0 3
Credits	1
Course Assessment Methods Practical (Continuous and end semester evaluation)	50
Course Prerequisites	None

Course Outcomes (CO)	1. To formulate algorithms for simple problems and translate given algorithms to a working and correct program 2. To be able to develop programs using arithmetic expressions and if-then else constructs 3. To be able to execute iterative as well as recursive programs 4. To be able to demonstrate use of arrays, strings and structures for representing data and manipulate them through a program 5. To be able to implement various pointers operations and use them in defining self-referential structures. 6. To be able to create, read and write to and from simple text files

Lab1: Familiarization with programming environment

Lab 2: Simple computational problems using arithmetic expressions

Lab 3: Problems involving if-then-else structures

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

Lab 5: 1D Array manipulation, Arrays: searching, sorting

Lab 6: Matrix problems, String operations

Lab 7: Simple functions and parameter passing

Lab 8: Numerical methods (Root finding, numerical differentiation, numerical integration)

Lab 9: Recursive functions

Lab 10: Pointers and structures

Lab 11: File operations

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	2	2	1	1	1	1	1		1			1	1	-
CO2	2	2	1	1	1			1	1				1	-
CO3	2	1	2	1								2		
CO4	3	3	1	1				2				1	1	1
CO5	3	2	2	1					1				1	1
CO6	2	3	1	1	1			1	1			2	1	1

Course Code	**ESC X04**
Course Title	**Engineering Graphics**
Course Assessment Methods End Semester Assessment(University Exam) Continuous Assessment (Minors, Assignments, Quiz)	 50 50
Course Objectives (CO)	1. To learn computer-aided-drafting skills using computer software. 2. To communicate ideas using engineering drawings. 3. To be able to interpret and express using standard symbols and conventions of engineering drawing.
Course Outcomes	1. Students will gain the ability to draw engineering views of products. 2. Ability to turn their ideas into sketches and drawings for good communication. 3. Ability to read and understand drawing symbols and conventions. 4. Ability to learn fundamental of 2 D construction related to projections of points, lines and planes. 5. Ability to draw isometric view of a given orthographic projections. 6. Ability to draw and read sectional and auxiliary drawings.

SYLLABUS

Note for the examiner: The semester question paper will be of 50 Marks having 7 questions of equal marks. Students are required to attempt 5 questions in all. First question, covering the whole syllabus and having questions of conceptual nature, will be compulsory. Rest of the paper will be divided into two parts having three questions each and the candidate is required to attempt two questions from each section.

Section A

1. Introduction: Demonstrating knowledge of the theory of CAD software, Tabs and Panels, The Command Line Box, Command Tools, Starting a New Drawing , Naming a Drawing , Drawing Units, Drawing Limits, Grid and Snap, Save and Save As, Open, Close, Terminology and Conventions, Linear Dimension, Dimension Styles, Units, Aligned Dimensions, Radius and Diameter Dimensions, Angular Dimensions, Ordinate Dimensions, Baseline Dimensions, Continue Dimension, Quick Dimension, Center Mark, MLEADER and QLEADER, Text,

Dimensioning Holes, Placing Dimensions, Fillets and Rounds, Polar Dimensions, Chamfers, Symbols and Abbreviations.

2. Fundamentals of 2D Construction and Advanced Commands: Line-Random Points, Erase, Line-Snap Point, Line-Dynamic Inputs, Construction Line, Circle, Circle Centerlines, Polyline, Spline, Ellipse, Rectangle, Polygon, Point, Text, Move, Copy, Offset, Mirror, Array, Rotate, Trim, Extend, Break, Chamfer, Fillet, Table, OSNAP, Layer command.

3. **Orthographic Projections**: Principles of Orthographic Projections-Conventions - Projections of Points, Projection of line- Parallel to both H.P. and V.P., Parallel to one and inclined to other, and inclined to both, contained in profile plane. True length and angle determination of straight line: Rotation method and Auxiliary plane method, Traces of a line, Difference between plane and lamina, Projection of lamina- Parallel to one and perpendicular to other, Perpendicular to one and inclined to other, Inclined to both reference planes.

4. **Projection of Regular Solids:** Definition of Solids, Types of solids, and elements of solids, Projection of solids in first quadrant- with axis parallel to one and perpendicular to other, axis parallel to one inclined to other and axis inclined to both the principle planes.

Section B

5. **Section of Solids:** Theory of Sectioning, Cutting Plane Lines, Section Lines, Hatch, Styles of Section Lines, Sectioning of Prism, Pyramid, Cone and Cylinder (Simple Cases).

6. Development of Surfaces: Purpose of development, Methods of development of prism, cylinder, cone and pyramid surfaces (for right angled solids only) and development of surface of sphere.

7. Isometric Projection: Classification of pictorial views, Basic Principle of Isometric projection, Difference between isometric projection and isometric drawing. Isometric projection of solids such as cube, prism, pyramid and cylinder.

Reference Books:

Title	Author	Publisher	Edition
Engineering Graphics with AutoCAD	James Bethune	Pearson	2016
Fundamentals of Engg. Drawing	Warren J. Luzadder	Literary Licensing, LLC	2015
Engineering Drawing and Design	Cecil Jensen	Mc-Graw Hill	2012
Manual of Engineering Drawing	T.E. French	WENTWORTH Press	2016

CO	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO1 0	PO1 1	PO1 2	PSO 1	PSO2
CO1	3	2	3	-	1	1	1		2	3	2	1	3	2
CO2	3	2	3	1	1	1	1	-	2	3	1	1	3	1
CO3	3	2	3	1	3	1	1	-	2	3	1	1	2	3
CO4	3	1	3	1	3	1	1	-	2	3	1	1	3	1
CO5	2	1	3	-	3	-	-	-	1	3	-	1	2	1
CO6	2	1	3	-	3	-	-	-	1	3	-	1	2	1

Course Code	**ESC X54**
Course Title	**Engineering Graphics (P)**
Course Assessment Methods Practical (Continuous and end semester evaluation)	**50**
Course Outcomes	1. Ability to learn and understand basic and advanced commands of AutoCAD. 2. Ability to draw the two-dimensional drawings using different toolbars of AutoCAD. 3. Ability to understand and draw the orthographic projections. 4. Ability to draw isometric, sectional and auxiliary views using AutoCAD. 5. Ability to draw basic solid models using AutoCAD. 6. Ability to learn and use solid editing toolbars and related commands.

The candidates will be required to make AutoCAD drawing sheets covering the following as per B.I.S. SP46-2003 for general engineering drawing:

1. To draw two dimensional drawings in AutoCAD by using draw, modify, dimension, layers and object-snap toolbars.
2. To draw orthographic views of points.
3. To draw orthographic views of lines and to find traces of the lines.
4. To find true length of lines using rotation as well as trapezoidal method.

5. To draw orthographic views of laminas in different positions.
6. To draw orthographic views of polyhedral solids in different positions.
7. To draw orthographic views of solids of revolution in different positions.
8. To draw sectional views of solids, true sections and apparent sections.
9. To draw isometric views of laminas and solids.
10. To draw development of polyhedral solids.
11. To draw development of solids of revolution.
12. To draw basic solid models using AutoCAD by using solids and solid editing toolbars and related commands.

CO	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO10	PO11	PO12	PSO 1	PSO 2
CO1	3	2	3	-	1	1	1		2	3	2	1	3	2
CO2	3	2	3	1	1	1	1	-	2	3	1	1	3	1
CO3	3	2	3	1	3	1	1	-	2	3	1	1	2	3
CO4	3	1	3	1	3	1	1	-	2	3	1	1	3	1
CO5	2	1	3	-	3	-	-	-	1	3	-	1	2	1
CO6	2	1	3	-	3	-	-	-	1	3	-	1	2	1

Course Code	**EC 203**
Course Title	**Digital Design**
Type of Course	**Core**
L T P	**3 0 3**
Credits	**3**
Course Assessment Methods End Semester Assessment(University Exam) Continuous Assessment (Minors, Assignments, Quiz)	 50 50
Course prerequisites	None
Course Objectives (CO)	1. To apply minimization techniques for reducing the functions up to six variables. 2. To design various combinational circuits 3. To write the truth table, excitation table, characteristic equations of various flip flops and to design the sequential circuits using Flip flops. 4. To familiarize the various A/D, D/A Converters, Logic families and their characteristics.
Course Outcomes	1. Understand the functioning of logic gates, and flip-flops. 2. Design and implementation of combinational circuits using different minimization techniques. 3. Design counters and shift-registers. 4. Understand the working of different data converters and digital logic families.

SYLLABUS

Note for Examiner: The semester question paper will be of 50 marks having 7 questions of equal marks. Students are required to attempt 5 questions in all. First question, covering the whole syllabus and having questions of conceptual nature, will be compulsory. Rest of the paper will be divided into two parts having three questions each and the candidate is required to attempt two questions from each section.

SECTION – A

Introduction (5 hours)

Digital logic, Number Systems and Conversions for Binary, Octal, Decimal, Hexadecimal, Binary Arithmetic, Basic and Universal gates, Boolean Alegbra, Binary addition and subtraction.

Minimization Techniques (6 hours)

Sum of Products and Products of Sum forms, Minterms & Maxterms, Karnaugh Map for two, three, four five and six variables, Quine-McCluskey method.

Combinational Circuit Design (6 hours)

Half adder, full adder, subtractor, BCD adder, comparator, code converter, encoder decoder, multiplexer, demultiplexer, parity detector and generator, PLA, PAL and ROM

Flip Flops (5 hours)

1-bit memory cell, clocked and unclocked flip flops, S-R Flip flop, D flip flop, JK Flip flop, T flip flop, edge triggered flip flop, race around condition , Master slave flip flop, conversion of flip flops using excitation table.

SECTION - B

Counters (5 hours)

Ripple counter, design of Mod-N ripple counter, design of synchronous counter with and without lockout condition, decade counter, ring counter, Johnson counter

Shift Registers (5 hours)

Serial in serial out shift register, serial in parallel out shift register, parallel in serial out shift register and parallel in parallel out shift register, bidirectional shift register, universal shift register.

A/D and D/A Converters (6 hours)

Weighted resistor D/A converter, Binary ladder D/A converter. A/D Converters- flash type, successive approximation, counter ramp type, dual slope type, characteristics of ADC and DAC.

Logic Families (7 hours)

Characteristics of logic families: fan-out, noise margin, propagation delay, power dissipation. Circuit diagrams and working of DTL, DCTL, I^2L, HTL, TTL, Totem pole TTL, ECL, CMOS logic families.

RECOMMENDED BOOKS			
S. No.	**NAME**	**AUTHORS**	**PUBLISHER**
1.	Digital Design	Morris Mano	PHI, 4th edition
2.	Digital principles and Applications	Malvino Leach	Tata-McGraw Hill
3.	Digital System Principles and Applications	R J Tocci	PHI
4.	Modern Digital Electronics	R P Jain	Tata-McGraw Hill
5.	Digital Integrated Electronics	Taub Schilling	Tata-McGraw Hill

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO 1	PSO 2	PSO 3
1	2	3	1	2	0	0	0	0	1	0	0	0	3	2	1
2	3	3	3	2	0	0	0	0	1	0	0	0	3	2	1
3	3	3	3	3	0	0	0	0	1	0	0	0	3	2	1
4	2	3	2	3	0	0	0	0	1	0	0	0	3	3	1

Course Code	**EC 253**
Course Title	**Digital Design (P)**
Type of Course	**Core**
L T P	**0 0 3**
Credits	**1**
Course Assessment Methods Practical (Continuous and end semester evaluation)	50
Course prerequisites	None
Course Objectives (CO)	1. To apply minimization techniques for reducing the functions up to six variables. 2. To design various combinational circuits 3. To write the truth table, excitation table, characteristic equations of various flip flops and to design the sequential circuits using Flip flops. 4. To familiarize the various A/D, D/A Converters, Logic families and their characteristics.
Course Outcomes	1. Understand the functioning of logic gates, and flip-flops. 2. Design and implementation of combinational circuits using different minimization techniques. 3. Design counters and shift-registers. 4. Understand the working of different data converters and digital logic families.

List of Experiments

1. To Study the data sheets of TTL and ECL gates
2. Implementation of Adder and Subtractor using Logic Gates.
3. Implementation of Binary Adder/Subtractor.
4. Implementation of BCD Adder.
5. Design & implementation of Combinational circuits using Multiplexers
6. Design and implement a Universal shift register having shift-right, shift-left, SISO, PIPO capabilities.
7. Implementation of Flip-flops using Logic Gates.
8. Implementations of Ripple counter.
9. Implementation of Modulo-N Synchronous Counter.
10. Implementation of Synchronous counters with unused states and/or avoiding Lock Out condition.
11. To convert 8 bit Digital data to Analog value using DAC
12. To convert Analog value into 8 bit Digital data using ADC.

CO	PO1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO1 0	PO11	PO12	PS O 1	PS O 2	PS O 3
1	2	3	1	2	0	0	0	0	1	0	0	0	3	2	1
2	3	3	3	2	0	0	0	0	1	0	0	0	3	2	1
3	3	3	3	3	0	0	0	0	1	0	0	0	3	2	1
4	2	3	2	3	0	0	0	0	1	0	0	0	3	3	1

Course Code	**BTBS X01**
Course Title	Fundamentals of Biotechnology
Type of Course	**Core**
L T P	**2 0 0**
Credits	**2**
Course Assessment Methods End Semester Assessment (University Exam) Continuous Assessment (Minors, Assignments, Quiz)	 50 50
Course Prerequisites	None
Course Objectives	1. To build on the foundation of biological aspects with emphasis on origin and propagation of various life forms and their constituent molecules. 2. To develop the concept of biosafety, GLP, GMP and biological waste disposal.
Course Outcome (CO)	1. To develop basic understanding about applications of biotechnology. 2. To understand the components of living systems, cells, tissues and organs. 3. To be apply the concepts of GLP and GMP in industry settings. 4. To understand and be able to apply the concept of biosafety, transport and disposal of biomedical waste.

Note: The semester question paper will be of 50 Marks having 7 questions of equal marks. Candidates are required to attempt 5 questions in all. First question, covering the whole syllabus and having questions of conceptual nature, will be compulsory. Rest of the paper will be divided into two sections having three questions each and the candidate is required to attempt at least two questions from each section.

SECTION A

Introduction to Biotechnology: definition, scope, applications in agriculture medical, food industry, bioremediation and future prospects **[CO1]** 2

Origin of Life: theories of evolution, chemical evolution, organic evolution, Oparin-Haldane hypothesis, Miller's experiment **[CO1]** 4

Cell structure and function: prokaryotic and eukaryotic cell (plant and animal cell), various cell organelles, their structure and functions **[CO2]** 4

SECTION B

Types of Animal Tissues: Basic structure and function of epithelial tissue, connective tissue, muscular tissue and nervous tissue **[CO2]** 4

Biological Systems: outlines of the major biological systems – digestive, circulatory, nervous, endocrine, and reproductive system **[CO2]** 4

Introduction to biosafety, bioethics and IPR in biotechnology: concept of biosafety, need and application of biosafety in laboratories and industries, international and national norms regarding biosafety, GLP, GMP, bio-medical wastes, transportation of biological materials 3 **[CO3, CO4]**

Books Recommended:

1 Campbell, NA, Reece, JB, Urry, LA, Cain, ML, Wasserman, SA, Minorsky, PV and Jackson, RB: Biology, Pearson/Benjamin Cummings, 8th edition,2008

2 Pelczar MJ and Chan ECS (Jr): Microbiology, Tata McGraw Hill Pub. Co., 5th edition,2003

3 Nelson DL and Cox MM: Lehninger Principles of Biochemistry, W.H. Freeman and Company, USA. 6th edition,2013

4. Singh BD: Biotechnology: Expanding Horizons, Kalyani Publishers, 4th edition,2012

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	3	3	3	3	3	1	-	1	-	-	2	1	1	-	-
CO2	3	2	2	1	-	-	-	-	-	-	-	-	1	-	-
CO3	3	1	1	1	-	-	-	-	-	-	1	1	1	-	-
CO4	2	2	3	3	1	2	-	-	-	-	1	1	1	-	-

Course Code	**HSMC X01**
Course Title	**Professional Communication**
Type of Course	**Core**
L T P	**2 0 0**
Credits	**2**
Course Assessment Methods End Semester Assessment (University Exam) Continuous Assessment (Minors, Assignments, Quiz)	 **50** **50**
Course Prerequisites	Basic knowledge of English Language and Grammar
Course Outcomes (CO)	After the completion of this course the students will be able to 1. Understand sentence formation in English language and based on the context, to express oneself in formal and informal communication. 2. Understand and develop the four fundamental skills namely speaking , writing , listening and reading skills in English language. 3. Understand as to how communication takes place in organizations. Understand various documents used in official communication in different situations. 4. Understand as to how to use the latest channels to build a stronger and effective communication system. Understand the importance and components of Non-verbal communication and how to handle Cross-culture communication.

Syllabus

Note for the examiner: The semester question paper will be of 50 Marks having 7 questions of equal marks. Students are required to attempt 5 questions in all. First question, covering the whole syllabus and having questions of conceptual nature, will be compulsory. Rest of the paper will be divided into two parts having three questions each and the candidate is required to attempt two questions from each section.

Section A

English Grammar : Subject-verb agreement , Noun-pronoun agreement , Misplaced modifiers , Articles , Prepositions , Tenses, One word substitutes , Idioms and Phrases , Active-Passive , Synonyms –Antonyms

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 , Paragraph , Essay and Letter writing.
[CO 1] (11 hours)

Communication details : Four Fundamental communication methods namely Writing, Speaking, Listening and Reading ,7 Cs of Communication , Barriers to Communication
[CO 2] (3 hours)

Section B

Communication in Organizations : Formal- Informal Communication, Communication Networks, Intra and Inter Firm Communication

Communication methods : Reports and their types , Layout of a report , writing a report, Office notice , Memo ,Business proposals, Minutes of meeting
[CO 3] (6 hours)

Modes of Communication: Emerging channels of communication , Telephone and Email Etiquettes, Non-Verbal Communication, Cross culture communication, Formal Presentations
[CO 4] (3 hours)

Reference Books

1. Practical English Usage. Michael Swan. OUP. 1995.

2. Remedial English Grammar. F.T. Wood. Macmillan.2007

3. On Writing Well. William Zinsser. Harper Resource Book. 2001

4. Study Writing. Liz Hamp-Lyons and Ben Heasly. Cambridge University Press. 2006.

5. Communication Skills. Sanjay Kumar and PushpLata. Oxford University Press. 2011.

6. Exercises in Spoken English. Parts. I-III. CIEFL, Hyderabad. Oxford University Press

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

Course Code	**HSMC X51**
Course Title	**Professional Communication (P)**
Type of Course	**Core**
L T P	**0 0 2**
Credits	**1**
Course Assessment Methods (Continuous and end semester evaluation)	**50**
Course Prerequisites	Basic knowledge of English Language and Grammar
Course Outcomes (CO)	After the completion of this course the students will be able to: 1. Develop their English speaking skills and will learn how to speak clearly and effectively. 2. Overcome stage fear and communicate with people without hesitation. 3. Handle communication in various formal and informal settings 4. Handle communication as team member. Listen and understand.

Practical Oral Communication (This unit involves interactive practice sessions in Language Lab)

1. Telling something about oneself [CO1 , CO2, CO3]
2. Story Telling and Event [CO1 , CO2]
3. Listening Comprehension [CO4]
4. Pronunciation, Intonation, Stress and Rhythm [CO1, CO2, CO3]
5. Common Everyday Situations: Conversations and Dialogues [CO1, CO2,CO3]
6. Communication at Workplace [CO3 , CO4]
7. Facing an Interview [CO1, CO2]
8. Formal Presentations [CO1, CO2, CO3, CO4]

Reference Books

1. Communication Skills. Sanjay Kumar and PushpLata. Oxford University Press. 2011.

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

Course Code	**HSMC X01**
Course Title	**Environment Sciences**
Type of Course	**HSMC**
L T P	**0 0 0**
Credits	**1**
Total lectures	-
Course Assessment Methods: End Semester Assessment (University Exam.) Continuous Assessment (Sessional)	**-** **Satisfactory/unsatisfactory**
Course Prerequisites	
Course Objectives	1. Create awareness among students about environmental problems, 2. Evaluate the scale of degradation of the environment and its allied problems, 3. Reflect on the role and responsibility of everyone in the interconnected world 4. Encourage social participation towards conservation of environment
Course Outcomes	1. Create awareness about the importance of the environment, its basic components and identify the role of individuals in environmental conservation and sustainability. 2. Give an overview on the concept of ecology. Describe various parts and structures of ecology. Understand the interaction between social and environmental processes. Introduce methods of ecological and social science knowledge in solving environmental problems. 3. Define air pollution, list the source, and scale its effects on living and nonliving things. Evaluate the amounts of air pollutants emitted by monitoring and sampling. Find measures to substantially control the emission of air pollutants and minimize its hazardous impacts on the society. 4. Introduce key terms related to water pollution. Explain different types of water pollutants and its adverse impact on human health. Social remedies to control water pollution. 5. Discuss various types of pollutants (municipal, industrial, commercial, agricultural, hazardous solid wastes): their origin and effects. Solid waste management from collection, segregation, and disposal methods. Role of organized and unorganized sectors towards solid waste management and conservation of land above and below ground level. 6. To introduce and build an understanding of the various types of noise pollution. Explore questions relating to human activities responsible for it pollution and its socio-economical impacts. Various ways to monitor and curtain the disastrous outcomes due to noise pollution.

SYLLABUS	
This value-added course may be offered as a self-study course via MOOCs/Swayam/NPTEL portal etc. There will be internal assessment for this subject on the basis of presentation/report submission, etc.	
	Hours
General Introduction, components of the environment, environmental degradation.	**(4)**
Ecology Elements of ecology: Ecological balance and consequences of change, principles of environmental impact assessment.	**(3)**
Air pollution and control Atmospheric composition, energy balance, climate, weather, dispersion, sources and effects of pollutants, primary and secondary pollutants, green house effect, depletion of ozone layer, standards and control measures.	**(6)**
Water pollution and control Hydrosphere, natural water, pollutants their origin and effects, river/lake/ground water pollution, standards and control.	**(6)**
Land Pollution Lithosphere, pollutants (municipal, industrial, commercial, agricultural, hazardous solid wastes): their origin and effects, collection and disposal of solid waste, recovery and conversion methods.	**(6)**
Noise Pollution Sources, effects, standards and control.	**(6)**

RECOMMENDED BOOKS			
S.No.	**NAME**	**AUTHORS**	**PUBLISHER**
1.	Introduction to Environmental Engineering and Science	C. M. Masters	Prentice Hall of India Pvt. Ltd., 1991
2.	Environmental Science	B. J. Nebel	Prentice Hall Inc., 1987

Course Outcomes	**PO1**	**PO 2**	**PO3**	**PO 4**	**PO5**	**PO 6**	**PO 7**	**PO 8**	**PO 9**	**PO1 0**	**PO1 1**	**PO1 2**
CO1	2	1	1		1							1
CO2	2							1				1
CO3	2		2									1
CO4	2	1		1								1
CO5	2	2							1			1
CO6	1	1										1

Course Code	UHV01
Course Title	Universal Human Values
Course Type	Core
Course LTP	0 0 0
Course Credits	3
Course Assessment Methods: **End Semester Assessment (University Exam.)** **Continuous Assessment (Sessional)**	-- Satisfactory/Unsatisfactory
Course Prerequisites	None. Desirable – UHV-I: Universal Human Values-Introduction
Course Objectives	1. Development of a holistic perspective based on self-exploration about themselves (human being), family, society and nature/existence . 2. Understanding (or developing clarity) of the harmony in the human being, family, society and nature/existence. 3. Strengthening of self-reflection. 4. Development of commitment and courage to act.
Course Outcomes	On the completion of the course, the students are expected 1. To become aware of themselves, and their surroundings (family, society, nature) 2. They would become more responsible in life, and in handling problems with sustainable solutions, while keeping human relations and human nature in mind. 3. To have better critical ability. 4. To become sensitive to their commitment towards what they have understood (human values, human relationship and human society). 5. To apply what they have learnt to their own self in different day-to-day settings in real life, at least a beginning would be made in this direction.

This value-added course may be offered as a self-study course via MOOCs/Swayam/NPTEL portal etc. There will be internal assessment for this subject on the basis of presentation/report submission, etc.

The course has 28 lectures and 14 practice sessions in 5 modules:

Module 1: Course Introduction - Need, Basic Guidelines, Content and Process for Value Education

1. Purpose and motivation for the course

2. Self-Exploration–what is it? - Its content and process; 'Natural Acceptance' and Experiential Validation- as the process for self-exploration
3. Continuous Happiness and Prosperity- A look at basic Human Aspirations
4. Right understanding, Relationship and Physical Facility- the basic requirements for fulfillment of aspirations of every human being with their correct priority
5. Understanding Happiness and Prosperity correctly- A critical appraisal of the current scenario
6. Method to fulfill the above human aspirations: understanding and living in harmony at various levels.

Module 2: Understanding Harmony in the Human Being - Harmony in Myself! 7. Understanding human being as a co-existence of the sentient 'I' and the material 'Body'
8. Understanding the needs of Self ('I') and 'Body' - happiness and physical facility
9. Understanding the Body as an instrument of 'I' (I being the doer, seer and enjoyer)
10. Understanding the characteristics and activities of 'I' and harmony in 'I'
11. Understanding the harmony of I with the Body: Sanyam and Health; correct appraisal of Physical needs, meaning of Prosperity in detail
12. Programs to ensure Sanyam and Health.

Module 3: Understanding Harmony in the Family and Society- Harmony in Human- Human Relationship

13. Understanding values in human-human relationship; meaning of Justice (nine universal values in relationships) and program for its fulfillment to ensure mutual happiness; Trust and Respect as the foundational values of relationship
14. Understanding the meaning of Trust; Difference between intention and competence
15. Understanding the meaning of Respect, Difference between respect and differentiation; the other salient values in relationship
16. Understanding the harmony in the society (society being an extension of family): Resolution, Prosperity, fearlessness (trust) and co-existence as comprehensive Human Goals
17. Visualizing a universal harmonious order in society- Undivided Society, Universal Order- from family to world family.

Module 4: Understanding Harmony in the Nature and Existence - Whole existence as Coexistence

18. Understanding the harmony in the Nature
19. Interconnectedness and mutual fulfillment among the four orders of nature- recyclability and self regulation in nature
20. Understanding Existence as Co-existence of mutually interacting units in all-pervasive space
21. Holistic perception of harmony at all levels of existence.

Module 5: Implications of the above Holistic Understanding of Harmony on Professional Ethics

22. Natural acceptance of human values
23. Definitiveness of Ethical Human Conduct
24. Basis for Humanistic Education, Humanistic Constitution and Humanistic Universal Order
25. Competence in professional ethics: a. Ability to utilize the professional competence for augmenting universal human order b. Ability to identify the scope and characteristics of people friendly and eco-friendly production systems, c. Ability to identify and develop appropriate technologies and management patterns for above production systems.
26. Case studies of typical holistic technologies, management models and production systems
27. Strategy for transition from the present state to Universal Human Order: a. At the level of individual: as socially and ecologically responsible engineers, technologists and managers b. At the level of society: as mutually enriching institutions and organizations
28. Sum up.

Text Book

1. Human Values and Professional Ethics by R R Gaur, R Sangal, G P Bagaria, Excel Books New Delhi, 2010

Reference Books

1. Jeevan Vidya: Ek Parichaya, A Nagaraj, Jeevan Vidya Prakashan, Amarkantak, 1999.
2. Human Values, A.N. Tripathi, New Age Intl. Publishers, New Delhi, 2004.
3. The Story of Stuff (Book).
4. The Story of My Experiments with Truth - by Mohandas Karamchand Gandhi
5. Small is Beautiful - E. F Schumacher.
6. Slow is Beautiful - Cecile Andrews
7. Economy of Permanence - J C Kumarappa
8. Bharat Mein Angreji Raj - PanditSunderlal
9. Rediscovering India - by Dharampal
10. Hind Swaraj or Indian Home Rule - by Mohandas K. Gandhi
11. India Wins Freedom - Maulana Abdul Kalam Azad
12. Vivekananda - Romain Rolland (English) Gandhi - Romain Rolland (English)

Course Outcomes	PO1	PO 2	PO3	PO 4	PO5	PO 6	PO 7	PO 8	PO 9	PO1 0	PO1 1	PO1 2
CO1							2	2		2		2
CO2							2	2		2		2
CO3							2	2		2		2
CO4							2	2		2		2
CO5							2	2		2		2

THIRD SEMESTER

Course Code	MATHS-301
Course Title	**Linear Algebra and Complex Analysis** (Theory)
Type of Course	Core
L T P	4 1 0
Credits	4
Course Assessment Methods End Semester Assessment (University Exam.) Continuous Assessment (Sessional, Assignments, Quiz)	 50 50
Course Prerequisites	Calculus (MATHS-101)
Course Outcome	1. Student will learn to solve system of linear equations and related concepts and will be introduced to the idea of vector spaces and linear transforms along with their applications. 2. Student will be able to carry out various operations on matrices including its diagonalization using eigen vectors and shall be able to understand the concept of change of basis and its matrix representation. 3. Student will be introduced to the concept of complex valued functions, the calculus of complex valued functions on elementary functions. 4. Student will understand the concept of series representations of complex functions and its applications to solving complex integrals. Transformation using complex functions is also introduced.

SYLLABUS

Note for Examiner*- Examiner will set 7 questions of equal marks. First question will cover whole syllabus, having 10 conceptual questions of 1 mark each or 5 questions of 2 mark each and is compulsory. Rest of the paper will be divided into two parts having three questions each and the candidate is required to attempt at least two questions from each part.*

SECTION-A

Systems of Linear equations: 5

Introduction, Linear equations, solutions, Linear equations in two unknowns, Systems of linear equations, equivalent systems, Elementary operations, Systems in Triangular and echelon form, Reduction Algorithm, Matrices, Row equivalence and elementary row operations, Systems of Linear equations and matrices, Homogeneous systems of Linear equations. (Scope as in Chapter 1, Sections 1.1-1.10 of Reference 1).

Vector Spaces: 5

Introduction, Vector spaces, examples of vector spaces, subspaces, Linear combinations, Linear spans, Linear dependence and Independence, Basis and

Dimension, Linear equations and vector spaces. (Scope as in Chapter 5, Sections 5.1-5.8 of Reference 1).

Eigenvalues and Eigenvectors, Diagonalization: 4

Introduction, Polynomials in matrices, Characteristic polynomial, Cayley-Hamilton theorem, Eigen-values and Eigen-vectors, computing Eigen-values and Eigen-vectors, Diagonalizing matrices. (Scope as in Chapter 8, Sections 8.1-8.5 of Reference 1).

Linear Transformations: 6

Introduction, Mappings, Linear mappings, Kernal and image of a linear mapping, Rank-Nullity theorem (without proof), singular and non-singular linear mappings, isomorphisms. (Scope as in Chapter 9, Sections 9.1-9.5 of Reference 1).

Matrices and Linear transformations: 4

Introduction, Matrix representation of a linear operator, Change of basis and Linear operators. (Scope as in Chapter 10, Sections 10.1-10.3 of Reference 1).

SECTION-B

Complex Functions: Definition of a Complex Function, Concept of continuity and differentiability of a complex function, Cauchy – Riemann equations, necessary and sufficient conditions for differentiability (Statement only). Study of complex functions: Exponential function, Trigonometric functions, Hyperbolic functions, real and imaginary part of trigonometric and hyperbolic functions, Logarithmic functions of a complex variable, complex exponents (Scope as in Chapter 12, Sections 12.3 – 12.4, 12.6 – 12.8 of Reference 4). 8

Laurent Series of function of complex variable, Singularities and Zeros, Residues at simple poles and Residue at a pole of any order, Residue Theorem (Statement only) and its simple applications (Scope as in Chapter 15, Sections 15.1 – 15.3 of Reference 4). 6

Conformal Mappings, Linear Fractional Transformations (Scope as in Chapter 12, Sections 12.5, 12.9 of Reference 4). 7

RECOMMENDED BOOKS

S. No.	NAME	AUTHOR(S)	PUBLISHER
1	Shaum's Outline of Theory and Problems of Linear Algebra	Seymour Lipschutz	Second Edition, McGraw-Hill, 1991.
2	Complex Variables and Applications	R. V. Churchill, J. W. Brown	Sixth Edition, McGraw-Hill, Singapore, 1996
3	Linear Algebra	VivekSahai, VikasBist.	Narosa Publishing House, New Delhi, 2002
4	Advanced Engineering Mathematics	E. Kreyszig	Eighth Edition, John Wiley.
5	Advanced Engineering Mathematics	Michael D. Greenberg	Second Edition, Pearson Education

Course Code	**EC 302**
Course Title	**Signals & Systems(Theory)**
Type of Course	Core
L T P	3 1 0
Credits	3
Course Assessment Methods End Semester Assessment (University Exam.) Continuous Assessment (Sessional, Assignments, Quiz)	 50 50
Course Prerequisites	Differential Equations and Transforms (MATHS 201)
Course Objectives (CO)	1. To understand different types of Signals, Systems and their examples in real life situations. 2. To study solution of differential and difference equations. 3. To study Fourier Series and Fourier Transform of Continuous and Discrete time systems and using these tools to solve systems represented by differential and difference equations. 4. To study Laplace Transform, Z-transform, their properties and their use in finding the output of LTI systems.
Course Outcome	1. Understand the classification of signals and Systems. 2. Analyze the behavior of C.T. and D.T. LTI systems in time domain using differential and difference equations and Convolution. 2. Determine the Fourier series representation of C.T. and D.T. LTI systems. 3. Determine the Fourier transform of C.T. and D.T. LTI systems. 4. Perform the characterization of C.T. and D.T. LTI systems using Laplace Transform, Z Transform, Hilbert transform and state space analysis.

SYLLABUS

Note for Examiner*- Examiner will set 7 questions of equal marks. First question will cover whole syllabus, having 10 conceptual questions of 1 mark each or 5 questions of 2 mark each and is compulsory. Rest of the paper will be divided into two parts having three questions each and the candidate is required to attempt at least two questions from each part.*

SECTION-A

Signals & Systems 4

Energy and Power of Signals, Transformations of independent variable,Classification of Signals, Elementary Signals, Classification of Systems, System models for Electrical, Mechanical, Electromechanical, Hydraulic, Thermal, and Biomedical Systems.

Time domain analysis of Continuous-time and Discrete-time Systems 9

Continuous-time Systems: Zero-input response, Zero-state response, Convolution, Impulse response, Classical solution of Differential equations, System Stability

Discrete-time systems: Zero-input response, Zero-state response, Convolution, Impulse response, Classical solution of Difference equations, System Stability

Continuous-time signal analysis: Fourier Series and Fourier Transform 8

Response of LTI systems to complex exponentials, Fourier series representation of continuous time periodic signals, Convergence of fourier series, Properties of CTFS, Fourier Transform of continuous time Aperiodic signals, The Fourier transform for periodic signals, Properties of CTFT.

Sampling 2

The Sampling Theorem and its implications, Spectra of sampled signals, Reconstruction,Ideal interpolator, Aliasing and its effects.

SECTION-B

Discrete-time signal analysis: Fourier Series and Fourier Transform 9

Fourier series representation of discrete time periodic signals, Properties of DTFS, Fourier transform of discrete time aperiodic signals, The Fourier transform of periodic signals, Properties of DTFT, Duality, The magnitude-phase representation of the Fourier Transform.

The Laplace Transform 5

Laplace Transform, ROC, Inverse Laplace Transform, Pole-zero plot, Properties of Laplace transform, Characterization of LTI systems using Laplace Transform, Unilateral Laplace Transform.

The Z-Transform 5

The Z-Transform, ROC, Inverse Z-Transform, Pole-Zero plot, Properties of Z-Transform, Characterization of LTI systems using Z-Transform, The Unilateral Z Transform.

State-Space Analysis 3

State-space analysis and multi-input, multi-output representation,. The state-transition matrix and its role.

TEXT BOOKS			
S. No.	**NAME**	**AUTHOR(S)**	**PUBLISHER**
1	Principles of Linear Systems	B. P. Lathi	Oxford University

	and Signals		Press
RECOMMENDED BOOKS			
1	Signals and Systems	Haykin, S., Van Veen, B.	Wiley; 2003
2	Signals and Systems	Oppenheim, A. V., Willsky , A. S., Nawab ,S.H	Pearson Education
3	Signals and Systems	T. K. Rawat	Oxford University press
4	Signals and Systems	A. Rajeshwari, V. Krishnaveni	Wiley India

Course Code	EC 304
Course Title	**Microprocessor and Micro-controllers (Theory)**
Type of Course	Core
L T P	4 0 2
Credits	4
Course Assessment Methods End Semester Assessment (University Exam.) Continuous Assessment (Sessional, Assignments, Quiz)	 50 50
Course Prerequisites	Digital Design
Course Objectives (CO)	1. To introduce with the basics of microprocessor and microcontrollers. 2. To develop the capability to write the assembly language programs. 3. To introduce with the peripheral devices (such as memory and I/O interfaces) and their interfacing. 4. To use all the above in the design of microcontroller based systems
Course Outcome	1. Understand the need and the basics of microprocessor 8085 and 8051 microcontroller. 2. Able to demonstrate their programming proficiency by designing and conducting experiments related to microprocessor based system design and analyze their outcomes. 3. Understand both hardware and software aspects of integrating digital devices (such as memory and I/O interfaces) 4. To design the systems /models based on microcontrollers.

SYLLABUS

Note for Examiner*- Examiner will set 7 questions of equal marks. First question will cover whole syllabus, having 10 conceptual questions of 1 mark each or 5 questions of 2 mark each and is compulsory. Rest of the paper will be divided into two parts having three questions each and the candidate is required to attempt at least two questions from each part.*

SECTION-A

Microprocessor Architecture **5**

Microprocessor Architecture, Memory, Input and Output Devices, Memory- Mapped I/O, processor architectures: Harvard v/s Princeton, CISC v/s RISC.

8085 Microprocessor **8**

8085 MPU, Architecture of 8085 MP, Pin diagram , 8085 Programming Model, Instruction Classification, Instruction Format, Data Transfer (Copy) Operations, Arithmetic Operations, Logic Operations, Branch Operations, Writing Assembly Language Programs.

Programming Techniques with Additional Instructions **6**

Programming Techniques Looping, Counting and Indexing, Arithmetic Operations Related to Memory, Logic Operations.

Advanced concepts **6**

Counters and Time Delays, Stack, Subroutine, Basic introduction to Interrupts and Polling.

SECTION-B

Introduction of 8 Bit Micro-Controllers **7**

Comparison between Microprocessor and Micro-controller , Factors to choose the micro-controller, Various 8 bit micro-controller families , Architecture of 8051 microcontroller, Pin configuration, SFR's, Memory , 8051 Addressing modes.

8051 Programming Language **6**

Introduction to 8051 assembly language programming: JUMP, LOOP and CALL instructions, Arithmetic instructions: Unsigned and signed number concepts, Logic and Compare instructions, I/O PORT, Single bit instruction programming, Single bit operations with CY.

Applications Based on 8051 Microcontrollers **7**

Interfacing of memory, LED display, Seven segment, LCD, ADC, DAC, stepper motor.

TEXT BOOKS

S. No.	NAME	AUTHOR(S)	PUBLISHER
1	Microprocessor Architecture, Programming and Applications with the 8085	Ramesh S. Gaonkar	Penram International, Edition 3rd
2	Microcomputer Systems 8086/8088 Family	Yu Cheng Liu & G. A. Gibson	PHI
3	The 8051 Microcontroller and Embedded System	Muhammad Ali Mazidi, Janice Gillespie Mazidi	Pearson Education
4	Advanced Microprocessors & Interfacing	Badri Ram	Tata Mc-Graw Hill
5	The 8051 Microcontrollers	Ayala	Penram Publications
6	Microprocessors and Interfacing programming and Hardware	Douglas V. Hall	

Course Title	**Microprocessor and Micro controllers (practical)**
Type of Course	Core
Credits	1
Course Assessment Methods Continuous Assessment	 50

LIST OF EXPERIMENTS

1. Study the 8085 Microprocessor Hardware Kit.
2. Write a program to add 2 numbers.
3. Write a program to dissemble a byte to a nibble.
4. Write a program to reassemble a byte from 2 nibbles.
5. Write a program to add two numbers without carry.
6. Write a program to find the greatest number and smallest number from the given data.
7. Write a program to arrange the given numbers in descending order.
8. Write a program to move a block of data from one section of memory to another section of memory.
9. Interfacing of LED, seven segment display, keypad, LCD WITH 8051
10. Microcontroller based projects

Course Code	**EC-307**
Course Title	**Electronic Devices and Circuits**
Type of Course	Core
L T P	3 1 2
Credits	3
Course Assessment Methods End Semester Assessment (University Exam.) Continuous Assessment (Sessional, Assignments, Quiz)	 50 50
Course Prerequisites	Introduction to Electronics
Course Objectives (CO)	1. To provide the capability to use abstractions to analyze and design simple electronic circuits. 2. To make students understand transistors and its biasing and how complex devices such as Bipolar Junction Transistors are modelled and the use of the mathematical models in the design and analysis of various circuits. 3. To familiarize the student with the analysis and design of basic transistor amplifier circuits, feedback amplifiers, oscillators and power amplifiers.
Course Outcome	1. Students will have understanding of structure and working of basic electronics devices, transistors, amplifier, and biasing. 2. Students will understand working principles, characteristics, analysis and applications of BJT, FET, and MOSFET. 3. Students will understand frequency response characteristics of BJT and performance of small signal BJT amplifiers - single stage and multistage amplifiers 4. Students will understand designing and analysis of oscillators and power amplifier circuits.

SYLLABUS

Note for Examiner*- Examiner will set 7 questions of equal marks. First question will cover whole syllabus, having 10 conceptual questions of 1 mark each or 5 questions of 2 mark each and is compulsory. Rest of the paper will be divided into two parts having three questions each and the candidate is required to attempt at least two questions from each part.*

SECTION-A

Transistor and its Biasing: 8

Transistor operation and Characteristics, CB, CC and CE configurations,Operating point,

Bias stability, various biasing circuits, stabilization against variation in Ico, Vbe andbeta, Bias compensation, Thermistor and Sensistor compensation, Thermal Runaway, Thermalstability.

BJT Modeling: 8

Transistor as an amplifier, comparison of CB, CC and CE amplifier stages, BJT modeling, Important parameters: Input Impedance, Output Impedance, voltage and current gain,Transistor h–parameters, conversion formulas, re model, analysis of transistor amplifiers using h-parameters.

Field Effect Transistors: 6

Introduction, FET Construction, types of FET, Characteristics of FETs,MOSFET: types and working principle, FET biasing, FET small signal model, FET applications.

SECTION-B

BJT Frequency Response: 6

Frequency Response of single stage CE amplifier, Multistage amplifiers,Direct coupled, RC coupled and Transformer coupled, frequency response of multistage amplifiers,cascode circuits.

Oscillators: 8

Introduction to feedback, basic principles of sinusoidal oscillators, condition for sustained oscillations, tuned collector, tuned base, Hartley oscillator, Colpitt's Oscillator, Phase ShiftOscillator, Wein Bridge Oscillator and Crystal Oscillator.

Power Amplifiers: 8

Classification of amplifiers, Single tuned and double tuned amplifiers, analysis ofclass A, B, C and AB amplifiers, push pull amplifier, complementary symmetry, amplitude distortionin amplifiers, harmonics, power distortion, heat sinks.

TEXT BOOKS			
S. No.	**NAME**	**AUTHOR(S)**	**PUBLISHER**
1	Electronics Devices & Circuit Theory	RL Boylestead & L Nashelsky	Pearson
RECOMMENDED BOOKS			
1	Integrated electronics	Millman & Halkias	Tata-McGraw Hill
2	Microelectronic Circuits	AS Sedra & KC Smith	OXFORD
3	Electronics Circuit Analysis and Design	Donald A. Neamen	Tata McGraw Hill

Course Title	Electronic Devices and Circuits
Type of Course	Core
Credits	1
Course Assessment Methods Continuous Assessment	 50

LIST OF EXPERIMENTS

All these experiments are to be performed on bread board and simulated in Pspice software.

1. Familiarization with electronic components and usage of Multimeter
2. Familiarization with CRO and Signal Generator.
3. To study the V-I characteristics of pn junction diode and determine static resistance and dynamic resistance.
4. To implement clipper and clamper circuits.
5. To plot the characteristics of BJT
6. To plot the frequency response of a single stage BJT amplifier.
7. To measure the voltage and current gain of a BJT amplifier.
8. To plot the characteristics of FET.
9. To verify the operation of BJT as an amplifier and draw the frequency response RC coupled amplifier.
10. To measure the distortion in the output of a push pull amplifier.

Course Code	EC306
Course Title	**Electronics Measurements & Instrumentation** (Theory)
Type of Course	Core
L T P	3 0 2
Credits	3
Course Assessment Methods End Semester Assessment (University Exam.) Continuous Assessment (Sessional, Assignments, Quiz)	 50 50
Course Prerequisites	Physics, Basic Electrical Engineering,
Course Objectives (CO)	1. To review the basics of electronic measurement and instrumentation. 2. Explain the design and operation of different types of Electromechanical and Electronic Indicating Instrument. 3. To learn the working principles of Sensors and Transducers. 4. To learn the principles of Virtual Instrumentation and impart practical knowledge of Instrumentation in LabVIEW.
Course Outcome	1. Understand the Concepts and applications of Electronics Measurements & Instrumentation. 2. Explain the working and design criteria of different types of Electromechanical and Electronic Instruments. 3. Explain the working principle and applications of various Transducers. 4. Explain the basic electronics instruments and their implementation in a virtual Instrumentation.

SYLLABUS

Note for Examiner*- Examiner will set 7 questions of equal marks. First question will cover whole syllabus, having 10 conceptual questions of 1 mark each or 5 questions of 2 mark each and is compulsory. Rest of the paper will be divided into two parts having three questions each and the candidate is required to attempt at least two questions from each part.*

SECTION-A

Measurement Systems and Characteristics Of Instruments: 07

Introduction- Measurements, Significance of measurements, Methods of measurements, Instruments and measurement system, Electronic instruments, Classification of instruments, Deflection and Null type instruments, Static Characteristics, Errors in measurements, Types of errors, Accuracy and Precision, Noise, Resolution or discrimination, loading effects, Standards and their classification.

Electronic Instruments: 11

Electronic Instruments for Measuring Basic Parameters: DC meter, AC Voltmeter, True-RMS responding Voltmeter, Electronic multi-meter, Digital voltmeter, Vector Voltmeter, Multirange DC Voltmeter, Ohmmeter: Series and shunt. Bridge Circuits for RLC Measurements: Measurement of R (Medium, High and Low), L, Cand frequency, Wheatstone, Kelvin, Maxwell, Anderson, Schering and Wien bridge.

Signal Measurement: 06

Introduction- Block diagram of CRO, Cathode ray tube, Electrostatic Deflection, Time base generator, Measurement of voltage, phase and frequency using CRO; Digital Storage Oscilloscope , Logic Analyzer, Function generator, Spectrum Analyzer.

SECTION-B

Transducers: 10

Introduction to Sensor Electronics and terminology, Active and Passive Transducers, Strain, Temperature, Pressure, Flow measurement. Instrumentation amplifier, Smart Transducers, optical transducers, light modulating techniques, fiber optic sensors, ECG, EEG, cardiovascular measurements, pacemakers, instrumentation for diagnostic x-rays. Qualitative treatment of Potentiometer, Strain Gauge, LVDT, Thermocouple, IR sensor, Piezo-electric crystal, Accelerometer, and Photoelectric transducers.

Virtual Instrumentation: 11

Virtual Instrumentation in engineering process, Comparison between conventional programming and graphical programming.Introduction to Lab VIEW Front Panel, Block Diagram, Tools And Palettes, Menus, Code Debugging, Creating Sub-Vis, For Loop, While Loop, data types and conversions, operations on numbers, Feedback, Auto indexing, Local Variable, Global Variables, Shift Registers, sub-VI creation, sequence structure, case structure, Formula Node,Arrays and cluster, Inter-conversion of arrays andclusters, charts and graphs and property nodes, strings and string manipulation, output to files and input from files, Introduction to Data acquisition and applications.

RECOMMENDED BOOKS

S. No.	NAME	AUTHOR(S)	PUBLISHER
1	Electronic Instrumentation & Measurement Techniques	W.D. Cooper and A.D. Hilfrick	PHI
2	Learning with LabVIEW 7 Express	R.H.Bishop	Pearson Education, Delhi.
3	Electrical and Electronic Measurements and Instrumentation	Sawhney A K	DhanpatRai and Sons
4	Electronic Instrumentation	Kalsi H S	Tata McGraw Hill
5	Transducers and Instrumentation	Murthy D V S	Prentice Hall of India
6	Virtual Instrumentation Using LabVIEW Kindle Edition	Jovitha Jerome	EEE

Course Title	Electronics Measurements & Instrumentation (Practical)
Type of Course	Core
Credits	1
Course Assessment Methods Continuous Assessment	50

LIST OF EXPERIMENTS

1. **Create a VI and build a Sub-VI that converts and**:
   1. Celsius into Fahrenheit (F)
   2. Degree into Radians
   3. Use Case Structure to create a Temperature converter (oC to F and oC to Kelvin)
   4. 4bit BCD to Gray Code
   5. Half Adder (HA)
   6. Use subVI of HA to create a Full Adder
2. **Loops:** Create a VI to find
   7. Factorial of a number using FOR loop and Shift Register
   8. Sum of n natural numbers using WHILE loop and Feedback node
   9. Decimal to binary conversion using FOR loop
   10. Whether a given number is prime or not.
3. **Array**
   11. Create a 1D array. Multiply its elements with a scaling factor and find the resultant array.
   12. Create a 2D array (5X5) and find its transpose
4. **Clusters**
   13. Create a VI to compare cluster elements and switch ON an LED, if nth element is same.
5. **Plotting Data:** Build a VI to
   14. Plot a Circle using FOR Loop and XY graph
   15. Examine the different charts like Strip, Scope, Sweep.
   16. Draw and analyze effect of variation of frequency, phase and amplitude using Lissajous patterns
6. **Formula Node**
   17. Create a VI to find roots of Quadratic equation. Given constants a, b, c. Display roots and type of roots
7. **Strings and File I/O**
   18. Build a VI to replace a particular word in a string with a new word.
   19. Create a VI to read a file and Display the file path and its contents in a numeric and string indicator.
8. **A hardware project to be prepared.**

Course Code	**HSS301**
Course Title	**Economics (Theory)**
Type of Course	Elective
L T P	300
Credits	3
Course Assessment Methods End Semester Assessment (University Exam.) Continuous Assessment (Sessional, Assignments, Quiz)	 50 50
Course Prerequisites	
Course Objectives (CO)	1. To make students understand how society manages its scarce resources for achieving maximum satisfaction. 2. To make students learn about economic aspects related to a consumer, firm, market and economy.
Course Outcome	1. Understand the basic concepts of economics and relate it with other disciplines. 2. Measure price elasticity of demand and understand the determinants of elasticity of demand. 3. Understand the choices made by a rational consumer. 4. Explain the relationship between production function and cost function. 5. Analyze the causes and consequences of different market conditions. 6. Understand basic concepts of macroeconomics and measure national income using different approaches.

SYLLABUS

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SECTION-A

Introduction to Economics 5

Nature of Economics, Economic Thoughts, Economic Activities, Relationship of Economics with other Social Sciences and Engineering

Theory of Consumer Behaviour 11

Demand: Types, Law of Demand, Determinants of Demand and Change in Demand

Elasticity of Demand: Nature, Degrees, Types, Measurement and Factors Affecting Elasticity of Demand and its Application

Laws of Consumption: Concept and Applicability of Law of Diminishing Marginal Utility and Law of Equi-Marginal Utility

Theory of Production and Cost 7

Cost: Types of Costs, Production: Law of Variable Proportion, Returns to Factor and Returns to Scale, Economies and Diseconomies of Scale

SECTION-B

Theory of Market 8

Nature and Relevance of Perfect Competition, Monopoly and Monopolistic Competition

Basic Concepts of Macro Economics 9

National Income: Concept and Measurement, Determination of Equilibrium of Income

Inflation: Concept, Causes and Effect of Inflation, Measures to Control Inflation

Project Presentations 5

RECOMMENDED BOOKS

S. No.	NAME	AUTHOR(S)	PUBLISHER
1	Modern Economics	Ahuja H. L	S. Chand & Co. Ltd
2	Economics For Engineers	Gupta M. L. & Gupta S. P.	ESS PEE Publications
3	Business Economics	Ahuja H. L.	S. Chand & Co. Ltd
4	Macro Economic Theory	Jhingan M.L.	Konark Publisher Pvt. Ltd.
5	Principles of Microeconomics	Stiglitz J. & Walsh Carl E.,	W. W. Norton & Company
6	Principles of Economics	Mankiw N Gregory	Cengage Learning
7	Course in Micro Economics Theory	Kreps A.	Prentice Hall
8	Economics	Samuelson Paul A. &Nordhaus William D.	Tata McGraw Hill
9	Microeconomics	Gravelle H. & Reiss R.	Pearson Education
10	Macro Economics: Theory and Practice	Ahuja H. L	S. Chand & Co. Ltd

Course Code	**HSS 302**
Course Title	**Introduction to Psychology (Theory)**
Type of Course	Elective
L T P	300
Credits	3
Course Assessment Methods End Semester Assessment (University Exam.) Continuous Assessment (Sessional, Assignments, Quiz)	 50 50
Course Prerequisites	
Course Objectives (CO)	1. To provide knowledge and understanding about important concepts in Psychology. 2. To make students learn the application of principles of psychology in working life.
Course Outcome	1. The students will learn the causes and dynamics of human behavior. 2. The students will be able to apply psychological principles to enhance their personal and professional life.

SYLLABUS

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SECTION-A

Understanding Human Behaviour: Definition, methods, branches and application of psychology for engineers (5)

Measuring Human abilities: Intelligence, theories and assessment (6)

The individual working life: Personality, approaches and trait theories (6)

Psychological problems of everyday life: Stress and coping (6)

SECTION-B

Work and mental health, workplace spirituality (4)

Motivation : the concept and theoretical framework, motivating people at work (5)

Group dynamics, Intergroup relations, conflict and negotiation (6)

Leadership and Management (4)

RECOMMENDED BOOKS

S. No.	NAME	AUTHOR(S)	PUBLISHER
1	Psychology	Ciccarelli, S.K., & Meyer, G.E.	Pearson, 2007
2	OrganisationalBehaviour	Parikh, M., & Gupta, R.	Tata McGraw Hill , 2010.
3	Introduction to Psychology	Morgan C. T., King, R.A., Weiss J. R., & Schopler J.	McGraw-Hill, 1986
4	Organizational Behavior	Robbins, S.P.	Prentice Hall of India, 2003.
5	Organizational Behavior	Luthans,F.	McGraw Hill,2010

Course Code	**HSS 303**
Course Title	**Sociology**
Type of Course	Elective
L T P	300
Credits	3
Course Assessment Methods End Semester Assessment (University Exam.) Continuous Assessment (Sessional, Assignments, Quiz)	 50 50
Course Prerequisites	
Course Objectives (CO)	1. To make the students understand the role of theory in social sciences. 2. To explain students how social problems interact and react with the larger society. 3. To make students learn whether the problem is evaluated on the macro or micro perspective and their cause and effect patterns.
Course Outcome	1. The students will be able to identify the function and application of sociology theory in social sciences. 2. The students will be able to understand how social class affects individual life chances. 3. The students will learn about social structure and how it shapes and influences social interactions.

SYLLABUS

Note for Examiner*- Examiner will set 7 questions of equal marks. First question will cover whole syllabus, having 10 conceptual questions of 1 mark each or 5 questions of 2 mark each and is compulsory. Rest of the paper will be divided into two parts having three questions each and the candidate is required to attempt at least two questions from each part.*

SECTION-A

Sociology – The Discipline (4)

Sociology as a Science, Impact of Industrial and French Revolution on the Emergence of Sociology, Relevance of Sociology for Engineering

Basic Concepts (5)

Society, Association, Institution, Culture Relativism, Social Structure, Social System, Socialisation, Competition, Conflict, Accommodation, Social Mobility

Pioneering Contributions to Sociology (4)

Seminal Views of Karl Marx, Emile Durkheim, Max Weber, AlwinToeffler

Evolution of Society (5)

Primitive, Agrarian, Industrial and Post-Industrial, Features of Industrial and Post-Industrial Society, Impact of Automation and Industrialization on Society

Economy and Society (4)

Economic Systems of Simple and Complex Societies, Sociological Dimensions of Economic Life, Market (free) Economy and Controlled (planned) Economy

SECTION-B

Industrial Sociology (4)

Nature and Scope of Industrial Sociology, Pre-Conditions and Consequences of Industrialization

Science and Technology (4)

Ethos of Science and Social Responsibility of Science

Social Change (5)

Theories of Change, Factors of Change, Directed Social Change, Social Policy and Social Development, Social Cost Benefit Analysis, Role of Engineers in Development

Understanding Indian Society (7)

Traditional Hindu Social Organization, Caste System, Agrarian Society in India, Social Consequences of Land Reforms and Green Revolution, Working of the Democratic Political System in a Traditional Society, Problem of Education in India, Gender Discrimination, Economic Reforms: Liberalization, Privatization and Globalization, Strategies for Development in India

Social Problems (3)

AIDS, Alcoholism, Drug Addiction, Corruption

RECOMMENDED BOOKS

S. No.	NAME	AUTHOR(S)	PUBLISHER
1	Sociology	VardhanRanjay and Kapila S.	New Academic Publishing.
2	Sociology: Themes and Perspective	Haralambos M.	Collins Educational Publications
3	Sociology of Indian Society	Rao Shankar C.N.	Sultan Chand and Co.
4	Introduction to Sociology	BhushanVidya and Sachdeva D.R.,	KitabMahal Publications
5	Sociological Thought	Abraham Francis and Morgan J.H.	Macmillan India Ltd.

6	An Introduction to Sociology	Dassgupta Samir and SahaPaulomi	Dorling Kindersley (India) Pvt. Ltd.
7	Social Change and Modern India	Srinivas M.N.,	Orient Longman
8	Social Problems	AmitaiEtzioni	Prentice Hall
9	Industrial Sociology	Scheneider	Tata McGraw Hill
10	Society in India	Mandilbaum David	Popular Publications.
11	Sociology	Broom L., Selznick P. and Dorrock D.	Harper International Publishing House

Course Code	**HSS 306**
Course Title	**Entrepreneurship and Project Management**
Type of Course	Core
L T P	3 0 0
Credits	3
Course Assessment Methods End Semester Assessment (University Exam.) Continuous Assessment (Sessional, Assignments, Quiz)	 50 50
Course Prerequisites	
Course Objectives (CO)	The main aim of this course is to make prospective engineers familiar with the concept of entrepreneurship and MSMEs and to provide knowledge about different aspects to be considered while formulating the business plan for a new entrepreneurial venture. This course also intends to create awareness among students about financial and marketing functions that is required for a new venture.
Course Outcome	1. The students will be able to apply engineering knowledge effectively in the field of entrepreneurship development. 2. The students can make effective use of entrepreneurial knowledge to start and manage their venture. 3. The students will learn to check the feasibility of a new project to maintain its long run sustainability.

SYLLABUS

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SECTION-A

Introduction to Entrepreneurship

Concept of Entrepreneurship, Characteristics and Functions of Entrepreneur
Forms of Ownership of Business, Factors Affecting Entrepreneurship
Case Studies of Entrepreneurs (8 hours)

Women Entrepreneurship

Nature of Women Entrepreneurship, Problems of Women Entrepreneurs, Institutional Initiatives for Promotion of Women Entrepreneurs (4 hours)

Micro, Small and Medium Enterprises (MSMEs)

Concept of MSMEs, Schemes of MSMEs

Functions of Entrepreneurial Development Programmes (EDPs) (3 hours)

Project Identification

Idea Generation, Project Life Cycle, Concept of SWOT Analysis

SWOT Analysis of Selected Project (3 hours)

SECTION-B

Project Planning and Formulation

Elements of Project Formulation: Product, Technical (Location, Scale, Technology, Production Process, Layout, Manpower, Resources), Market, Finance and Economic Aspects

Feasibility Analysis: Financial Viability and Profitability, and Socio-Economic Desirability (12 hours)

Project Report

Formulation of Business Plan and Project Report, Hypothetical Example of a Real-Life Project (4 hours)

Finance and Marketing Function

Concept of Finance, Finance Related Terminologies, Sources of Finance, Cost Estimations

Marketing Mix: Product, Place, Price, Promotion, People, Process and Physical Evidence

Marketing Segmentation Targeting and Positioning (8 hours)

Discussions on Additional Reading (any one of the following in the semester)

- The New Age Entrepreneurs
- The $100 Startup: Fire your Boss, Do what you Love and Work Better to Live More
- A Guide to Entrepreneurship
- Dhandha: How Gujaratis Do Business
- Rokda: How Baniyas Do Business
- Take Me Home
- Business Families of Ludhiana (3 hours)

TEXT BOOKS			
S. No.	**NAME**	**AUTHOR(S)**	**PUBLISHER**
1	"Dynamics of Entrepreneurial Development & Management"	Desai V	5th Edition, Himalaya Publishing House
2	"Projects: Planning, Analysis, Selection, Financing, Implementation and Review"	Chandra P.	8th Edition, McGraw-Hill Education (India), 2014
RECOMMENDED BOOKS			
1	"Entrepreneur's Toolkit"	Harvard Business School.	Harvard University Press, 2004
2	"Entrepreneurship"	Hisrich R.D., Peters M.P. and Shepherd D.A.	McGraw Hill Education, 2006.
3	"Essentials of Project Management"	Ramakrishna K	PHI Learning
4	"Entrepreneurship"	Roy R.	Oxford University Press, 2e, 2011

5	"Entrepreneurship Development in India"	Gupta C.B. and Srinivasan N.P.	Sultan Chand and Sons, 2013

FOURTH SEMESTER

Course Code	**EC401**
Course Title	**Communication Engineering (Theory)**
Type of Course	Core
L T P	3 0 2
Credits	3
Course Assessment Methods End Semester Assessment (University Exam.) Continuous Assessment (Sessional, Assignments, Quiz)	 50 50
Course Prerequisites	Signals & Systems
Course Objectives (CO)	1. To study the fundamentals, mathematical analysis, generation and reception of Amplitude modulation, Frequency Modulation, and Phase Modulation. 2. To study different types of Pulse modulation techniques and their mathematical analysis. 3. To study noise considerations in AM, FM, and PCM systems 4. To study the mathematical analysis of baseband pulse transmission. 5. To impart practical knowledge of different communication systems.
Course Outcome	1. Understand the concepts of amplitude modulations systems. 2. Understand the concepts of angle modulations and analog pulse modulation systems. 3. Explain the concepts of digital pulse modulation systems and baseband pulse transmission. 4. Analyze the effects of noise in communication systems.

SYLLABUS

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SECTION-A

Amplitude modulation 10

Communication System, Signal-to-noise Ratio, Channel bandwidth, The need for modulation, Mathematical analysis of AM, Generation and demodulation of AM, Properties of AM signals, DSB-SC, generation and demodulation of DSB-SC signals, mathematical analysis of single-sideband system, generation and demodulation of SSB signal, vestigial sideband modulation, Coherent reception, Costa's receiver, Quadrature amplitude modulation, Homodyne and heterodyne receiver structures, characteristics of a super-heterodyne receiver, selectivity, sensitivity, fidelity, image frequency and its rejection, Frequency division multiplexing.

Angle Modulation 9

Instantaneous frequency, Frequency and phase modulation, mathematical analysis, narrowband FM, frequency multiplication, Wideband FM, the spectra of FM signals, transmission bandwidth requirement for FM, generation of FM and PM signals, demodulation of FM and PM signals along-with mathematical analysis, Immunity of angle modulation to non-linearities, Pre emphasis and de emphasis, The phase locked loop: linear and nonlinear models, The second order PLL, Nonlinear effects in FM systems.

Pulse Modulation 4

The need for sampling, the sampling process, Nyquist sampling theorem, Practical sampling, aperture effect and its analysis, band-pass sampling, PAM, PWM, PPM.

SECTION-B

Digital pulse modulation 8

Quantization Process, midrise and midtread quantizers, PCM, Time-division multiplexing, quantization noise, companding, A-law and μ-law companding, Delta modulation, Adaptive delta modulation, Linear prediction, Differential PCM, Vocoders and video compression.

Noise in communication systems 7

The receiver model and figure of merit of a communication receiver, Noise in baseband systems, Noise in AM, DSB-SC, SSB systems, threshold effect, Noise in frequency modulation and phase modulation systems, FM threshold reduction, Noise in PCM.

Baseband pulse transmission 7

Line codes, PSD and Bipolar Signaling, Pulse Shaping, ISI, Criterion for zero ISI, Controlled ISI, Differential Encoding, Baseband data transmission in white Gaussian noise, Probability of error, Band-limited nature of channels, baseband M-ary transmission.

RECOMMENDED BOOKS

S. No.	NAME	AUTHOR(S)	PUBLISHER
1	Communication Systems	Simon Haykin	Wiley India Ltd

2	Modern Digital and Analog Communication Systems	B P Lathi, Zhi Ding	Oxford University Press
3	Principles of Communication Systems	H. Taub, D. L. Schilling, G. Saha	McGraw Hill, 2011
4	Electronic Communication Systems	G. Kennedy	McGraw Hill, 4th Edition
5	Electronic Communications	Dennis Roddy & John Coolin	PHI, latest Edition
6	Communication Systems: Analog and Digital	R P Singh and S D Sapre	Tata McGraw Hill

Course Title	**Communication Engineering** (Practical)
Type of Course	Core
Credits	1
Course Assessment Methods Continuous Assessment	50

LIST OF EXPERIMENTS

1. To measure the modulation index of AM signals using the trapezoidal method
2. To study DSB/ SC AM signal and its demodulation using product Detector Circuit.
3. To study the voltages and waveforms of various stages of super-heterodyne receiver
4. To measure the sensitivity and selectivity of a super heterodyne radio receiver
5. To study the voltages and waveforms of various stages of FM Receiver
6. To study the pulse code modulation and de-modulation circuit
7. To study the Time division multiplexing and de-multiplexing circuits.
8. To study delta modulation and demodulation circuits.
9. To study sigma delta modulation and demodulation circuits.
10. To study Pulse Amplitude Modulation, Pulse Width Modulation, and Pulse Position Modulation.
11. Implementation of modulation techniques in simulation tool.

Course Code	EC402
Course Title	**Advanced Microcontrollers & Applications**
Type of Course	**Core**
L T P	**3 0 2**
Credits	**3**
Course Assessment Methods End Semester Assessment (University Exam.) Continuous Assessment (Sessional, Assignments, Quiz)	 **50** **50**
Course Prerequisites	**Microprocessor**
Course Objectives (CO)	
Course Outcome	1. Understand basic building blocks of embedded systems. 2. Analyze the internal design of Atmega-8 advanced microcontroller along with the features and its programming. 3. Understand hardware and software features of Arduino embedded development board and its interfacing with Digital and Analog I/O devices 4. Apply the knowledge of advanced microcontrollers to design embedded system applications.

Syllabus

Note for Examiner- Examiner will set 7 questions of equal marks. First question will cover whole syllabus, having 10 conceptual questions of 1 mark each or 5 questions of 2 mark each and is compulsory. Rest of the paper will be divided into two parts having three questions each and the candidate is required to attempt any two questions from each part.

SECTION A

Introduction to Embedded System: **(9)**

Define basic concept of embedded system, Explain Characteristics of embedded system, Operating System (OS): Types of OS, Types of Mobile OS, Characteristics of Real Time Operating System, Compare different Operating Systems used for embedded system designing.

8-bit Microcontrollers Architecture (Atmega 8, AVR): (12)

Microcontroller Types: PIC, AVR, ARM: features and applications, Compare different micro controllers used for embedded system designing, AVR microcontroller: Types , Architecture and functional diagram, Internal Architectural, Block diagram of controller (Atmega 8), pin diagram, Configuration of Two 8-bit and One 16-bit Timers and Counters, channel ADC Working, Essential Peripheral circuits: Crystal Circuit, Power supply, Oscillator Circuit, Initial

programming configurations of Atmega8: port, counter, timer, Bootloader Circuit, ISP of Atmega 8 and Tmega8 and ATmea328

SECTION B

Open Source Embedded Development Board (Arduino): (10)

Overview of open source embedded development board (Arduino), Explain working of open source embedded development board using block diagram, Identify pins of embedded development board, circuit diagram of open source embedded Hardware, features of open source tool used for programming a development board, programming of embedded development board, Interface Serial Port with embedded development board, Basic Circuit of embedded development Board

Interface Digital and Analog I/O Devices (Arduino Interfacing): (10)

Concept of input and output port of embedded development board (Arduino Interfacing Concept), Interfacing of Digital I/O devices with program (Digital I/O Interfacing), Interfacing of Analog I/O devices program (Analog I/O Interfacing), Interfacing of Keypad with programming (Keypad Interfacing). Interfacing of Serial port with programming (Serial Port Interfacing), Interfacing of DC motor with programming, Interfacing of 16x2 LCD with programming

Embedded system Applications (Arduino): (4)

Functional blocks of Line follower Robot using Arduino, functional blocks of accelerometer based gesture control robot, functional blocks of home automation using RF control.

TEXT BOOKS			
S. No.	Title	Author(s)	Publisher
1.	Exploring Arduino	Jeremy Blum.	Wiley
2.	30 Arduino Projects for Evil Genius	Simon Monk	McGraw-Hill Professional
3	AVR Microcontroller and Embedded Systems using Assembly and C	Muhammad Ali Mazidi, Sarmad Naimi, Sepehr Naimi	Pearson Education
RECOMMENDED BOOKS			
4	Make: Arduino Bots and Gadgets	Kimmo and Tero Karvine	O'REILLY
5	Arduino Cookbook	Michael Margolis	O'REILLY
6	Arduino Internas	Dale Wheat	Technology in Action

Course Title	**Advanced Microcontrollers & Applications** (Practical)
Type of Course	**Core**
Credits	**1**
Course Assessment Methods Continuous Assessment	50

List of Experiments:

1. Test AVR Micro-Controller Architecture.
2. Identify each block of ATmega8 with Pins.
3. Use Arduino Architectural diagram .
4. Test the different Arduino Boards, Open-Source and Arduino Shields.
5. Install Arduino IDE and its development tool.
6. Design an embedded development Board.(arduino)
7. Develop a program to Blink LED for 1second.
8. Develop a program to interface Input Switches and output LEDs with development board (arduino).
9. Interface 7 seg display with development board(arduino) and Write a program to count and display 0 to 9 on it.
10. Develop a program to generate led pattern using computer serial control.
11. Interface potentiometer with development board (arduino) and write a program to generate Led pattern on it.
12. Interface LM35 temperature sensor with arduino and monitor temp. on serial monitor.
13. Interface DC motor using L293D Motor Driver.
14. Interface RF Tx/RF Rx with Arduino
15. Interface 16x2 LCD and Display “HELLO WORLD”.
16. Make Line-Follower Robot using Arduino.
17. Build Digital thermometer using LM35 and LCD 16x2.
18. Build Gesture Control Robot using Accelerometer.

Course Code	EC407
Course Title	**Probability and Random Processes**
Type of Course	Core
L T P	3 1 0
Credits	3
Course Assessment Methods End Semester Assessment (University Exam.) Continuous Assessment (Sessional, Assignments, Quiz)	 50 50
Course Prerequisites	Signals & Systems
Course Objectives (CO)	1. To provide the student with an appreciation to implement the concepts of Signals and Systems to understand Communication Theory. 2. To promote understanding of probability theory and use of random-process models to characterize random signals and noise. 3. To develop the understanding of noise and interferences and how these issues can be addressed to design a communication system. 4. To analyze the response of optimum filter and understand how the system with minimum probability of error can be designed. 5. To appraise student with concept of information theory, entropy and coding techniques. 6. To help students obtain a necessary background for further study in Digital Communication.
Course Outcome	1. Understand and review the concepts of signals, systems, communication process, filters and transforms in the communication system. 2. Apply the knowledge of probability theory and concepts of random-process to characterize the random signals. 3. Analyze the types of and characteristics of noise in stochastic system models and evaluate the performance in terms of SNR. 4. Analyze the performance of communication systems using the concept of Information Theory and coding techniques.

SYLLABUS

Note for Examiner- *Examiner will set 7 questions of equal marks. First question will cover whole syllabus, having 10 conceptual questions of 1 mark each or 5 questions of 2 mark each and is compulsory. Rest of the paper will be divided into two parts having three questions each and the candidate is required to attempt at least two questions from each part.*

SECTION-A

Introduction 3

The communication process, The layered approach, block diagram of a general communication system, A brief history of communications

Representations of signals 5

Review of low pass and band pass filters, The communication channel as a filter, Low pass and band pass signals, Hilbert transform, Complex baseband representation of band pass signals, Band pass systems, phase and group delay, sources of information.

Random variables and processes 15

Probability theory, classical and axiomatic definition of probability, Bayes theorem, conditional and joint probability, Random variables, PDF,CDF and their properties, conditional and joint PDFs for several random variables, Standard distributions(Binomial, Poisson, Uniform, Gaussian, Rayleigh), Derivation of the Poisson distribution, statistical averages, moments and characteristic functions, Random processes, Ergodicity and stationarity, mean, correlation and covariance functions, PSD of a random process and its properties, Transmission of a random process through an LTI system, Gaussian process, Central limit theorem.

SECTION-B

Noise 9

Noise, classification and characterization of noise, Noise temperature, noise figure, narrowband noise and its representations, stochastic model of radio link channel, The requirement of a minimum working SNR, Link budgeting, FRIIS equation and system design for given SNR requirements.

Elements of Information Theory 13

Information, Measure of Information, Entropy, source encoding theorems, fixed length and variable length codes, Coding efficiency, Huffman coding, lossless and lossy coding, Discrete memoryless channels, Mutual information and channel capacity, Channel coding theorem, Capacity of a Gaussian channel and Shanon's channel capacity theorem.

TEXT BOOKS			
S. No.	**NAME**	**AUTHOR(S)**	**PUBLISHER**

1	Modern Digital and Analog Communication Systems	B P Lathi, Zhi Ding	Oxford University Press
RECOMMENDED BOOKS			
1	Communication Systems	Simon Haykin	Wiley India Limited, 5th Edition
2	Principles of Communication Systems	H. Taub, D. L. Schilling, G. Saha	McGraw Hill, 2011
3	Principles of Digital communication	J. Das, S. K. Mullick, P. K. Chatterjee	New Age International
4	Communication Systems: Analog and Digital	R P Singh and S D Sapre	TMH
5	An Introduction to Information Theory	F M Reza	

Course Code	**EC406**
Course Title	**Analog Electronic Circuits** (Theory)
Type of Course	Core
L T P	3 1 3
Credits	3
Course Assessment Methods End Semester Assessment (University Exam.) Continuous Assessment (Sessional, Assignments, Quiz)	 50 50
Course Prerequisites	Introduction to Electronics, Analog Electronics Circuits-I
Course Objectives (CO)	1. To introduce Op Amp as an important device that finds applications in a variety of electronic systems. 2. To study various essential properties of an ideal op-amp. 3. To make students aware of how to apply simple rules to analyze and realize op amp circuits. 4. To make students aware of the use of feedback in the construction of many op amp circuits. 5. To make students aware of the concepts of active filters, oscillators and power devices. 6. To make students high frequency model of a Transistor.
Course Outcome	1. Understand and analyze the IC 741 operational amplifier and its characteristics. 2. Understand the concept of feedback in terms of gain and feedback factor. 3. Infer the DC and AC characteristics of operational amplifiers and its effect on output and their compensation techniques. 4. Elucidate and design the linear and non-linear applications of an opamp and special application ICs. 5. Validate designs through P-SPICE Simulation program.

SYLLABUS

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candidate is required to attempt at least two questions from each part.

SECTION-A

Multistage or Cascaded Amplifiers 6

Classification of Multi-stage Amplifier, Types of coupling, Effect of cascading on voltage gain, Current gain, Phase, Input and output impedances and bandwidth Analog of cascaded or multistage amplifiers, Miller Theorem, Darlington pair, Bootstrap Circuits. Transistor at high frequency and it hybrid pi CE model

Feedback Amplifiers 6

Concept of feedback, Positive and negative feedback, Voltage and current feedback, Series and shunt feedback, Effect of feedback on performance characteristics of an amplifier.

Differential amplifiers 6

Differential Amplifiers Basic of Differential Amplifier, Transistorized differential Amplifier, Configurations of Differential Amplifier, Analysis of Dual Input Balanced Output Differential Amplifier, Constant Current Bias, Current Mirror Circuit.

Operational Amplifier 4

Block diagram of a typical Op-Amp, Schematic symbol, Characteristics and performance parameters of ideal Op-Amp, Open loop configurations: Differential, Inverting & Non-Inverting.

SECTION-B

Practical Op-Amp: offset voltage analysis and compensation, input bias and offsetcurrent analysis and compensation, Change in Input offset voltage and Input offset current withtime, Temperature and supply voltage, Common mode configuration and Common mode rejection Ratio, Frequency response, slew rate. 4

Op-amp Applications 7

DC and AC amplifiers, Peaking amplifiers, Summing, Scaling and Averaging amplifiers, Differential amplifier, Instrumentation amplifiers, V to I and I to V converters, Differentiator and integrator, A to D and D to A converters, Log and antilog amplifiers, Sample and hold circuits.

Active Filter, Oscillators 6

Active filters, Essentials of Oscillator, Types of Oscillator, Sinusoidal Oscillator, Schmitt Trigger Circuits

Non-Linear Wave Shaping 6

Clipping circuits (diode & transistor), Diode comparators, Transistor differential comparator, Operational amplifier comparator, clamping circuits, Practical clamping circuit, clamping circuit.

TEXT BOOKS

S. No.	NAME	AUTHOR(S)	PUBLISHER
1	Electronics Circuit Analysis and Design	Donald A. Neamen	Tata McGraw Hill
RECOMMENDED BOOKS			
1	Op-Amps and Liner integrated Circuits	Ramakant A. Gayakward	Pearson Education, 4th edition
2	Integrated electronics	Millman&Halkias	Tata McGraw Hill
3	Electronic devices and Circuit Theory	Boylstead	Pearson

Course Title	**Analog Electronic Circuits** (Practical)
Type of Course	Core
Credits	1
Course Assessment Methods Continuous Assessment	50

LIST OF EXPERIMENTS

1. To study the Pspice Simulation software
2. Design fabrication & testing of Differentiator Circuits using Op-Amp & simulate using P-spice
3. Design fabrication & testing of Integrator Circuits using Op-Amp & simulate using P-spice
4. Design fabrication & testing of adder/Subtractor Circuits using Op-Amp & simulate using P-spice
5. Design fabrication & testing of Clippers and Clampers Circuits using Op-Amp & simulate using P-spice
6. Design fabrication & testing of Universal Active filter & simulate using P-spice
7. To study the frequency response of OP-Amp & simulate using P-spice
8. To design Butter worth Low pass filter & simulate using P-spice
9. To design Butter worth High pass filter & simulate using P-spice
10. To design Butter worth Band pass filter & simulate using P-spice
11. Hartley and Colpitts Oscillator.
12. RC Phase shift oscillator.

Course Code	**EC 408**
Course Title	**Electromagnetic Theory (Theory)**
Type of Course	Core
L T P	3 0 0
Credits	3
Course Assessment Methods End Semester Assessment (University Exam.) Continuous Assessment (Sessional, Assignments, Quiz)	 50 50
Course Prerequisites	Calculus, Oscillations and Optics
Course Objectives (CO)	1. To understand the relationship between the electricity, magnetism, electric fields, magnetic fields and electromagnetic waves. 2. To study Maxwell equations 3. To deal with the application of electromagnetic waves i.e. reflection and refraction of plane electromagnetic waves 4. To discuss the need of field theory approach of electromagnetic in understanding the waveguides.
Course Outcome	1. Apply the various theorems related to electric and magnetic fields to derive Maxwell's equation. 2. Understanding the plane wave propagation in dielectric and conducting mediums. 3. Explain the basic principle and performance parameters of transmission lines. 4. Analyze the field pattern and wave propagation in waveguides.

SYLLABUS

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SECTION-A

Electrostatics & Steady Magnetic Field

Introduction, Gauss's law, Divergence theorems, Stoke's Theorem, Poisson's equation and Laplace's equation, Electrostatics energy, The Electrostatics uniqueness theorem, Theories of magnetic field, Faraday's law, Ampere's law, Magnetic vector potential,

Analogies between Electric and magnetic fields. (7)

Maxwell's equation

Derivation of Maxwell's equations in their integral and differential forms, Maxwell's equations in free space and in harmonically varying fields, Physical Interpretation and Boundary Conditions. (4)

Plane waves in Dielectric and Conducting Media

Uniform plane wave: properties, relation between E and H; Conductors and Dielectrics: Wave equations, wave propagation, Intrinsic impedance, skin effect, Poynting Theorem and Electromagnetic vector, application to energy radiation, Velocities of propagation, Electromagnetic wave polarization, Reflection and transmission of the wave at a boundary (Perfect conductor, perfect dielectric, perfect insulator), Poynting Theorem: Application to energy radiation (11)

SECTION-B

Transmission lines

Basic principle, Equivalent circuit, Primary constants, Transmission line parameters, Transmission line equations, input impedance, relation between infinite and finite line, standing wave ratio and power. (7)

Guided Waves

Waves between parallel planes, TEM waves, Field analysis of T.M. & T.E. wave, Characteristics of T.M. & T.E. Waves. (6)

Wave Guides

Rectangular and Circular waveguides: T.M. & T.E. Modes, Impossibility of TEM wave in waveguides, Solution of the Field equations (Rectangular and Circular), Wave impedance and characteristic impedances, Attenuation factor and Q of waveguides, Cavity Resonator. (10)

TEXT BOOKS			
S. No.	**NAME**	**AUTHOR(S)**	**PUBLISHER**
1	Electromagnetic Waves & Radiation System	E.C. Jordan & K. G. Balmain,	Prentice Hall India,
RECOMMENDED BOOKS			
1	Electromagnetics	Krauss	McGraw Hill, 5ed.
2	Antennas and Wave Propagation	G S N Raju	Pearson
3	Antennas and Radio Wave Propagation	K D Prasad	SatyaPrakashan
4	Antenna and Radio Wave Propagation	Collin R.E.	Mc-Graw Hill

Course Code	EC 409
Course Title	**Network Analysis**
Type of Course	Core
L T P	3 0 2
Credits	3
Course Assessment Methods End Semester Assessment (University Exam.) Continuous Assessment (Sessional, Assignments, Quiz)	 50 50
Course Prerequisites	Basic Electrical and Electronics Engineering
Course Objectives (CO)	1. To acquire knowledge about Circuit components and Network graph. 2. To identify response of Network Functions. 3. To identify the Two Port Network Descriptions. 4. To identify the characteristics of passive and active filters. 5. To learn about the theory and applications of transmission lines.
Course Outcome	1. Identify the circuit components and their applications in various circuits. 2. Evaluate the characteristics, parameters and different network functions of two port networks. 3. Design and analyse active and passive filters. 4. Understand the theory and applications of transmission lines.

SYLLABUS

Note for Examiner- Examiner will set 7 questions of equal marks. First question will cover whole syllabus, having 10 conceptual questions of 1 mark each or 5 questions of 2 mark each and is compulsory. Rest of the paper will be divided into two parts having three questions each and the candidate is required to attempt at least two questions from each part.

PART-A

Circuit Concepts: Charge, Drift Velocity, Current, Current density, Voltage, Energy, Power, Basic Circuit, ohm's law, Resistance and resistivity, Conduction and Conductivity, Open circuit and short circuit, Series and parallel combination of resistors, Current division and

voltage division, Inductors and capacitors, Energy stored in inductors and capacitors, Energy sources and source transformation, Review of network theorems. (7)

Networks functions: Concept of complex frequency, Transform impedance and transform circuits, Network functions for the one port and two port, Calculation of network functions, Poles and Zeros for Network functions, Restrictions on Poles and Zeros, Locations for Driving Point and Transfer functions, Time domain behaviour from Pole and Zero plot, Stability of networks functions. (7)

Two Port Network: Relationship of Two port variables, Short Circuit Admittance and Open circuit Impedance parameters, Transmission and hybrid parameters, Interrelation between different two port parameters, T-Netwotks, π-Networks and lattice networks, Network Topology and Graph Theory. (7)

PART-B

Passive Filters: Classification of filters, characteristic impedance and propagation constantof pure reactive network, Ladder network, T–section, Pi–section, terminating half section, Pass bands and stop bands, Design of constant–K, m–derived filters, Composite filters Introduction. (7)

Active Filters: All-pass filter, low pass filter, Butterworth filter, high pass filter, band pass filter, band reject filter, notch filter. (5)

Transmission lines: Types and fundamental of transmission lines, Equations of transmission lines, Transmission line with load impedance, Input Impedance of a transmission line terminated with load impedance, Voltage and current at any point: on a transmission line, when the receiving end is open circuited, when the receiving end is short circuited, Input impedance of low-loss transmission line, Infinite transmission line, Characteristic Impedance, Propagation constant, Definitions: wavelength, group and phase velocity, Input Impedance of open and short circuited lines, Reflection constant, Standing wave ratio. (12)

RECOMMENDED BOOKS			
S.No.	**NAME**	**AUTHORS**	**PUBLISHER**
1.	Engineering Circuit Analysis	Milliam H. Hayt., Jack E. Kemmerly	Tata McGraw-Hill
2.	Network Analysis	M.E. Van Valkenburg	Prentice Hall of India
3.	Circuits and Networks: Analysis and Synthesis	Anant Sudhakar & Shyammohan S. Palli	Tata McGraw Hill 2015
4.	Network Theory: Analysis and Synthesis,	Smarajit Gosh	PHI learning, 2015
5	Networks, Lines and Fields	John D. Ryder	PHI, 2nd Edition
6	Network Analysis and	D. R. Chaudhry	New Age International

	Synthesis		Publishers
7	Theory and Problems of Electric Circuits	Joseph A. Edminister	Tata McGraw Hill, 4th Edition

Course Title	**Network Analysis**
Type of Course	Core
Credits	1
Course Assessment Methods Continuous Assessment	 50

LIST OF EXPERIMENTS

1. To measure the Z-Parameters of a two port network.
2. To measure the ABCD parameters of a two port network.
3. To measure the characteristics of constant K low pass filter.
4. To measure the characteristics of constant K high pass filter.
5. To measure the characteristics of constant band pass filter.
6. To measure the characteristics of a m-derived low pass filter.
7. To measure the characteristics of a Butterworth filter.
8. To measure the input impedance of a transmission line.
9. To study the stationary waves in a transmission line.
10. To measure the frequency characteristics of a transmission line.

FIFTH SEMESTER

Course Code	EC501
Course Title	**VLSI Design** (Theory)
Type of Course	Core
L T P	3 1 2
Credits	3
Course Assessment Methods End Semester Assessment (University Exam.) Continuous Assessment (Sessional, Assignments, Quiz)	 50 50
Course Prerequisites	Introduction to Electronics, AEC-I, AEC-II
Course Objectives (CO)	1. To understand theoretical and practical aspects of all the basic processes involved in Integrated circuit fabrication technology. 2. To develop the understanding of MOSFET physics, its design parameters and Scaling rules. 3. To study the static characteristics, dynamic characteristics and layout design of nMOS, CMOS Logic, and Transmission Gate. 4. To develop the capability to analyze CMOS logic circuit based on Power dissipation, Speed and Noise Margin.
Course Outcome	1. Describe basic processes involved in Integrated Circuit fabrication technology. 2. Describe Bipolar and MOS based device fabrication process. 3. Derive the MOSFET characteristics, its design parameters and scaling rules. 4. Explain the static characteristics and dynamic characteristics of nMOS, CMOS Logic, and Transmission Gate. 5. Design transistor level digital logic circuit.

SYLLABUS

Note for Examiner*- Examiner will set 7 questions of equal marks. First question will cover whole syllabus, having 10 conceptual questions of 1 mark each or 5 questions of 2 mark each and is compulsory. Rest of the paper will be divided into two parts having three questions each and the candidate is required to attempt at least two questions from each part.*

SECTION-A

Monolithic IC Processes:

General classification of Integrated Circuits, advantages of ICs over Discrete Components, Refining, and growth of silicon crystals, Si-Wafer preparation, Diffusion of dopant impurities, Defication systems, Ion implantation, Thermal oxidation, Photolithography, Fine Line lithography, Relative Plasma etching, Chemical Vapour Deposition (CVD), Metallization, Packaging. (10hours)

Monolithic Components:

Epitaxial devices and their characteristics, Bipolar IC process, P-N junction Isolation, Monolithic Bipolar transistor constructions, Dielectric isolation, Monolithic Diodes, Monolithic Junction FETS, Monolithic resistors and Monolithic capacitors. Fabrication of MOSFET, CMOS n-well process, Lambda based Design rules, Short channel MOS structures, MOS layers, stick Diagrams and layout design for nMOS and CMOS technology. (10hours)

SECTION-B

Introduction to MOS Technology:

MOSFET Structure and operation, Characteristics – Threshold Voltage, Body Bias concept, Square-Law Current-Voltage Model. Geometric Scaling Theory – Full-Voltage Scaling, Constant-Voltage Scaling. Challenges of MOSFET Scaling – Short Channel Effects. (8hours)

MOS Inverter Design:

Resistive Load inverter Design, Comparison of depletion and enhance type MOS load. CMOS inverter Static Characteristics: Basic Circuit Operation, static characteristics and switching characteristics, Noise Margins. CMOS Inverter Switching Characteristics – Delay time definition and calculation of delay time, rise time and fall time. Static Power Dissipation and Dynamic Power Dissipation. (10hours)

CMOS Logic Design:

CMOS NAND and NOR Gate, XOR, combinational circuit, Full Adder Circuit. Basic principal of nMOS Pass transistor, CMOS Transmission gate Logic design, Clocked-CMOS, Pre-Charge/ Evaluate Logic and Domino Logic. (7hours)

TEXT BOOKS			
S. No.	**NAME**	**AUTHOR(S)**	**PUBLISHER**
1.	Integrated circuits	K.R. Botkar	Khanna Publishers
2.	CMOS Digital Integrated Circuits	Sung- Mo (Steve) Kang and Yusuf Leblebici	Tata McGraw Hill
RECOMMENDED BOOKS			
S. No.	**NAME**	**AUTHOR(S)**	**PUBLISHER**

1.	Principles of Microelectronics Technology	D. Nagchoudhuri, A H Wheele	PHI
2.	VLSI Technology	Simon Sze	Tata McGraw Hill
3.	Principles of CMOS VLSI Design	Neil H.E. Weste and Kamran Eshraghian	AddisonWesley
4.	Basic VLSI Design	Douglas- A. Pucknell	PHI
5.	Digital Integrated Circuit Design	Ken Martin	OXFORD University

Course Title	**VLSI Design(Practical)**
Type of Course	**Core**
Credits	**1**
Course Assessment Methods **Continuous Assessment**	 **50**

LIST OF EXPERIMENTS

1. Introduction to Tanner EDA Tool.
2. To study the effect of variation of Threshold voltage, Transconductance parameter, Lambda on I-V characteristics of n-MOSFET using SPICE Level 1 MOSFET model.
3. To implement CMOS logic NANDGate, NOR Gate, XOR Gate and Full adder.
4. To study the Voltage Transfer Characteristics an nMOS inverter with resistive load and to observe changes in the characteristics with change in value of load Resistor.
5. To study the Voltage Transfer Characteristics of CMOS inverter.
6. To compare Transient Characteristics of:
   (a) nMOS Pass Transistor
   (b) CMOS Pass Transistor
7. To implement Multiplexer and EXOR Gate using Pass Transistor.
8. To determine the Propagation Delay (high to low and low to high) in CMOS Logic.
9. To compare and analyze static and dynamic Power Dissipation in nMOS and CMOS logic.
10. To implement a give Boolean expression using Dynamic CMOS Logic.

Course Code	**EC502**
Course Title	**Digital Signal Processing (Theory)**
Type of Course	**Core**
L T P	**3 1 2**
Credits	**3**
Course Assessment Methods End Semester Assessment (University Exam.) Continuous Assessment (Sessional, Assignments,Quiz)	 50 50
Course Prerequisites	Signals & Systems
Course Objectives (CO)	1. To get an introduction of basics like Sampling, Interpolation, Aliasing and operations Convolution and correlation. 2. To Study the basics, mathematical analysis and applications of DTFT, DFT, FFT, DCT, and wavelet transforms. 3. To study the design and implementation of Digital Filters. 4. To study the analysis of multirate systems. 5. To study the architecture of DSP processors. 6. To impart practical knowledge of signal processing operations in MATLAB.
Course Outcome	1. Analyze the behavior of signals and systems using transform tools. 2. Understanding FFT and its role in implementation of digital systems. 3. Selection and design of filters to meet given requirements. 4. Learning filter structures, multi-rate structures and architecture of digital processors.

SYLLABUS

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SECTION-A

Introduction:

Classification of Discrete-time Signals & Systems, The Sampling Theorem, Reconstruction using Interpolation filter, Aliasing, Stability and Causality, Convolution of discrete time signals, Correlation of Discrete time signals, Solution of Linear constant coefficient difference equations, Review of Z-transform. (7hours)

Frequency Domain Representation of Signals & Systems:

Review of DTFT, Discrete Fourier Transform and its properties, Filtering of long data sequences, Divide and Conquer approach to computation of DFT, Fast Fourier Transform, Decimation in time and Decimation in frequency algorithms, Computations Complexity Calculations, Discrete Cosine Transform, Audio & Video Coding, JPEG coding, Time-Frequency Analysis, Wavelet Transform. (15hours)

SECTION-B

Digital Filters:

Ideal Filter vs Practical Filters, General Specifications and Design Steps, Comparison of FIR & IIR Filters, Design of FIR Filters using Window technique, Frequency sampling technique, Design of IIR Filters using Impulse Invariance technique, Bilinear Transformation, Design of IIR Filters using Butterworth, Chebyshev and Elliptic filter, Digital frequency transformation. (9hours)

Implementation of Discrete Time Systems:

Block diagrams and signal flow graphs for FIR and IIR systems, Direct form, Cascade form, Frequency Sampling Structures, and Lattice structures for FIR systems, Direct form, Cascade form, Parallel form, and Lattice and Lattice-Ladder Structures for IIR systems, Representation of fixed point and floating point numbers, Finite word length effects. (5hours)

Multirate Signal Processing:

Basic Sampling rate alteration devices, Time domain and frequency domain representation, Multirate structures, Multistage design, Polyphase decomposition. (7hours)

Processors:

Architecture of TMS320CXX series, Addressing modes, Memory management. (2hours)

TEXT BOOKS			
S. No.	**NAME**	**AUTHOR(S)**	**PUBLISHER**
1.	Digital Signal Processing: Principles, Algorithms and Applications	Proakis & Manolakis	Pearson Education Ltd. 4th edition
RECOMMENDED BOOKS			
S. No.	**NAME**	**AUTHOR(S)**	**PUBLISHER**
1.	Digital Signal Processing	E C Ifeacher and B W Jervis	Pearson

2.	Digital Signal Processing	A.V Oppenheim and R.W.Schafer	Pearson Education Ltd
3.	Digital Signal Processing	Sanjit and Mitra	Tata Mcgraw Hill
4.	Digital Signal Processing	S Salivahanan, A Vallavraj, C Gnanapriya	Tata Mcgraw Hill
5.	Digital Signal Processing	E C Ifeacher and B W Jervis	Pearson

Course Title	**Digital Signal Processing (Practical)**
Type of Course	Core
Credits	1
Course Assessment Methods Continuous Assessment	50

LIST OF EXPERIMENTS

(To be performed using any simulation software like MATLAB, Octave, Scilab or equivalent)

1. Introduction to Simulation Software.
2. Effect of noise on signals.
3. Z-Transform.
4. Convolution of sequences.
5. Correlation of sequences.
6. Detection of Signals buried in Noise.
7. System Response to Arbitrary Inputs
8. DFT & IDFT of two sequences
9. FFT of two Sequences
10. Circular Convolution
11. Overlap-add method and overlap-save methods
12. FIR Filter Design.
13. IIR Filter Design.
14. Interpolation and Decimation of sequences
15. Implementation of digital filter banks
16. System Design based on DSP kits

Course Code	EC503
Course Title	**Antennas & Wave Propagation(Theory)**
Type of Course	Core
L T P	3 0 0
Credits	3
Course Assessment Methods End Semester Assessment (University Exam.) Continuous Assessment (Sessional, Assignments, Quiz)	 50 50
Course Prerequisites	Physics, Electromagnetic Theory
Course Objectives (CO)	1. To provide an in depth understanding of basic antenna parameters. 2. To provide in depth study for the analysis and design of antenna arrays. 3. To provide in depth study of Yagi-Uda array, log periodic array, and Dolph-Techebysheff arrays. 4. To provide in depth study of Practical Antennas such as rhombic antennas, ferrite rod, whip antennas. 5. To provide in depth study of special antennas such as frequency independent antennas and receiving antennas. 6. To study the effect of propagation of radio waves in actual environment.
Course Outcome	1. Understand the antenna theory and performance parameters. 2. Apply the theory of antenna arrays to design the antenna for improved gain and directivity. 3. Design and analysis of frequency independent antennas for practical applications. 4. Understand modes of wave propagations in free space.

SYLLABUS

Note for Examiner*- Examiner will set 7 questions of equal marks. First question will cover whole syllabus, having 10 conceptual questions of 1 mark each or 5 questions of 2 mark each and is compulsory. Rest of the paper will be divided into two parts having three questions each and the candidate is required to attempt at least two questions from each part.*

SECTION-A

Antenna Radiation:

Antenna Parameters: Antenna impedance, Directional patterns, Effective length, Radiation Intensity, Directivity, Power gain, Efficiency, Effective area, Equivalent circuit, Front to back ratio, polarization and antenna temperature, Radiation field, Radiation power, Radiation resistance, Directivity and gain of an alternating current element, half wave dipole and quarter wave monopole, Effect of earth on patterns. (15hours)

Antenna Arrays:

Multiplication of patterns, one dimensional broadside and endfire arrays, Feed network for arrays: series, shunt, delta matching, Impedance matching: Folded dipole, BALUNS and stubs, Yagi Uda array, log-periodic arrays, Dolph-Techebysheff arrays (10hours)

SECTION-B

Practical Antennas:

Top loading and tuning, rhombic antennas, ferrite rod, whip antennas, Receiving antennas, frequency independent antennas.(08hours)

Wave Propagation:

Modes of Propagation: Surface Wave Propagation, Sky Wave (Ionospheric) Propagation- Virtual height, Maximum usable Frequency, Skip Distance, Optimum working frequency, Space Wave (Tropospheric) Propagation- line of sight distance.(12hours)

TEXT BOOKS			
S. No.	**NAME**	**AUTHOR**	**PUBLISHER**
1	Antennas and Radio Wave Propagation	K D Prasad	SatyaPrakashan
RECOMMENDED BOOKS			
1	Antennas and Wave Propagation	G S N Raju	Pearson
2	Antenna and Radio Wave Propagation	Collin R.E	Mc-Graw Hill.
3	Antenna and Radio Wave Propagation	Krauss	TMH
4	Antenna and Radio Wave Propagation	Ballanis	John Wiley & Sons

Course Code	EC504
Course Title	**Computer Networks (Theory)**
Type of Course	Core
L T P	3 0 0
Credits	3
Course Assessment Methods End Semester Assessment (University Exam.) Continuous Assessment (Sessional, Assignments, Quiz)	 50 50
Course Prerequisites	
Course Objectives (CO)	1. To build an understanding of the fundamental concepts and basic taxonomy of computer networking area. 2. To study layers of OSI model and TCP/IP model. 3. To explain the need and significance of different types of networks, topologies and protocols. 4. To study and understand how computer and rest of the world do actually communicates with each other.
Course Outcome	1. Understand the computer network system and its communication. 2. Explain the various roles, characteristics, and protocols of the physical layer and data link layer. 3. Analyze the various routing algorithms and protocols of the network layer. 4. Analyze the various roles, characteristics and protocols of transport and application layer.

SYLLABUS

Note for Examiner*- Examiner will set 7 questions of equal marks. First question will cover whole syllabus, having 10 conceptual questions of 1 mark each or 5 questions of 2 mark each and is compulsory. Rest of the paper will be divided into two parts having three questions each and the candidate is required to attempt at least two questions from each part.*

SECTION-A

Introduction: 05

Computer Networks, Network Hardware, Network Software, OSI & TCP/IP Reference models, ARPANET, Frame Relay, Introduction to Internet, ATM, Network devices: Hub, Bridge, Switch (Layer 2 & Layer 3), Router & Gateway, Addressing: Physical addresses, Logical addresses, Port Addresses.

Physical Layer: 05

Data Communication concepts, Wired and Wireless transmission media, Transmission Impairments and Performance, Parallel and Serial Transmission, Switching, Circuit Switching, Packet Switching, and Virtual Circuit Switching.

Data Link Layer: 06

Data link layer Design Issues, Framing, Error Detection and Correction, Flow Control, Sliding Window Protocols, HDLC, SLIP, and PPP.

Medium Access Control Sublayer: 06

Channel Allocation, Description and Analysis of ALOHA, Slotted ALOHA, CSMA, CSMA/CD, IEEE LAN Standards: Ethernet (802.3), Gigabit Ethernet, Wireless LAN (802.11), Broadband Wireless (802.16), Bluetooth.

SECTION-B

Network Layer: 12

Network layer Design Issues, IPv4 and IPv6 Structure and addresses, Routing algorithms– Shortest path, Flooding, Distance Vector Routing and Link State Routing; General principles of Congestion Control, Congestion Control in Datagram and Virtual Circuit Subnets, Brief idea of Quality of Service, Internetworking, IP protocol, IP Addresses, Internet Control Protocols, Subnetting and Supernetting, ARP, NAT, DHCP.

Transport Layer: 05

The Transport Service, Elements of Transport Protocols, TCP & UDP Protocols

Application Layer: 06

Domain Name System, SMTP, FTP, HTTP, WWW, SNMP, Multimedia, and Cryptography.

TEXT BOOKS			
S. No.	**NAME**	**AUTHOR(S)**	**PUBLISHER**
1	Data Communications and Networking	B. A. Forouzan	TMH, 1st ed, 2000.
2	Computer Networks	A. S. Tanenbaum	4th Edition, PHI
RECOMMENDED BOOKS			
1	Data & Computer Communication	William Stallings	PHI, 6ed, 2002
2	An Engineering approach to Computer Networking	S. Keshav	Addison Wesley, 1999

Course Code	EC505
Course Title	**Digital System Design (Theory)**
Type of Course	Core
L T P	3 1 2
Credits	3
Course Assessment Methods End Semester Assessment (University Exam.) Continuous Assessment (Sessional, Assignments, Quiz)	 50 50
Course Prerequisites	Basic Electronics, Digital Electronics
Course Objectives (CO)	1. To familiarize with basics of switching algebra using theorems and devise various minimization techniques for single and multi-output combinational functions. 2. To understand the need for error correction and error detection techniques. 3. To use and analyze various fault detection and correction techniques for combinational and sequential circuits. 4. To introduce the concept of Finite state machine and use it for minimization of completely and incompletely specified synchronous and asynchronous sequential circuits. 5. To draw and analyze ASM charts and learn the concept of races, cycles and hazards. 6. To impart practical knowledge of digital system design.
Course Outcome	1. Understanding of switching algebra and minimization techniques for single and multiple output functions. 2. Analyze the methods for error and fault detection for combinational and sequential circuits. 3. Analysis of minimization techniques of completely and incompletely specified finite state machines for synchronous circuits. 4. Design analysis and synthesis of asynchronous circuits using sequential machine flow charts.

SYLLABUS

Note for Examiner*- Examiner will set 7 questions of equal marks. First question will cover whole syllabus, having 10 conceptual questions of 1 mark each or 5 questions of 2 mark each and is*

compulsory. Rest of the paper will be divided into two parts having three questions each and the candidate is required to attempt at least two questions from each part.

SECTION-A

Combinational Circuits:

Review of switching algebra: Definitions, Theorems, Functions of n variable, Logic Detailed Diagram and Symbols minimization, Minimization Techniques: optimal combinations with K-map and tabular methods, simplification & minimization, complimentary approach with map method, map method for multi-output functions, Tabular and Iterative consensus method for obtaining prime implicants for single and multi-output functions.

Error Correction and Detection:

Error detection and correction techniques, Single error detection, Single error correction with double error

Fault detection and Location in combinational circuits:

Different methods of detecting and locating Faults in combinational circuits.

(20hours)

SECTION-B

Sequential Circuits: Synchronous circuits: Concept of state diagram and state table, state assignment, Analysis and synthesis of sequential circuits, designs of Next state decoder and output decoder, state reduction, Machine minimization of completely and incompletely specified machines.

Asynchronous Circuits: Analysis and Synthesis of Asynchronous circuits, Races and Cycles, hazards in asynchronous circuits. Sequential Machine Flow Charts, synthesis using sequential machine flow charts.

Fault detection and Location in sequential circuits.

(25hours)

TEXT BOOKS			
S. No.	**NAME**	**AUTHOR(S)**	**PUBLISHER**
1.	Switching and Finite Automata Theory	Kohavi	TMH
2.	Digital circuits and Logic Design	Lee	PHI

Course Title	Digital System Design (Practical)
Type of Course	Core
Credits	1
Course Assessment Methods Continuous Assessment	 50

LIST OF EXPERIMENTS

1. To Design and test the minimized circuit of Full Adder.
2. To Design and test the minimized circuit of BCD to Binary Converter
3. Implement decade counter using minimum number of gates
4. To test the minimized circuit of Decimal to BCD Encoder
5. Design and test hexadecimal to binary Encoder
6. Implement and test BCD to 7-Segment decoder
7. Design a sequence detector to detect a given sequence
8. Design and test twisted type ring counter
9. Implement the minimized circuit of Modulo-6 counter
10. To design, implement and test a 16:4 multiplexer using logic gates.
11. To design, implement and test a 4:16 demultiplexer using logic gates.
12. Design & test Johnson Counter.

Course Code	EC507
Course Title	**Data Structures & Algorithms (Theory)**
Type of Course	Elective
L T P	3 0 0
Credits	3
Course Assessment Methods End Semester Assessment (University Exam.) Continuous Assessment (Sessional, Assignments, Quiz)	 50 50
Course Prerequisites	Object Oriented Programming
Course Objectives (CO)	1. To develop an in depth understanding of various Data Structures such as stacks, queues, linked lists, trees and graphs. 2. To help students select an appropriate data structure for a particular application and design the algorithm to manipulate the data structure. 3. To analyze the complexity of various algorithms.
Course Outcome	1. Understand the concept of Dynamic memory management, data types, algorithms, Big O notation. 2. Understand basic data structures such as arrays, linked lists, stacks and queues. 3. Describe the hash function and concepts of collision and its resolution methods 4. Solve problem involving graphs, trees and heaps. 5. Apply Algorithms for solving problems like sorting, searching, insertion and deletion of data.

SYLLABUS

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SECTION-A

Introduction

Introduction to data structures, Introduction to Algorithms Complexity. (02hours)

Arrays, Stacks & Queues

Concepts; Basic operations & their algorithms: Transverse, Insert, Delete, Sorting of data in these data structures; Prefix, Infix, Postfix Notations. (08hours)

Lists

Concepts of Link List and their representation; Two way lists; Circular link list; Basic operations & their algorithms: Transverse, Insert, Delete, Searching and Sorting of data in List; Storage Allocation & Garbage Collection; Linked stack and queues; Generalized List; sparse matrix representation using generalized list structure. (11hours)

SECTION-B

Trees

Binary Trees and their representation using arrays and linked lists, Trees and their applications, Binary tree transversal, Inserting, deleting and searching in binary trees, Heap & Heap Sort, General Trees, Thread binary tree, Height balance Tree (AVL), B-Tree. (08hours)

Graphs and their applications

Graphs, Linked Representation of Graphs, Graph Traversal and spanning forests, Depth first search, Breadth first search. (08hours)

Sorting & Searching

Insertion sort, Selection sort, Merging, Merge sort, Radix sort, Sequential & Binary Search, Indexed Search, Hashing schemes, Binary search Tree. (08hours)

TEXT BOOKS			
S. No.	**NAME**	**AUTHOR(S)**	**PUBLISHER**
1.	Theory and problems of Data Structures	Seymour Lipschutz	McGraw Hill
RECOMMENDED BOOKS			
1.	Data Structure Using C and C++	A. Tenenbaum, Y. Langsam, M. J. Augenstein	PHI, Edition 2nd
2.	Data Structures & Program Design	Robert L. Kruse	PHI , Edition 3rd

Course Code	EC508
Course Title	**Audio and Visual Systems**
Type of Course	Elective
L T P	3 0 0
Credits	3
Course Assessment Methods End Semester Assessment (University Exam.) Continuous Assessment (Sessional, Assignments, Quiz)	 50 50
Course Prerequisites	Digital Design
Course Objectives (CO)	1. To Understand Television Transmitter and Receiver. 2. To Understand Audio devices and applications. 3. To Understand digital video and standards. 4. To Understand advanced television technologies.
Course Outcome	1. Illustrate knowledge of Television Transmitter and Receiver. 2. Ability to analyze Audio devices and applications. 3. Analyze digital video and standards. 4. Illustrate knowledge of advanced television technologies.

SYLLABUS

Note for Examiner*- Examiner will set 7 questions of equal marks. First question will cover whole syllabus, having 10 conceptual questions of 1 mark each or 5 questions of 2 mark each and is compulsory. Rest of the paper will be divided into two parts having three questions each and the candidate is required to attempt at least two questions from each part.*

SECTION-A

Fundamentals Of Television

Introduction of television, General concepts-interlaced scanning, Geometric form and aspect ratio, Image continuity, No. of scanning lines, Resolution, Brightness, Contrast, Composite video signal, Television Transmitter, Monochrome television receiver, compatibility between Monochrome and colour television, three color theory, PAL transmitter and receiver. (09hours)

Audio Devices And Applications

Microphone Sensitivity, Nature of Response and Directional Characteristics, Measurement Microphones, Various Types of Microphones, Various Types of Loudspeakers, Characteristic Impedance of Loud Speakers, Headphone Types, The basics of Magnetic Recording, Sound Cards, Sound Mixers, PA Systems & Installations, Digital Consoles, modern audio recording techniques. (08hours)

Digital Audio

Digital Audio Fundamentals, review of Sampling and Quantizing, PCM, Audio Compression, Disk-Based Recording, Rotary Head Digital Recorders, Digital Audio Broadcasting, Digital Filtering, Stereophony and Multichannel Sound. (06hours)

SECTION-B

Digital Video & Standards

Digitizing Video, Chroma Subsampling, Basics of Video Compression (MPEG-x, H.26x), Digital VTR, Non-Linear Editing, 4:3 Vs 16:9 for Digital Video. (11hours)

Advanced Television Concepts

HDTV, Display Technologies (CRT, LCD, Plasma, LED, Projection), Video Interfaces (Composite, Component, S-Video, DV, SDI, HDMI television DVI),Digital television, Digital video disc, Flatron picture tube, Video on demand, video on internet, cable television, closed circuit television, Dish TV. (11hours)

TEXT BOOKS			
S. No.	**NAME**	**AUTHOR(S)**	**PUBLISHER**
1	Modern Television Practice	R.R. Gulati	New Age publication, 3rd edition, 2007
2	Audio Video Systems	R.G. Gupta	Technical Education , TMH, 2010
RECOMMENDED BOOKS			
1	Essential Guide to Digital Video	John Watkinson	Snell & Wilcox Inc Publication 1996
2	Digital Television Fundamentals	Robin, Poulin	McGraw -Hill 2nd ed, 2000
3	Audio Video Systems Principles Practices and Troubleshooting	Bali & Bali	Khanna Publishing Company. 2010

Course Code	**EC509**
Course Title	**Bio-Medical Electronics**
Type of Course	Elective
L T P	3 0 0
Credits	3
Course Assessment Methods End Semester Assessment (University Exam.) Continuous Assessment (Sessional, Assignments, Quiz)	 50 50
Course Prerequisites	
Course Objectives (CO)	1. To provide an acquaintance of the physiology of the heart, lung, blood circulation andcirculation respiration. Biomedical applications of different transducers used. 2. To introduce the student to the various sensing and measurement devices of electricalorigin. To provide awareness of electrical safety of medical equipments. 3. To provide the latest ideas on devices of non-electrical devices. 4. To bring out the important and modern methods of imaging techniques. 5. To provide latest knowledge of medical assistance / techniques and therapeutic equipments.
Course Outcome	At the end of the course, students will demonstrate the ability to: 1. Understand the application of the electronic systems in biological and medical applications. 2. Understand the practical limitations on the electronic components while handling bio-substances. 3. Understand and analyze the biological processes like other electronic processes.

SYLLABUS

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SECTION-A

PHYSIOLOGY AND TRANSDUCERS (12)

Brief introduction to human physiology: Cell and its structure; Resting and Action Potential; Nervous system: Functional organisation of the nervous system ; Structure of nervous system, neurons; synapse; transmitters and neural communication; Cardiovascular system; respiratory system; Basic components of a biomedical system.

Biomedical transducers: Transducers selection criteria; Piezoelectric; ultrasonic; displacement, velocity, force, acceleration, flow, temperature, potential, dissolved ions and gases; Temperature measurements; Fibre optic temperature sensors;

ELECTRO – PHYSIOLOGICAL MEASUREMENTS (10)

Bio-electrodes and Biopotential amplifiers for ECG, EMG, EEG, etc.: Limb electrodes; floating electrodes; pregelled disposable electrodes ;Micro, needle and surface electrodes; Preamplifiers, differential amplifiers, chopper amplifiers ;Isolation amplifier.ECG; EEG; EMG; ERG; Lead systems and recording methods

SECTION-B

NON-ELECTRICAL PARAMETER MEASUREMENTS (9)

Measurement of blood temperature, pressure and flow; ; Cardiac output ; Heart rate ; Heart sound ;Pulmonary function measurements ; spirometer ; Impedance plethysmography; Photo Plethysmography, Body Plethysmography

MEDICAL IMAGING (7)

Ultrasonic, X-ray and nuclear imaging: Radio graphic and fluoroscopic techniques; Computer tomography; MRI; Ultrasonography

ASSISTING AND THERAPEUTIC EQUIPMENTS (7)

Prostheses and aids: pacemakers, defibrillators, heart-lung machine, artificial kidney, aids for the handicapped; Safety aspects: safety parameters of biomedical equipments

RECOMMENDED BOOKS

S. No.	Title	Author(s)	Publisher
1	Review of Medical Physiology	W.F. Ganong	8thAsian Ed, Medical Publishers, 1977
2	Medical Instrumentation	J.G. Websster	Houghton Mifflin, 1978
3	Therapeutic Medical Devices	A.M. Cook and J.G. Webster	Prentice-Hall, 1982.
4	Hand Book of Bio-Medical instrumentation	R.S.Khandpur	Tata McGraw Hill, 2003
5	Bio-Medical Instrumentation andMeasurements	Leslie Cromwell, Fred J.Weibell, Erich A.Pfeiffer	Pearson Education 2nd edition

SIXTH SEMESTER

Course Code	EC601
Course Title	**Microwave & Radar Engineering (Theory)**
Type of Course	Core
L T P	3 1 2
Credits	3
Course Assessment Methods End Semester Assessment (University Exam.) Continuous Assessment (Sessional, Assignments, Quiz)	 50 50
Course Prerequisites	Physics, Electromagnetic Theory, Antenna and Wave Propagation.
Course Objectives (CO)	1. To study and design the microwavecircuits, components, and systems. 2. To study the special techniques that applies to circuits and devices operating at very high frequencies. 3. To impart practical knowledge of Microwave components. 4. To familiarize with the working of radar and derive its radar equation for different types of radar systems.
Course Outcome	1. Design and analysis of microwave components. 2. Explain the microwave frequency and power measurement techniques. 3. Understanding the working of microwave tubes as microwave source and amplifier. 4. Introduction to different type of RADAR and derivation of their range equation.

SYLLABUS

Note for Examiner*- Examiner will set 7 questions of equal marks. First question will cover whole syllabus, having 10 conceptual questions of 1 mark each or 5 questions of 2 mark each and is compulsory. Rest of the paper will be divided into two parts having three questions each and the candidate is required to attempt at least two questions from each part.*

SECTION-A

Waveguide Components:

Transitions, Discontinuities, Matched loads, Shorts, Flanges, Bends & Twists, Attenuator & phase

shifters, Microwave Hybrid Circuits: Waveguide Tees, Magic (Hybrid) Tees, Scattering matrix of tees, Hybrid Rings (Rat-Race Circuits), Directional Couplers: Two Hole Directional Couplers, Scattering matrix of a directional coupler, Hybrid Couplers, Multi-hole couplers. Propagation in ferrites, Faraday rotation, Microwave Circulators: 3 port circulators and Isolators. (10hours)

Measurements:

Slotted waveguide, Swept Frequency Technique Detectors, Power & Impedance measurement. (06hours)

Solid State Sources:

Tunnel Diodes, Transferred Electron Devices (TEDs): GUNN Diode, LSA Diodes. Avalanche Transit Time Devices: IMPATT Diodes, TRAPATT, BARITT Diodes and Parametric Devices. (06hours)

SECTION-B

Microwave Tubes: Microwave Linear Beam Tubes: Klystron, Multicavity Klystron, Reflex Klystron, Helix Traveling-Wave Tubes (TWT), Coupled Cavity Travelling-Wave Tubes, Microwave Crossed-Field Tubes: Cylindrical Magnetron. (09hours)

Introduction to Radar:

Radar Principles, Radar Equation, Types of Radars & Radar Functions, Doppler & Moving Target Indicator (MTI) Fundamentals, MTI Principles & Methods, CW Radar. Radar Equation Introduction, Points Targets in Noise, Radar Equation with Pulse Compression, Search Radars, Tracking Radars, CW & Pulse Doppler Radar, Area Targets & Clutter, Volume Targets & Clutter, Augmentation, Bistatic Radar Equation, including Missile Illumination, Losses in Radar Equation. Introduction to Radar cross-section (RCS) (14hours)

TEXT BOOKS		
NAME	**AUTHOR(S)**	**PUBLISHER**
1.Elements of Microwave Engineering	R. Chatterjee	East-West Press
RECOMMENDED BOOKS		
1. Microwave Devices & Circuits	S Y LIAO	Prentice Hall, 3rd Edition
2. Microwave	K. C. Gupta	New Age , Edition 2nd
3.Microwave Engineering---Special topics	R. Chatterjee	East-West Press
4.Foundations of Microwave Engineering	R.E. Collin	Wiley, 2nd Edition
5.Introduction to Radar Systems	Skolnik	McGraw Hill
6.Radar: Principles, Technology, Applications	Byron Edde	Pearson Education

Course Title	**Microwave & Radar Engineering(Practical)**
Type of Course	Core
Credits	1
Course Assessment Methods Continuous Assessment	 50

LIST OF EXPERIMENTS

1. Measurement of impedance.
2. Measurement of (i) Insertion loss & (ii) Isolation of a circulator.
3. Measurement of S parameters of a Hybrid Tee.
4. Measurement of SWR.
5. Reflex klystron mode curves.
6. Antenna radiation pattern.
7. Verification of Diode law.
8. Gunn Oscillator characteristics.
9. Directivity & Coupling of a directional coupler.
10. To verify the waveguide law.

Course Code	EC602
Course Title	**Fiber Optic Communication Systems (Theory)**
Type of Course	Core
L T P	3 0 2
Credits	3
Course Assessment Methods End Semester Assessment (University Exam.) Continuous Assessment (Sessional, Assignments,Quiz)	 50 50
Course Prerequisites	Electromagnetic Theory, Communication Engineering, Digital Communication
Course Objectives (CO)	1. To explain the need and significance of Optical Communication System 2. To impart knowledge of types, basic laws, and transmission characteristics of optical fibers. 3. To study various types of losses and non-linear effects. 4. To study and compare various types of basic components of optical communication i.e. sources, detectors and optical amplifiers. 5. To explain the characteristics of Digital and Analog Transmission System and study of advanced system techniques. 6. To impart practical knowledge of Fiber optic systems
Course Outcome	1. Understand the need, fundamentals, and advancements of fiber optic communication systems; different types of fiber, and manufacturing processes. 2. Apply knowledge of ray and mode theory, and characteristics of optical fibers to understand the propagation of the optical signals. 3. Analyze the different types of linear and nonlinear fiber impairments. 4. Understand the working of important optical components of optical communication systems and networks. 5. Evaluate the performance of different lightwave systems.

SYLLABUS

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compulsory. Rest of the paper will be divided into two parts having three questions each and the candidate is required to attempt at least two questions from each part.

SECTION-A

Overview of Optical Fiber Communication:

Elements of basic communication system, communication system architecture, need and advantages of optical communication, Definition of dB and dBm (03hours)

Optical Fiber Wave Guides:

Ray Theory of Transmission: Total Internal reflection, Acceptance Angle, Numerical Aperture, Electromagnetic mode theory for optical communication of both types of fibers viz step index fiber and graded index fibers, Fiber materials, fiber fabrication, fiber to fiber joints, fiber splicing, optical fiber connectors. (09hours)

Signal Degradation in Optical Fibers:

Attenuation, Material absorption losses, linear and non linear scattering losses, fiber bend loss, dispersion viz intermodal dispersion and intramodal dispersion, overall fiber dispersion and polarization mode dispersion, Introduction to nonlinear effects: Self phase modulation, cross phase modulation, Stimulated Brillion and Raman scattering, Four Wave Mixing. (08hours)

SECTION-B

Optical Sources and Detectors:

Sources: Basic Concepts: emission & absorption, p-n junctions, non-radiative recombination, semiconductor materials, LED: power-current characteristics, internal quantum efficiency, LED spectrum, modulation Response, LED structures, LASER Diode: optical gain, feedback and Laser threshold, internal quantum efficiency and Laser characteristics.

Detectors: Basic Concepts: Detector responsivity, rise time bandwidth. common photodetectors: p-n photodiodes, p-i-n photodiodes, avalanche photodiode, MSM photodetector (08hours)

Lightwave systems:

Point to point links; Design guidelines: loss-limited lightwave systems, dispersion-limited lightwave systems, power budget, rise time budget. Multichannel systems: WDM lightwave systems; system performance parameters: Bit Error Rate (BER), Eye Diagrams, optical signal to noise ratio. (07hours)

Optical components and sensors:

Coupler/splitter, optical switches, optical add/drop multiplexers, fiber grating, Optical amplifiers: working principle and types (EDFA, Raman). Introduction to fiber-optic sensors, Intensity modulated sensors. (08hours)

Advances in Optical Communication:

Introduction to Free Space Optics, Photonics Microwave, DWDM (02 hours)

TEXT BOOKS			
S. No.	**NAME**	**AUTHOR(S)**	**PUBLISHER**
1.	Fiber optic communication systems,2E	Govind P. Agrawal	Wiley India
2.	Optical Fiber Communications Designs,3rd Edition	Gerd Keiser	McGraw Hill
3.	Fundamentals of Fibre Optics in Telecommunication and sensor systems	Bishnu P. Pal	New Age International
RECOMMENDED BOOKS			
1.	Fiber optic communication technology	D. F. Mynbaev and L. Scheiner	Pearson Education
2.	Fiber-Optic Communication	Vivekanand Mishra, Sunita P. Ugale	Wiley India

Course Title	Fiber-optic Communication systems (Practical)
Type of Course	Core
Credits	1
Course Assessment Methods **Continuous Assessment**	 50

LIST OF EXPERIMENTS

1. Demonstration and study of different types of Optical Fibers and connectors.
2. To establish and Study a 650nm fiber optic analog link.
3. To establish and Study a 650nm fiber optic digital link.
4. Study of Intensity Modulation Technique using Analog input signal. To obtain intensity modulation of the analog signal, transmit it over a fiber optic cable and demodulate the same at the receiver and to get back the original signal.
5. Study of Intensity Modulation Technique using digital Input signal. The objective of this experiment is to obtain intensity modulation of digital signal, transmit it over fiber optic cable and demodulate the same at the receiver end to get back the original signal.
6. To measure propagation or attenuation loss in optical fiber.
7. To measure propagation loss in optical fiber using optical power meter.
8. To measurement of the Numerical Aperture (NA) of the fiber.
9. To study the characteristics of PIN photodiode as a sensor.

Course Code	EC603
Course Title	**Digital Communication (Theory)**
Type of Course	Core
L T P	3 1 2
Credits	3
Course Assessment Methods End Semester Assessment (University Exam.) Continuous Assessment (Sessional, Assignments, Quiz)	 50 50
Course Prerequisites	Communication Theory, Communication Engineering
Course Objectives (CO)	
Course Outcome	1. Analyze the methods of transmission of digital data using carrier modulation techniques. 2. Apply the concept of Information Theory, Entropy and coding Techniques (Block codes and convolutional codes) in digital communication systems. 3. Understand multiple access techniques, system design for no Inter Symbol Interference. 4. Analyze performance of the spread spectrum communication system.

SYLLABUS

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SECTION-A

Signal Space Analysis:

Geometric Representation of Signals, Gram-Schmidt Orthogonalization Procedure. (04hours)

Digital Modulation Techniques:

PSK, FSK, MSK, QAM. Error calculations for PSK, FSK, MSK, QAM, Shannon's limit.(08hours)

Information theory and coding: Entropy, Capacity of a Gaussian Channel. Block codes, Convolution coding and decoding, Soft and Hard decision decoding, State & Trellis diagrams, Viterbi Algorithm, Trellis decoded modulation. (10hours)

SECTION-B

Multiplexing and Multiple Access: Allocation of communication Resources, FDM/FDMA, TDM/TDMA, CDMA, SDMA,Multiple Access Communications and Architecture, Access Algorithms. (08hours)

Spread Spectrum Techniques: Spread Spectrum Overview, Pseudo-noise Sequences, Direct Sequence and Frequency Hopped Systems, Synchronization of DS and FH systems, Jamming Considerations, Commercial Applications. (08hours)

Signal design for band-limited channels for No Inter Symbol Interference: Pulse shaping to Reduce ISI, types of error-performance degradation, demodulation/ detection of shaped pulses. (07hours)

TEXT BOOKS			
S. No.	**NAME**	**AUTHOR(S)**	**PUBLISHER**
1.	Digital Communications	Bernard Sklar	PHI
2.	Principles of Communication Systems	Taub and Schilling	Tata McGraw Hill
RECOMMENDED BOOK			
S. No.	**NAME**	**AUTHOR(S)**	**PUBLISHER**
1.	Communication Signals and Systems	S. Haykins	Wiley
2.	Principles of Digital Communication	J. Das, S.K. Mullick, P.K. Chatterjee	New Age International Ltd
3.	Digital Communications	J.G. Proakis	Tata McGraw Hill

Course Title	**Digital Communication (Practical)**
Type of Course	Core
Credits	1
Course Assessment Methods Continuous Assessment	 50

LIST OF EXPERIMENTS

1. Design and practical implementation of ASK systems
2. Design and practical implementation of PSK systems
3. Design and practical implementation of QPSK systems
4. Design and practical implementation of FSK systems
5. To study the application of CDMA in voice communications
6. To practically compare the noise in PCM and DM systems
7. To practically study Frequency Division Multiplexing.
8. To practically study Time Division Multiplexing.
9. Implementation of Viterbi algorithm using C-language

Course Code	EC624
Course Title	**Control Systems** (Theory)
Type of Course	Core
L T P	3 1 0
Credits	3
Course Assessment Methods End Semester Assessment (University Exam.) Continuous Assessment (Sessional, Assignments, Quiz)	 50 50
Course Prerequisites	Basics of Electrical Engineering, Signals & Systems
Course Objectives (CO)	1. To familiarize with the basics of control systems, using suitable examples. 2. To devise mathematical models and perform time-domain analysis for different types of first and higher order systems. 3. To analyze various methods to find the stability for a control system and draw Bode and Polar plots using it. 4. To introduce the concept of compensators and design lead and lag compensators. 5. To acquire knowledge about modeling and analyzing state space equations for continuous and discrete time systems.
Course Outcome	1. Understand the concept of Control system, transfer function and discuss the importance of performance, robustness and stability in control design. 2. Analyze the mathematical models, apply block diagram, signal flow graph representations and perform time-domain analysis for first order, second order and higher order systems. 3. Compute stability of linear systems using the Routh array test and use root locus techniques to generate control design constraints for real world systems. 4. Compute gain and phase margins from Bode diagrams and Nyquist plots and understand their implications in terms of robust stability. 5. Illustratate the need for compensators and design of lead, lag and lead-lag compensators. 6. Analyse the systems using state space equations for continuous and discrete time systems.

SYLLABUS

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SECTION-A

Introduction:

History of automatic control, servomechanism, regulating systems, open loop , closed loop control systems, feedback, effect of feedback, linear and non linear control systems, block diagrams, Examples: speed control system, robot control system., temperature controls system traffic control system , business control systems etc. (06hours)

Modeling:

Differential equations of physical systems, electrical, mechanical, translational, rational, gear systems, thermal systems. Electrical, mechanical analogies, Laplace transforms, transfer function. Block diagram algebra, signal flow graphs, characteristic equation, Control system components: Error detectors potentiometer, synchros, stepper motor, ac and dc techo-generators. (07hours)

Time Domain Analysis:

Typical test input signals, Transient response of the first order, second order system, Time domain specifications Dominant closed loop poles of higher order systems, Steady state error and error coefficients. (04hours)

Stability:

Concepts of absolute and relative stability pole zero location, Routh-Hurwitz criteria. (02hours)

Root Locus Technique:

Introduction, Root Locus Concept, Construction Root Loci, Stability analysis. (04hours)

SECTION-B

Frequency Response:

Introduction, Bode diagram, polar plots, log magnitude vs. phase plot, nyquist stability criterion, stability analysis, relative stability, Gain margin & Phase margin close loop frequency response. (04hours)

Introduction To Design:

Necessity of compensation, lag and lead compensation, design of PID Controller. (05hours)

State Space Analysis:

Concept of State, state variable and state vector, state space modeling of continuous time and discrete time systems, solution of state equation, concepts of controllability and observability, pole-placement design. (09hours)

TEXT BOOKS			
S. No.	**NAME**	**AUTHOR(S)**	**PUBLISHER**
1	Control Systems Engineering	I.J. Nagrath and M. Gopal	Wiley Easter
RECOMMENDED BOOKS			
1	Design of feedback Control Systems	R. T. Stefani et al	Oxford University Press
2	Modern Control Engineering	K. Ogata	PHI

Course Code	**EC625**
Course Title	**Power Electronics**
Type of Course	Core
L T P	3 1 0
Credits	3
Course Assessment Methods End Semester Assessment (University Exam.) Continuous Assessment (Sessional, Assignments, Quiz)	 50 50
Course Prerequisites	Analog Electronic Circuits
Course Objectives (CO)	
Course Outcome	1. Describe the fundamentals of power electronics. 2. Explain the working of power electronic devices and circuits. 3. Calculate the design and performance parameters of power converters, drives and power supplies 4. Examine the use of power electronic circuits in real-world situations.

SYLLABUS

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SECTION-A

Semiconductor Power Devices **(9)**

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.

Controlled Rectifiers **(7)**

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.

Choppers **(7)**

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

SECTION-B

Single-phase inverters **(9)**

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

Switching Power Supplies **(6)**

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 **(7)**

Power line disturbances, EMI/EMC, power conditioners. Block diagram andconfiguration 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.

TEXT BOOKS			
S. No.	**Title**	**Author(s)**	**Publisher**
1	Power electronics	Muhammad H. Rashid	Prentice Hall of India
RECOMMENDED BOOKS			
1	Power electronics	Ned Mohan, Robbins	John Wiley and sons. 3rd edition
2	Modern Power Electronics	P.C. Sen	Chand & Co. 2nd edition
3	Power Electronics	V.R.Moorthi	Oxford University Press.
4	Power Electronics	Cyril W., Lander	McGraw Hill. 3rd edition
5	Thyristorised Power Controllers	G K Dubey, S R Doradla	New Age International Publishers

Course Code	EC605
Course Title	**Satellite Communications (Theory)**
Type of Course	Elective
L T P	3 0 0
Credits	3
Course Assessment Methods End Semester Assessment (University Exam.) Continuous Assessment (Sessional, Assignments, Quiz)	 50 50
Course Prerequisites	Communication Engineering, Antennas & Wave Propagation
Course Objectives (CO)	1. To gain knowledge of key issues in satellite communication. 2. Satellite Communication is one of the most important spin-offs from space programs and has made major contribution to the pattern of international communication 3. The engineering aspect of satellite communication combines such diverse topics as antennas, radio wave propagation signal processing, data communication, modulation, detection, coding, filtering orbital mechanics, and electronics. Each is a major field of study and each has its own extensive literature. 4. Satellite Communication Engineering emphasizes the relevant material from various areas and help the students to compete with the growing needs.
Course Outcome	1. Understand the basic knowledge of satellite communication principles and orbital mechanics. 2. Describe the concepts of satellite subsystems. 3. Analyze the satellite link design for better C/N ratio. 4. Understanding of propagation effects and satellite navigation systems.

SYLLABUS

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SECTION-A

Communication Satellite: Orbit and Description

A Brief history of satellite Communication, Satellite Frequency Bands, Satellite Systems, Applications, Orbital Period and Velocity, effects of Orbital Inclination, Azimuth and Elevation, Coverage angle and slant Range, Eclipse, Orbital Perturbations, Placement of a Satellite in a Geo-Stationary orbit. (08hours)

Satellite System Modules

Attitude and Orbit Control system, TT&C subsystem, Attitude Control subsystem, Power systems, Communication subsystems, Satellite Antenna Equipment. (06hours)

Satellite Link

Basic Transmission Theory, System Noise Temperature and G/T ratio, Basic Link Analysis, Interference Analysis, Design of satellite Links for a specified C/N, (With and without frequency Re-use). (08hours)

SECTION-B

Propagation effects

Introduction, Atmospheric Absorption, Cloud Attenuation, Tropospheric and Ionospeheric Scintillation and Low angle fading, Rain induced attenuation, rain induced cross polarization interference. (13hours)

GPS Principles:

History of Navigation, GPS Constellation, Principle of operation, GPS Orbits, Orbital mechanics and Satellite position determination, Time reference, Various DOPs, signal structure, Code and carrier phase measurements, position estimation with pseudorage measurements. GPS applications

(10hours)

TEXT BOOKS			
S. No.	**NAME**	**AUTHOR(S)**	**PUBLISHER**
1.	Satellite Communications	Timothy Pratt, Charles Bostian, Jeremy Allnutt	John Wiley & Sons
2.	Satellite Communications	D. C.Agrawal	Khanna Publishers
RECOMMENDED BOOKS			
1.	Satellite Communications	Dennis Roddy	Mc-Graw Hill
2.	Digital Satellite Communications	Tri.T.Ha	Mc.Graw Hill

Course Code	EC620
Course Title	**Information Theory & Coding**
Type of Course	Elective
L T P	3 00
Credits	3
Course Assessment Methods End Semester Assessment (University Exam.) Continuous Assessment (Sessional, Assignments, Quiz)	 50 50
Course Prerequisites	Digital Communication
Course Objectives (CO)	1. To explain the principles and applications of information theory in digital communication systems. 2. Calculation of the capacity of a communication channel in noiseless and noisy channels. 3. Understanding of different coding schemes.
Course Outcome	1. Describe the concepts of information theory and digital communication. 2. Construct efficient codes for data on imperfect communication channels. 3. Explain the concepts of coding schemes.

SYLLABUS

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SECTION-A

Modulation & Detection :

Overview of Shannon's contributions to Information Theory and the digital communication system. Digital modulation: Modulation classification, Signal space representation & the symbol constellation, Linear memory less modulation scheme examples Optimum detection: Correlation demodulator & matched filter, Optimum symbol detectors, Detector performance for several modulation schemes. (08hours)

Source Coding & Channel Coding :

Lossless coding for discrete-valued sources, Discrete memory less source (DMS) Discrete stationary source, Lossy coding for discrete-time sources. Channel models, Channel capacity, The noisy channel coding theorem. (07hours)

Block Codes:

Introduction to block codes, A Galios field primer, Linear block codes, Initial comments on Performance & implementation, Important binary linear block codes, Binary linear block code decoding & performance analysis, Non-binary block codes - Reed-Solomon (RS) codes, Techniques for constructing more complex block codes: product codes, interleaving, concatenated block codes, Space-time block codes. (07hours)

SECTION-B

Convolutional Codes:

Linear convolutional codes & their descriptions, Transfer function representation & distance properties, Decoding convolutional codes, Soft-decision MLSE, Hard-decision MLSE, The Viterbi algorithm for MLSE, Performance of convolutional code decoders, Viterbi algorithm implementation issues: RSSE, trellis truncation, cost normalization, Sequential decoding: Stack, Fano, feedback decision decoding, Techniques for constructing more complex convolutional codes. (09hours)

Turbo & Low Density Parity Check (LDPC) Codes:

Decoding algorithms which generate extrinsic information Turbo codes, Turbo product codes, Turbo equalization, Low Density Parity Check (LDPC) coding & decoding-Basic graph theory concepts, Graph representation of LDPC codes, Decoding LDPC codes. (08hours)

Trellis Coded Modulation (TCM):

Introduction, Trellis coding with higher order modulation, Set partitioning, Trellis coded modulation (TCM),TCM decoding and performance. (06hours)

TEXT BOOKS			
S. No.	**Name**	**AUTHOR(S)**	**PUBLISHER**
1.	Digital Communications	John Proakis&MasoudSalehi	McGraw-Hill, 5th edition, 2008
2.	Digital Communication	Amitabha Bhattacharya,	Tata McgrawHill,2006

Course Code	EC622
Course Title	**Data Acquisition and Hardware Interfacing**
Type of Course	Elective
L T P	3 00
Credits	3
Course Assessment Methods End Semester Assessment (University Exam.) Continuous Assessment (Sessional, Assignments, Quiz)	 50 50
Course Prerequisites	
Course Objectives (CO)	This course will introduce various data acquisition systems and techniques and their application using different hardware interfacing mechanisms.
Course Outcome	1. To understand the principles of operation and limitations of the data acquisition system (single and Multiple channels). 2. To use Labview for analyzing and generating reports of various acquired signals. 3. To use different interface mechanism of devices for communication.

SYLLABUS

Note for Examiner*- Examiner will set 7 questions of equal marks. First question will cover whole syllabus, having 10 conceptual questions of 1 mark each or 5 questions of 2 mark each and is compulsory. Rest of the paper will be divided into two parts having three questions each and the candidate is required to attempt at least two questions from each part.*

SECTION-A

Signal Conditioning and Data Acquisition:

Analog-to-digital and digital-to-analog converters; sampling rate, multiplexing, resolution, range, and code width; grounding, isolation and noise; single-ended and differential measurements; attenuation, amplification, and filtering; excitation and linearization; impedance mismatch and loading; digital signal conditioning; signal transmission (voltage vs. current loop); and hardware architecture of a modern multi-function data acquisition card. Various DAS Configurations, Single Channel DAS, Multi-Channel DAS, IC Based DAS, Data Acquisition, Data Acquisition in PLC.

(10hours)

Fundamentals of programming logic - Lab View:

Virtual instruments; indicators and controls; front panel and block diagram; data types and data flow programming; case and sequence structures; arrays, loops, and clusters;graphs and charts; sub VIs; and file I/O. (08hours)

Instrument control:
Components of an instrument control system (GPIB and RS-232); detecting and configuring instruments; and instrument drivers. (04hours)

SECTION-B

Instrumentation system design:
Design specifications; functional block representation; design, debugging, and testing; interpretation and presentation of data; user interface; temperature control system design; motor speed control system design; and instrumentation project incorporating multiple sensors, signal interfacing electronics, data-acquisition hardware, instrument control. (09hours)

Buses:
Industry standard architecture (ISA), peripheral component Interconnect (PCI) – Instrumentation Buses: Serial (RS232C, USB) and Parallel (GPIB) Accelerated Graphics port (AGP) – plug-and-play devices – SCSI concepts – USB architecture. (07hours)

Project Work (Using LABVIEW):
Generation of signal (different function generators) on PC and acquiring the signal from sensor at PC again with different sampling rate and quantization level. Representations of different characteristics of acquired signals and their analysis and reporting. (07hours)

S. No.	NAME	AUTHOR(S)	PUBLISHER
1	Instrumentation Devices And Systems	Rangan C. S., Sarma G. R. and Mani V. S. V.	Tata McGraw-Hill
2	Modern Electronic Instrumentation and Measurement Techniques	Helfrick Albert D. and Cooper W. D.,	Prentice Hall India
3	Digital Instrumentation	A. J. Bouvens	McGraw-Hill
4	Process Control Instrumentation Technology	Johnson Curtis D.,	Prentice Hall
5	A Course In Electrical And Electronics Measurements And Instrumentation	Shawhney A. K.	DhanpatRai& Sons
6	Data acquisition technique using personal computers	Howard Austurlitz.	

Course Code	EC626
Course Title	**Speech and Audio Processing**
Type of Course	Elective
L T P	3 0 0
Credits	3
Course Assessment Methods End Semester Assessment (University Exam.) Continuous Assessment (Sessional, Assignments, Quiz)	 50 50
Course Prerequisites	
Course Objectives (CO)	
Course Outcome	1. Mathematically model the speech signal 2. Analyze the quality and properties of speech signal. 3. Modify and enhance the speech and audio signals.

SYLLABUS

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SECTION-A

Introduction- Speech production and modeling - Human Auditory System; General structure of speech coders; Classification of speech coding techniques – parametric, waveform and hybrid ; Requirements of speech codecs –quality, coding delays, robustness. (6 hours)

Speech Signal Processing- Pitch-period estimation, all-pole and all-zero filters, convolution; Power spectral density, periodogram, autoregressive model, autocorrelation estimation. (3 hours)

Linear Prediction of Speech- Basic concepts of linear prediction; Linear Prediction Analysis of non-stationary signals –prediction gain, examples; Levinson-Durbin algorithm; Long term and short-term linear prediction models; Moving average prediction. (7 hours)

Speech Quantization- Scalar quantization–uniform quantizer, optimum quantizer, logarithmic quantizer, adaptive quantizer, differential quantizers, Vector quantization – distortion measures, codebook design, codebook types. (6 hours)

SECTION-B

Scalar Quantization of LPC- Spectral distortion measures, Quantization based on reflection

coefficient and log area ratio, bit allocation; Line spectral frequency – LPC to LSF conversions, quantization based on LSF. (6 hours)

Linear Prediction Coding- LPC model of speech production; Structures of LPCencoders and decoders; Voicing detection; Limitations of the LPC model. (6 hours)

Code Excited Linear Prediction-CELP speech production model; Analysis-by-synthesis; Generic CELP encoders and decoders; Excitation codebook search – state-save method, zero-input zerostate method; CELP based on adaptive codebook, Adaptive Codebook search; Low Delay CELP and algebraic CELP (8 hours)

Speech Coding Standards-An overview of ITU-T G.726, G.728 and G.729standards(3 hours)

TEXT BOOKS			
S. No.	**Title**	**Author(s)**	**Publisher**
1	Digital Speech	A. M. Kondoz	Wiley Students Edition
2	Speech Coding Algorithms: Foundation and Evolution of Standardized Coders	W.C. Chu	Wiley Inter science, 2003.

Course Code	**EC627**
Course Title	**Project-I**
Credits	1
Course Assessment Methods Continuous Assessment	 50
Course Outcomes:	At the end of the course, students will demonstrate the ability to: 1. Conceive a problem statement either from rigorous literature survey or from the requirements raised from need analysis. 2. Design, implement and test the prototype/algorithm in order to solve the conceived problem. 3. Write comprehensive report on project work.

Guidelines:

1. The project is a team activity having 3-4 students in a team. This is electronic product design work with a focus on electronic circuit design.
2. The project may be a complete hardware or a combination of hardware and software. The software part in project should be less than 50% of the total work.
3. Project should cater to a small system required in laboratory or real life.
4. It should encompass components, devices, analog or digital ICs, micro controller with which functional familiarity is introduced.
5. After interactions with assigned supervisor and based on comprehensive literature survey/need analysis, the student shall identify the title and define the aim and objectives of project.
6. Student is expected to detail out specifications, methodology, resources required, critical issues involved in design and implementation and submit the proposal within first week of the semester.
7. The student is expected to exert on design, development and testing of the proposed work as per the schedule.
8. Art work and Layout should be made using CAD based PCB simulation software. Due considerations should be given for power requirement of the system, mechanical aspects for enclosure and control panel design.

9. Completed project and documentation in the form of project report is to be submitted at the end of semester.
10. The lab sessions should be used for discussion on standard practices used for electronic circuits/product design, converting the circuit design into a complete electronic product, PCB design using suitable simulation software, estimation of power budget analysis of the product, front panel design and mechanical aspects of the product, and guidelines for documentation /report writing.

SEVENTH SEMESTER

Course Code	EC710
Course Title	**Wireless & Mobile Communication**
Type of Course	Core
L T P	3 1 2
Credits	3
Course Assessment Methods End Semester Assessment (University Exam.) Continuous Assessment (Sessional, Assignments,Quiz)	 50 50
Course Prerequisites	Digital Communication
Course Objectives (CO)	1. To gain an understanding of the principles behind the design of wireless communication systems and technologies 2. To impart practical knowledge of wireless systems.
Course Outcome	1. Explain the Classification of wireless and mobile communication systems 2. Analyze the cellular design fundamentals of mobile communication systems. 3. Explain the different modulation schemes, multiple access techniques, fading, equalization and diversity concepts used in wireless communications. 4. Analyze different Multiuser Systems, wireless networking and MIMO Concepts.

SYLLABUS

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SECTION-A

Introduction : 12

Evolution of Mobile Communication Systems, cellular telephone systems, comparison of common wireless communication systems, 2G cellular networks, 2.5 G wireless network, HSCSD, GPRS, EDGE technology, 3G wireless network, UMTS, 3G CDMA2000, 3G TD-SCDMA, Wireless Local Loop, Blue tooth and Personal Area Networks.

System Design Fundamentals 10

Frequency reuse, Channel alignment strategies, handoff strategies, interference and system capacity, improving coverage and capacity in cellular systems, parameters for mobile multipath channel.

SECTION-B

Modulation Techniques 10

spread spectrum modulation techniques, Equalization, Equalizers in communication receiver, Diversity techniques, RAKE receiver, Fundamentals of channel coding , Small scale fading, Fading Channels (Rayleigh, Rician)

Multiple Access Techniques 2

FDMA, TDMA, CDMA, SDMA

Wireless Networking 3

Difference between wireless and fixed telephone networks, development of wireless networks, ISDN, VOIP, IP based telephony

Wireless Systems 8

GSM, GSM Architecture, CDMA digital cellular standard, IS-95 system, LTE, LTE Advanced, MIMO systems

TEXT BOOKS			
S. No.	**NAME**	**AUTHOR(S)**	**PUBLISHER**
1	Wireless Communications	Andrea Goldsmith	Cambridge University Press
2	Wireless Communications Principles and practice	Theodore S. Rappaport	Prentice Hall India
RECOMMENDED BOOKS			
3	Modern Wireless Communications	Simon Haykin , Michael Moher	PHI
4	Wireless Communication and Networking	Jon W Mark	PHI

Course Title	Wireless& Mobile Communication(Practical)
Type of Course	Core
Credits	1
Course Assessment Methods Continuous Assessment	 50

LIST OF EXPERIMENTS

1. Equipment orientation
    a. Familiarisation with spectrum analyser , simulation softwares, various kits to be used in the laboratory.
    b. Review of working of function generator , CRO , multimeter& other instruments.
2. Simulation and implementation of baseband digital signals
    a. Types of baseband signals: unipolar, polar, bipolar, RZ, NRZ, etc.
    b. Distortion and noise. Eye diagram.
3. Simulation and implementation of modulated digital signals
    a. PSK, ASK and FSK modulations.
    b. Demodulation with envelope detection and synchronous.
    c. PSK differential modulation.
    d. Quadrature modulations (QASK and QPSK).
    e. QAM modulation.
4. Global System for Mobiles (GSM)
    a. Cellular telephony. GSM Architecture.
    b. Radiofrequency. Traffic and control channels. Frames.
    c. AT Commands
    d. Working of GSM mobile station.
5. Multiple Access
    a. Time division multiple Access
    b. Frequency division multiple access
6. Spread Spectrum communication systems
    a. Pseudo-noise coders
    b. Direct sequence spread spectrum communication systems
    c. Frequency hopped spread spectrum communication systems
    d. CDMA wireless computer communication systems
7. Channel Characteristics
    c. Multipath channel propagation characteristics
    a. Bit-error rate measurement
8. Wireless Networks
    a. Bluetooth wireless network.
    b. Wi-Fi
    c. Wi-Max

Course Code	EC701
Course Title	**Embedded System Design (Theory)**
Type of Course	Core
L T P	4 0 2
Credits	3
Course Assessment Methods End Semester Assessment (University Exam.) Continuous Assessment (Sessional, Assignments, Quiz)	 50 50
Course Prerequisites	Microprocessors, Microcontrollers & Interfacing, Advanced Microprocessors
Course Objectives (CO)	1. To familiarize with the basic hardware of Embedded System, PIC Microcontroller its register file structure, Instruction set,programming& interfacing methods. 2. To understand the concept of software structures, scheduling architecture, IDE , Linker , Locator, Simulators. 3. To know how to get Embedded software into target system debugging strategies. 4. To familiarize with RTOS and RTOS Services.
Course Outcome	1. Describe the ARM microprocessor architectures and its feature in embedded system 2. Analyze the instruction set and development tools of ARM 3. Explain ARM organization and interfacing of peripherals with ARM microcontroller· 4. Understand the concept of RTOS, memory and communication interface. 5. Understand the architecture of various ARM Processor cores.

SYLLABUS

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SECTION-A

Embedded system concepts: 5

Introduction to embedded systems, Difference between embedded and general purpose computing, Embedded system architecture, Embedded system model, RISC, CISC, VLIW, superscalar architecture.

The ARM Architecture 10

The ARM Family History, The Acorn RISC' Machine, Architectural inheritance, The ARM programmer's model, ARM development tools

ARM Assembly Language Programming 6

Data processing instructions, Data transfer instructions, Control flow instructions, Writing simple assembly language programs

The ARM Instruction Set 8

Introduction, Exceptions, Conditional execution, Branch and Branch with Link (B, BL) Branch, Branch with Link and exchange (BX, BLX), Software Interrupt (SWI), Data processing instructions, Multiply instructions, Count leading zeros (CLZ - architecture v5T only), Single word and unsigned byte data transfer instructions, Half-word and signed byte data transfer instructions, Multiple register transfer instructions, Swap memory and register instructions (SWP), Status register to general register transfer instructions, General register to status register transfer instructions

SECTION-B

ARM Organization and Implementation 6

3-stage pipeline ARM organization, 5-stage pipeline ARM organization, ARM instruction execution, ARM implementation, interfacing with various external hardware devices like LED,7 segment , LCD, Keypad.

The Thumb Instruction Set 6

The Thumb bit in the CPSR, The Thumb programmer's model, Thumb branch instructions, Thumb software interrupt instruction, Thumb data processing instructions, thumb single register data transfer instructions, Thumb multiple register data transfer instructions, Thumb implementation, Thumb

Architectural Support for System Development 4

The ARM memory interface, The Advanced Microcontroller Bus Architecture (AMBA)

ARM Processor Cores 5

ARM7TDMI, ARM8, introduction to ARM 9 architecture, Difference between ARM7 & ARM9 architecture, Introduction to RTOS

RECOMMENDED BOOKS

S. No.	NAME	AUTHOR(S)	PUBLISHER
1	ARM System-on-Chip Architecture	Steve Furber	
2	ARM assembly language: Fundamentals and Techniques	William Hohl	CRC Press
3	ARM Assembly Language Programming & Architecture	Mazidi&Naimi	ARM Books
4	ARM System Developer's Guide: Designing and Optimizing System Software	The Morgan Kaufmann	
5	An Embedded Software Primer	David E. Simon	

Course Title	**Embedded System Design (Practical)**
Type of Course	Elective
Credits	1
Course Assessment Methods Continuous Assessment	50
LIST OF EXPERIMENTS	
Programming examples of ARM Processor, Interfacing using ARM: Interfacing of LED, Seven segment display, keypad, LCD etc	

Course Code	EC702
Course Title	**Operations Research** (Theory)
Type of Course	Elective
L T P	4 0 0
Credits	4
Course Assessment Methods End Semester Assessment (University Exam.) Continuous Assessment (Sessional, Assignments, Quiz)	 50 50
Course Prerequisites	Linear Algebra and Complex Analysis
Course Objectives (CO)	1. To give the student experience in modeling, solving and analyzing problems using linear programming. Emphasis is stressed on theory, applications, and computer usage. 2. Optimization, i.e., "to do things best under the given circumstances." 3. To improve a quantitative decision making procedure. 4. To help the decision-makerto select the key decision variables that will influence the overall quality of decisions. 5. To make them understand how to transport goods from one place to another at minimum cost. 6. To be able to form networks and find project completion time. 7. To derive formulas to obtain solutions of various models of Dynamic programming.
Course Outcome	1. Identify and develop operational research models from the verbal description of the real system. 2. Understand the mathematical tools that are needed to solve optimization problems. 3. Use mathematical software to solve the proposed models. 4. Learn about the Alternate method to look at linear programming problem. 5. Learn about the methods to minimize the transportation cost. 6. Learn about how to assign jobs to the workers so that cost of assignment can be minimized. 7. Learn about forming networks,critical paths involved in projects,floats and probability of completing a project in a prescribed time. 8. Learn about methods to solve various models such as

	knapsack model,shortest route problem,workforce size models etc. of Dynamic programming. 9. Learn about the serving schedules, arrival rates of customers and time to be spent in a queue at a se4rvice center. 10. Learn about the strategy that a salesman should follow so that he can travel in all the destinations in minimum amount of time. 11. Learn to solve problems in which decision variables cannot take fractional values,using Branch and Bound method and cutting plane algorithm etc.

SYLLABUS

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SECTION-A

Optimization Problems 12

Linear Programming: Graphical Method (Scope as in Chapter 1 of Reference 1), Solution of simultaneous linear equations: An overview (Scope as in Chapter 2, Sections 2.15 – 2.16 of Reference 1), Basic solutions, lines and hyperplanes, convex sets, extreme points, convex sets and hyperplanes (Scope as in Chapter 2, Sections 2.19 – 2.21 of Reference 1), Reduction of any feasible solution to a system of equations to a basic feasible solution, Simplex Method: The simplex algorithm (Scope as in Chapter 3, 4 of Reference 1), Tableau format for simplex computations, Charne's M-method, Two phase method (Scope as in Chapter 5 of Reference 1), The revised simplex method (Scope as in Chapter 7 of Reference 1).

Duality theory: 6

Formulation of the dual problem, Theorems on duality: Weak Duality Theorem, Strong Duality Theorem, Complementary Slackness Theorem, Dual Simplex Algorithm (Scope as in Chapter 8, Sections 8.1 – 8.12 of Reference 1).

Integer Linear Programming: 4

Branch and Bound Algorithm, Cutting Plane Algorithm (Scope as in Chapter 9, Section 9.1 – 9.2 of Reference 2).

SECTION-B

Transportation Problem: 6

Initial solution by North-West corner rule, Row minima method, Column minima method, Matrix minima method, Vogel's method. Tableau of transportation problem, u-v algorithm for solving transportation problem. Degeneracy in transportation problem. (Scope as in Chapter 9 of Reference 1).

The Assignment Problem: 2

Hungarian Method

(Scope as in Chapter 5, Section 5.4 of Reference 2)

Traveling Salesman Problem 2

(Scope as in Chapter 9, Section 9.3 of Reference 2)

Dynamic Programming: 6

Shortest route problem, Knapsack Model, Workforce size model, Equipment replacement model, Investment model, Game of chance (Scope as in Chapter 10, Sections 10.1 – 10.3, Chapter 15, Section 15.1 – 15.2 of Reference 2

CPM and PERT: 2

Network representation, Critical path computations, Construction of time schedule, Linear programming formulation of CPM, PERT networks (Scope as in Chapter 6, Section 6.6 of Reference 2).

Basic Queuing Systems: 5

Elements of a queuing model, Pure birth and pure death model, Generalized Poisson queuing model (Scope as in Chapter 17, Section 17.1 to 17.5 of Reference 2).

RECOMMENDED BOOKS

S. No.	NAME	AUTHOR(S)	PUBLISHER
1	Linear Programming	G. Hadley	Narosa Publishing House
2	Operations Research, An Introduction	Hamdy A. Taha	Pearson Education
3	Operations Research	Kanti Swaroop, P. K. Gupta, Man Mohan	Sultan Chand and Sons
4	Operations Research	A. M. Natarajan, P. Balasubramani, A. Tamilarasi	Pearson Education

Course Code	EC 711
Course Title	**Operating Systems (Theory)**
Type of Course	Elective
L T P	4 0 0
Credits	4
Course Assessment Methods End Semester Assessment (University Exam.) Continuous Assessment (Sessional, Assignments, Quiz)	 50 50
Course Prerequisites	Computer Networks
Course Objectives (CO)	1. To introduce design and implementation issues of various Operating Systems: batch, multi-programmed, time sharing, real time, distributed, parallel Operating System structural Components, layered structure, functions 2. To understand concept of processes, CPU Scheduling Algorithms, Inter Process Communication, Process Synchronization, Deadlocks Detection , Recovery, Avoidance and Prevention 3. To familiarize with Memory Management using contiguous memory allocation, paging, segmentation, Virtual Memory, Thrashing. File Systems, directory structure, allocation methods, free-space management, and Protection mechanisms. 4. To understand Disk Structure & Management, Swap Space Management , Android, IOS, Windows Operating system in Mobile phone
Course Outcome	1. Analyze basic concept of operating system and their structures. 2. Implement algorithms of CPU scheduling and disk scheduling. 3. Analyze issues related to resource and memory management. 4. Compare latest operating systems with respect to characteristics and features.

SYLLABUS

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SECTION-A

Introduction: 5

What is an O.S., O.S. Functions; Different types of O.S.: batch, multi-programmed, time sharing, real time, distributed, parallel; General structure of operating system, O/S services, system calls.

Process Management: 10

Introduction to processes - Concept of processes, process scheduling, operations on processes; Inter Process Communication, Critical Sections, Mutual Exclusion with Busy Waiting, Sleep and Wakeup, Semaphores, Message passing; CPU scheduling-scheduling criteria, pre-emptive & non-pre-emptive scheduling, Scheduling Algorithms: FCFS, SJF, RR and priority, Circuit Switching & Packet Switching.

Memory Management: 6

Background, logical vs. physical address space, memory management without swapping; swapping; contiguous memory allocation, paging, segmentation, segmentation with paging; Virtual Memory, demand paging, performance, page replacement, page replacement algorithms (FIFO, Optimal ,LRU); Thrashing.

SECTION-B

File Systems: 6

Files - file concept, file structure, file types, access methods, File attributes, file operations; directory structure, allocation methods (contiguous, linked, indexed), free-space management (bit vector, linked list, grouping), Protection mechanisms.

Secondary Storage: 6

Disk Structure, Disk Scheduling (FCFS, SSTF, SCAN, C-SCAN, LOOK), Disk Management (Disk Formatting, Boot Blocks, Bad Blocks), Swap Space Management (Swap Space use, Swap Space Location, Swap Space Management)

Deadlocks: 6

Introduction to deadlocks, Conditions for deadlock, Resource allocation graphs, Deadlock Detection and Recovery, Deadlock Avoidance, Deadlock Prevention

Latest Operating Systems: 6

Introduction of Android, IOS, Windows Operating system in Mobile phone

RECOMMENDED BOOKS

S. No.	NAME	AUTHOR(S)	PUBLISHER
1	Operating Systems	Galvin &Silberschatz Addison	Wesley Publishing Ltd,5E
2	An Introduction to Operating System	Harvey M. Deitel,	Narosa Publishing House
3	Operating Systems: Design and implementation	Andrew S. Tanenbaum	PHI, 2 E
4.	Operating system	Millan Milankovic	McGraw Hill, 2E

Course Code	EC 703
Course Title	**Nano Technology (Theory)**
Type of Course	Elective
L T P	4 0 0
Credits	4
Course Assessment Methods End Semester Assessment (University Exam.) Continuous Assessment (Sessional, Assignments, Quiz)	 50 50
Course Prerequisites	Integrated Circuits, VLSI Design
Course Objectives (CO)	1. To understand what nanotechnology is about and how to use it. 2. To gain knowledge of structure, properties, manufacturing, and applications of silicon and carbon materials. 3. To understand various fabrication methods in nanotechnology (top down & bottom up) 4. To analyse and discuss various characterization methods in nanotechnology (optical, electrical, AFM, SEM, TEM, and nanoindentation)
Course Outcome	1. Students will be able to understand nanotechnology and its scope in modern technology. 2. Students will be able to understand the basic chemistry and physics of the bulk solid state. 3. Students will be able to understand various challenges for development of large scale inexpensive methods of fabrication in Nano science. 4. Students will be able to study various Biological materials used in nanotechnology.

SYLLABUS

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SECTION-A

Introduction to Physics of the Solid State: 10

Structure, Size dependence of properties, Crystal structures, Face-Centered cubic nanoparticles, Tetrahedrally Bonded semiconductor structures, Lattice Vibrations, Energy Bands, Insulators, Semiconductors and conductors, Resiprocal Space, Energy Bands and Gaps of Semiconductors, Effective masses, Fermi surfaces, Localized particles, Donors, Acceptors and Deep Traps, Mobility, Excitons.

Properties of Individual Nanoparticles: 9

Introduction to Semiconducting Nanoparticles, Introduction to Quantum Dots, wells, wires, Preparation of Quantum Nanostructures, Introduction to Carbon Nanotubes, Fabrication, Structure, Electrical properties, Vibrational properties, Mechanical properties.

Biological Materials: 4

Biological Building Blocks, Nucleic Acids, Biological Nanostructures.

SECTION-B

Tools: 11

TEM, Infrared and Raman Spectroscopy, Photoemission and X-RAY spectroscopy, Electron microscopy, SPMs, AFMs, Electrostatic force Microscope, Magnetic force microscope

Nanoscale Devices: 11

Introduction, Nanoscale MOSFET-planer and non planer, Resonant-tunneling diodes, Single electron transistor, Quantum-Dot, Nano-electrochemical systems, Molecular/Bimolecular electron devices

RECOMMENDED BOOKS

S. No.	NAME	AUTHOR(S)	PUBLISHER
1	Nanotechnology	G.Timp; Bell Labs	NJ(Ed.)
2	Inroduction to Nanotechnology	Charless P. Poole	Wiley International
3	Nano Systems: Molecular machinery, manufactureing and computation	Eric Drexler	John wiley and sons

Course Code	**EC723**
Course Title	**Adaptive Signal Processing**
Type of Course	Elective
L T P	4 0 0
Credits	4
Course Assessment Methods End Semester Assessment (University Exam.) Continuous Assessment (Sessional, Assignments, Quiz)	 50 50
Course Prerequisites	Digital Signal Processing
Course Objectives (CO)	
Course Outcome	1. Understand the non-linear control and the need and significance of changing the control parameters w.r.t. real-time situation. 2. Mathematically represent the 'adaptability requirement'. 3. Understand the mathematical treatment for the modeling and design of the signal processing systems.

SYLLABUS

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SECTION-A

General concept of adaptive filtering and estimation (12)

Applications and motivation, Review of probability, random variables and stationary random processes, Correlation structures, properties of correlation matrices. Optimal FIR (Wiener) filter, Method of steepest descent, extension to complexvalued The LMS algorithm (real, complex), convergence analysis, weight error,correlation matrix, excess mean square error and mis-adjustment

Variants of the LMS algorithm (11)

The sign LMS family, normalized LMSalgorithm, block LMS and FFT based realization, frequency domain adaptive filters, Sub-band adaptive filtering. Signal space concepts - introduction to finite dimensional vectorspace theory, subspace, basis, dimension, linear operators, rank and nullity, inner product space, orthogonality, GramSchmidt orthogonalization, concepts of orthogonal projection,orthogonal decomposition of vector spaces.

SECTION-B

Vector space of random variables (11)

Correlation as inner product, forward andbackward projections, Stochastic lattice filters, recursive updating of forward and backward prediction errors, relationship with AR modeling, joint process estimator, gradient adaptive lattice.

Introduction to recursive least squares (RLS) (11)

Vector space formulation of RLSestimation, pseudo-inverse of a matrix, time updating of inner products, development of RLS lattice filters, RLS transversal adaptive filters. Advanced topics: affine projection and subspace based adaptive filters, partial update algorithms, QR decomposition and systolic array.

RECOMMENDED BOOKS			
S. No.	**Title**	**Author(s)**	**Publisher**
1	Adaptive filter theory	Simon Haykin	Prentice Hall, 1986.
2	Adaptive signal processing	C. Widrow and S.D. Stearns	Prentice Hall, 1984.

Course Code	EC704
Course Title	**Computer Architecture & Organization** (Theory)
Type of Course	Elective
L T P	4 0 0
Credits	4
Course Assessment Methods End Semester Assessment (University Exam.) Continuous Assessment (Sessional, Assignments, Quiz)	 50 50
Course Prerequisites	Digital Electronics, Digital System Design
Course Objectives (CO)	1. To impart study of the structure and behaviour of various functional modules of a computer. 2. To study how hardware is to be designed given a set of specifications. 3. To gain an understanding of the detailed steps required to design an elementary basic computer.
Course Outcome	1. Understand the basics of structural, architectural and design issues of a digital computer. 2. Analyze the computer software concepts, pipelined architecture and control processor organization. 3. Analyze the hardwired and micro-programmed control of the CPU 4. Evaluate arithmetic algorithms for arithmetic processor design and data transfer techniques to interface Input-output devices and memory.

SYLLABUS

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SECTION-A

Register Transfer and Micro-Operations: Register Transfer Language, Inter Register Transfer Arithmetic, Complements, fixed and floating point Representation, Micro-Operations, Shift Micro-Operations and Control Operations. 06

Basic Computer Origination and design: Instruction Codes, Computer Instructions, 06

Timing and Control, Execution of Instructions, Input, Output and interrupt, Design of Computer.

Computer Software: Programming Language, Assembly Language, The Assembler, Program Loops, Programming Arithmetic and Logic Operations, Subroutines, Input-Output Programming. 07

Control Processor Organization: Processor Bus Organization, ALU stack Organization, General Register Organization, Instruction Formats, Addressing Modes, Data Transfer and Manipulation, Program Control, Microprocessor Organization, Pipelining, Parallel Processing. 07

SECTION-B

Micro program Control Organization: Control Memory, Address Sequencing, Micro program Sequences, Microinstruction Formats, and Software Aids. 06

Arithmetic Processor Design: Comparison and Subtraction of unsigned Binary Numbers, Addition, Subtraction, Multiplication, Division Algorithm, Processor configuration and control 06

Input-Output & Memory Organization: Input-Output interface, Asynchronous Data Transfer, DMA, Priority Interrupt, I/O Processor, Virtual Memory, Cache Memory, Associative memory, Memory Management Hardware. 07

RECOMMENDED BOOKS

S. No.	NAME	AUTHOR(S)	PUBLISHER
1	Computer system & Architecture	M. Morris Mano,	Pearson Education
2	Computer architecture and organization	Hayes .J.P	Narosa Publications
3	Logic and computer design Fundamentals	M. Morris and Charles R. Kinre	Pearson Education

Course Code	EC 705
Course Title	**Artificial Intelligence (Theory)**
Type of Course	Elective
L T P	4 0 0
Credits	4
Course Assessment Methods End Semester Assessment (University Exam.) Continuous Assessment (Sessional, Assignments, Quiz)	 50 50
Course Prerequisites	Data Structures & Algorithms
Course Objectives (CO)	1. To introduce the AI techniques to solve problems and search strategies to find optimal solution paths from start to goal state. 2. To introduces different knowledge representation methods in AI Programs. 3. To introduce different design techniques for Game Playing Programs. 4. To introduce the AI Agents, their design and planning techniques. 5. To introduce the natural language processing and expert systems.
Course Outcome	1. Understand the concepts of artificial intelligence and intelligent agents. 2. Apply AI planning and problem solving techniques to real world problems to develop intelligent systems 3. Analyze approaches to knowledge representation. 4. Understand the basics of natural language processing and design expert systems.

SYLLABUS

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SECTION-A

Introduction: 6

Artificial Intelligence and its applications, Artificial Intelligence Techniques, Level of models, criteria of success, Intelligent Agents, Nature of Agents, Learning Agents.

Planning: 6

The Planning problem, planning with state space search, partial order planning, planning graphs, planning with propositional logic, Analysis of planning approaches, Hierarchical planning, conditional planning, Continuous and Multi Agent planning

Problem solving techniques: 5

State space search, control strategies, heuristic search, problem characteristics, production system characteristics., Generate and test, Hill climbing, best first search, A* search, Constraint satisfaction problem, Mean-end analysis, Min-Max Search, Alpha-Beta Pruning, Additional refinements, Iterative Deepening.

SECTION-B

Knowledge representation: 16

Mapping between facts and representations, Approaches to knowledge representation, Propositional logic, predicate logic, Resolution, Resolution in proportional logic and predicate logic, Clause form, unification algorithm, procedural vs declarative knowledge, Forward vs Backward reasoning, Matching, conflict resolution, Non-monotonic reasoning, Default reasoning, statistical reasoning, fuzzy logic Weak and Strong filler structures, semantic nets, frame, conceptual dependency, scripts.

Introduction to Natural Language processing and expert system: 6

Basic Tasks of Natural Language processing, Expert systems, Expert system examples, Expert System Architectures, Rule base Expert systems, Non Monotonic Expert Systems, Decision tree base Expert Systems.

RECOMMENDED BOOKS

S. No.	NAME	AUTHOR(S)	PUBLISHER
1	Artificial Intelligence	Elaine Rich	McGraw Hill
2	Artificial Intelligence	Partick Henry Winston	Addison Wesley
3	AI: A Modern Approach	Stuart J.Russel	Pearson Education
4	Artificial Intelligence	George Luger	Pearson Education
5	Introduction to AI and Expert Systems	DAN, W. Patterson	PHI
6	Principles of AI	A.J. Nillson	Narosa publications

Course Code	EC 706
Course Title	**High Speed Semiconductor Devices & Circuits (Theory)**
Type of Course	Elective
L T P	4 0 0
Credits	4
Course Assessment Methods End Semester Assessment (University Exam.) Continuous Assessment (Sessional, Assignments, Quiz)	 50 50
Course Prerequisites	VLSI
Course Objectives (CO)	
Course Outcome	

SYLLABUS

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SECTION-A

Quantum Physics:

Quantum theory, Quantum mechanics, Schrodinger equation. Solution of Schrodinger Equation: Free Particle, Particle in Infinite Potential Well, Finite Potential Well, Linear Harmonic oscillator (8)

Energy Band Theory:

Culomb Field, Bloch Theorem, Kronig - Penney Analysis, Eigen value equation, Energy in Brilloun Zone representation, Motion of electrons in Energy Bands: Block parameter 'k', Energy-Momentum Relations, Effect of External forces: Concept of Holes (7)

Mobility:

Introduction, Lattice vibrations, Carrier Density: Density of States, Finite Drac Statistic, Maxwell-Bottzman approximation, Variation with energy carrier concentration (7)

SECTION-B

Extensive doping, Position of intrinsic Energy, Generation -Recombination process in semiconductors, Introduction, Band to Band generation, Band to Band recombination, Generation-Recombination Centimes/Traps. (8)

Diffusion and Continuity Equation:

Diffusion Current, Einstein Relation, Continuity Equations. Diodes: Introduction, P-N junction diodes, Diode Currents. Diffusion Capacitance, Transient response of Diode. Schottky Diode Schottky effect learning of the barrier Current transport in Metal-Semiconductor Schottky Diodes, Multivalley Semiconductors, MESFET (Metal Semiconductor Field Effect Transistor): Introduction, Basic FET Operation, Drain Current Field dependent mobility, Saturated velocity model (8)

Semiconductor Heterojunction:

Introduction, Energy Alignment, Current transport, Bipolar Junction Transistor: Introduction, BJT as variable current carrier storage, 1st order model of BJT, Current model, Heterojunction Bipolar Transistor: Introduction, Components of base currents. (7)

TEXT BOOKS			
S. No.	**NAME**	**AUTHOR(S)**	**PUBLISHER**
1	Device Electronics for Integrated circuits	Richard S.Muller Theodore I. Kamins	John Wiley and Sons, 1986.
2	Advanced semiconductors and fundamentals	Robert F. Pierret	Pearson Prentice Hall
RECOMMENDED BOOKS			
1	Fundamentals of Semi-Conductor Devices	Edward S. Yang	McGraw Hill, 1988
2	Physics of Semi Conductor Devices	S.M. Sze,1981	
3	MOS Field Effect Transistor and Integrated Circuits	Paul Richaman	John Wiley and Sons

Course Code	**EC722**
Course Title	**Project-II**
Credits	1
Course Assessment Methods Continuous Assessment	 50
Course Outcomes:	At the end of the course, students will demonstrate the ability to: 1. Conceive a problem statement either from rigorous literature survey or from the requirements raised from need analysis. 2. Design, implement and test the prototype/algorithm in order to solve the conceivedproblem. 3. Write comprehensive report on project work.

Guidelines:

1. The project is a team activity having 3-4 students in a team. This is electronic product design work with a focus on electronic circuit design.
2. The project may be a complete hardware or a combination of hardware and software. The software part in project should be less than 50% of the total work.
3. Project should cater to a small system required in laboratory or real life.
4. It should encompass components, devices, analog or digital ICs, micro controller with which functional familiarity is introduced.
5. After interactions with assigned supervisor and based on comprehensive literature survey/need analysis, the student shall identify the title and define the aim and objectives of project.
6. Student is expected to detail out specifications, methodology, resources required, critical issues involved in design and implementation and submit the proposal within first week of the semester.
7. The student is expected to exert on design, development and testing of the proposed work as per the schedule.
8. Art work and Layout should be made using CAD based PCB simulation software. Due considerations should be given for power requirement of the system, mechanical aspects for enclosure and control panel design.

9. Completed project and documentation in the form of project report is to be submitted at the end of semester.
10. The lab sessions should be used for discussion on standard practices used for electronic circuits/product design, converting the circuit design into a complete electronic product, PCB design using suitable simulation software, estimation of power budget analysis of the product, front panel design and mechanical aspects of the product, and guidelines for documentation /report writing.

EIGHTH SEMESTER

Course Code	EC808
Course Title	**Digital Image Processing (Theory)**
Type of Course	Elective
L T P	4 0 2
Credits	4
Course Assessment Methods End Semester Assessment (University Exam.) Continuous Assessment (Sessional, Assignments, Quiz)	 50 50
Course Prerequisites	Digital Signal Processing
Course Objectives (CO)	1. To provide the student with the fundamentals knowledge of the concepts of visual perception and image acquisition, basic techniques of image manipulation, segmentation and compression. 2. To impart knowledge of spatial and frequency domains image processing techniques. 3. To familiarize with MATLAB Image Processing Toolbox 4. To introduce the students to a preliminary understanding of Computer Vision. 5. To impart practical knowledge of Image processing operations in MATLAB.
Course Outcome	1. Understand the fundamentals of image processing systems. 2. Analyze the effects of filtering on gray-scale and color images. 3. Understand the principles of transforms for images. 4. Analyze the effects and applications of image compression methods.

SYLLABUS

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SECTION-A

Introduction 2

Fundamental Steps in Image Processing, Elements of Digital Image Processing, Image Acquisition, Storage, Processing.

Intensity Transformations and Spatial filtering 8

Relationship between pixels, Mathematical Tools used in image processing, Intensity Transformation Functions, Histogram Processing, Spatial Filtering, Smoothing Spatial Filters, Sharpening Spatial Filters.

Filtering and Restoration 8

Filtering in frequency domain, Image smoothing using low-pass frequency domain filters, Image sharpening using high-pass frequency domain filters,Noise Models, Restoration in the presence of noise and degradations.

Color Image Processing 5

Color Fundamentals, Color Models, Color Transformations, Color Image Smoothing and Sharpening.

SECTION-B

Wavelets and Other Image Transforms 11

Matrix based transforms, Correlation, Basis functions in time-frequency plane, basis images, Fourier related transforms, DHT, DCT, DST, Walsh Hadamard transforms, Slant transform, Haar transform, Wavelet transform: scaling functions, wavelet functions, wavelet series expansion, DWT in one dimension, Wavelet Transform in two dimensions, Wavelet Packets.

Image Compression 11

Redundancies in Images, Huffman Coding, Arithmetic coding, Symbol based coding, Bit-plane coding, Block Transform coding, Predictive coding, Wavelet Coding, Digital Image watermarking.

RECOMMENDED BOOKS

S. No.	NAME	AUTHOR(S)	PUBLISHER
1	Digital Image processing	R.C. Gonzalez and R.F.Woods	Pearson Education
2	Digital Image Processing	W.K.Pratt	Tata McGraw Hill
3	Fundamentals of Digital Image Processing	A.K Jain	
4	Digital Image Processing and Analysis	B. Chandra and D. Dutta Majumder	
5	Algorithms for image Processing and Computer Vision	James R.Parker	
7	Digital Image Processing using MATLAB	Woods & Gonzalez	Pearson Education

Course Title	**Digital Image Processing**(Practical)
Type of Course	Elective
Credits	1
Course Assessment Methods Continuous Assessment	50

LIST OF EXPERIMENTS **(To be performed using any simulation software like MATLAB, Scilab or equivalent)**	
1.	Intensity transformation
2	Histogram Processing.
3	Spatial Filtering.
4	Frequency Domain Processing
5	Image Restoration.
6	Image Denoising
7	Color Image Processing
8	Wavelet Transform
9	Image Compression

Course Code	EC 809
Course Title	**Advanced Digital Communication (Theory)**
Type of Course	Elective
L T P	4 0 2
Credits	4
Course Assessment Methods End Semester Assessment (University Exam.) Continuous Assessment (Sessional, Assignments, Quiz)	 50 50
Course Prerequisites	Communication Engineering, Digital Communication
Course Objectives (CO)	1. Understand basic components of digital communication systems. 2. Design optimum receivers for digital modulation techniques. 3. Analyze the error performance of digital modulation techniques. 4. Design digital communication systems under given power, spectral and error performance constrains. 5. Understand Multichannel and Multicarrier systems. 6. To impart practical training in Advanced Digital communication systems
Course Outcome	1. Understand basic components of digital communication systems. 2. Understand Digital modulation schemes and signal space representation of modulated signals. 3. Design optimum receivers for digital modulation techniques. 4. Analyze the error performance of digital modulation techniques. 5. Design digital communication systems under given power, spectral and error performance constrains. 6. Understand Multichannel and Multicarrier systems.

SYLLABUS

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SECTION-A

Elements of a Digital communication system: 5

Communication channels and their characteristics, mathematical models for

communication channels, recent trends in digital communication, Deterministic and Random Signal Analysis, Band pass and Low pass Signal Representation, Signal space representation of waveforms.

Digital modulation Schemes: 9

Representations of digitally modulated signals, memory less modulation methods, PAM, PM, QAM, multidimensional signaling, Signaling schemes with memory, CPFSK, CPM, Power spectrum of Digitally modulated signals, PSD of a digitally modulated signal with memory, PSD of linearly modulated signals.

Optimum Receivers for Additive White Gaussian Noise Channels: 9

Waveforms and vector channel models, waveforms and Vector AWGN channels, Optimum detection for the Vector AWGN channel, Implementation of the optimal receiver for AWGN channels, the correlation receiver, matched filter receiver, frequency domain interpretation of the matched filter, Performance analysis of wire line and radio communication systems.

SECTION-B

Digital Communication through Band-Limited Channels: 11

Characterization of band-limited channels, Signal Design for band-limited channels, The nyquist criterion, Controlled ISI, Optimum receiver for channels with ISI and AWGN, Optimum MLR, MLSE for Discrete time white noise filter model, Linear equalization, Decision feedback equalization.

Multichannel and Multicarrier System: 11

Multichannel Digital Communication in AWGN channels, binary signals, M-ary orthogonal signals, Multicarrier communication, single-carrier versus multicarrier modulation, Capacity of a Non-ideal linear filter channel, orthogonal frequency division multiplexing (OFDM), modulation and demodulation in an OFDM system, Spectral characteristics of multicarrier signals, Bit and Power allocation in multicarrier modulation.

RECOMMENDED BOOKS

S. No.	NAME	AUTHOR(S)	PUBLISHER
1	Digital Communications	J. G. Proakis	McGraw-Hill
2	Digital Communication	Haykins	McGraw Hill Int Edition
3	Modern Digital & Analog Communication	B P Lathi	Oxford University Press
4	Communication. Systems	A B Carlson	Tata McGraw Hill
5	Digital Communications	Ian A Glover& Peter M Grant	Pearson Education

Course Title	**Advanced Digital Communication (Practical)**
Type of Course	Elective
Credits	1
Course Assessment Methods Continuous Assessment	50
LIST OF EXPERIMENTS:	
	Experiments are based on Theory

Course Code	EC 810
Course Title	**Neural Networks and Fuzzy Logic (Theory)**
Type of Course	Elective
L T P	4 0 2
Credits	4
Course Assessment Methods End Semester Assessment (University Exam.) Continuous Assessment (Sessional, Assignments, Quiz)	 50 50
Course Prerequisites	Programming Fundamentals, Digital Electronics
Course Objectives (CO)	1. To explain the need and significance of soft computing concepts 2. To correlate the biological neural system with the artificial neural system 3. To study various artificial neural network architecture and implement the same using MATLAB. 4. To study the various basic concepts of Fuzzy Logic.
Course Outcome	1. Understand the need of Artificial Intelligence and training methods of ANN. 2. Design of ANN as memory network and function approximator. 3. Learn types of ANN for unsupervised clustering and self-organization. 4. Understand and design of Fuzzy logic based control systems.

SYLLABUS

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SECTION-A

Fundamentals of Neural Networks 7

Classical AI and Neural Networks, characteristics of neural networks, Historical perspective, The biological inspiration, models of artificial neuron & activation functions, Artificial neural networks & architectures, Training of artificial neural networks.

Supervised Learning 10

Learning and memory, Representation of perceptron, Linear separability, Perceptron Learning, Training of single layer and multi-layer, back propagation training algorithm, Applications of back propagation, Universal function approximation.

Attractors Neural Networks 8

Introduction, Associative memory, Hopfield networks, Content addressable memory, Bidirectional associative memories.

SECTION-B

ART Networks 7

Vector quantization & simplified ART architecture, Architectures & algorithms of ART1 & ART2 networks, Applications.

Self-organizing Feature Map 6

Introduction, Competitive learning, Maxican Hat networks, SOFM algorithm, Applications.

Fuzzy Logic 7

Basic concepts of Fuzzy Logic, Fuzzy vs Crisp set, Fuzzy uncertainty & Linguistic variables, membership functions, operations on fuzzy sets, fuzzy rules for approximate reasoning, variable inference techniques, defuzzification techniques, Applications of fuzzy logic, Fuzzy system design.

RECOMMENDED BOOKS

S. No	NAME	AUTHOR(S)	PUBLISHER
1	Neural Networks – A Classroom Approach	Satish Kumar	TMH
2	Neural Networks, fuzzy Logic, and Genetic Algorithms	Rajasekaran&VijayalakhmiPai	PHI
3	Principles of Soft Computing	Sivanandam, Deepa	Wiley India
4	Fuzzy Logic with engineering applications	Ross	Mc-GrawHil
5	Introduction to Neural Network using MATLAB 6.0	Sivanandam, Sumathi, Deepa	Wiley India

Course Title	**Neural Networks and Fuzzy Logic** (Practical)
Type of Course	Elective
Credits	1
Course Assessment Methods Continuous Assessment	50
Course Prerequisites	

LIST OF EXPERIMENTS	
	Experiments are based on Theory

Course Code	**EC 801**
Course Title	**ADVANCED DIGITAL SIGNAL PROCESSING**
Type of Course	Elective
L T P	4-0-0
Credits	4
Course Assessment Methods End Semester Assessment (University Exam.) Continuous Assessment (Sessional, Assignments, Quiz)	 50 50
Course Outcomes	1. Application of transform tools for analysis and synthesis of digital filters. 2. Design and analyze multirate systems and filter bank. 3. Explain the designing aspects and uses of prediction and adaptive filters. 4. Explain the need and process of power spectrum estimation and basics of DSP processors.

SYLLABUS

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SECTION-A

Transform Theory:

Review of Z-Transform, Solution of Linear Difference Equations, Fourier series and Fourier Transform, Discrete Fourier Transform, Radix-2 FFT.

Introduction to Radix-4 and Split Radix FFT, Discrete Cosine Transform, DCT as Orthogonal Transform, Walsh Transform, Hadamard Transform, Wavelet Transform. (6)

Digital Filters:

FIR Filter Design: Filter Specifications, Coefficient Calculation Methods- Window method, Optimal method, Frequency Sampling method. Realization Structures, Finite Word Length Effects.

IIR Filter Design: Specifications, Coefficient Calculation methods- Pole-Zero Placement method, Impulse Invariant method, Matched Z-Transform method, Bilinear Z-Transformation method, Use of BZT and Classical Analog Filters to design IIR Filters. Realization Structures, Finite Word Length Effects. (8)

Multirate Digital Signal Processing:

Sampling Rate Alteration Devices, Multirate Structures for sampling rate conversion, Multistage design of Decimator and Interpolator, The Polyphase Decomposition, Arbitrary Rate Sampling Rate Converter, Filter Banks, QMF banks, Multilevel Filter Banks, Sub-band Coding, Discrete Wavelet Transform. (7)

SECTION-B

Linear Prediction and Optimum Linear Filters:
Forward and Backward Linear Prediction, Properties of Linear Prediction-Error Filters, AR Lattice and ARMA Lattice-Ladder Filters, Wiener Filters for Filtering and Prediction. (5)

Adaptive Digital Filters:
Concepts of Adaptive Filtering, LMS Adaptive Algorithm, Recursive Least Squares Algorithm, Applications, Introduction to Active Noise Control (5)

Power Spectrum Estimation:
Nonparametric methods for Power Spectrum Estimation, Bartlett method, Welch method, Blackman and Tukey method, Parametric methods for Power Spectrum Estimation, Yule-Walker method, Burg method, Unconstrained Least-Squares method, Sequential Estimation methods, Selection of AR Model Order, MA model for Power Spectrum Estimation, ARMA model for Power Spectrum Estimation. (7)

DSP Chips:
Introduction to fixed point and floating point processors, TMS320C6x series: Architecture, Instruction set, Memory, Addressing Modes, Interrupts, Applications. (6)

TEXT BOOKS			
S. No.	**NAME**	**AUTHOR(S)**	**PUBLISHER**
1	Digital Signal Processing: Principles, Algorithms and Applications	Proakis&Manolakis	Pearson Education
RECOMMENDED BOOKS			
1	Digital Signal Processing	S.K.Mitra	Tata-Mcgraw Hill
2	Discrete Time Signal Processing	Oppenheim & Schafer	PHI
3	Digital Signal Processing: A Practical Approach	Ifeacher& Jervis	Pearson Education
4	Fundamentals of Digital Signal Processing using MATLAB	Robert J. Schilling &Sndra L. Harris	CENGAGE Learning
5	Modern Digital Signal Processing	Roberto Cristi	Nelson Engineering
6	Digital SignalProcessing	Salivahanan, Vallavaraj&Gnanapriya	Tata-Mcgraw Hill
7	Digital Signal Processing and Applications with the TMS320C6713 and TMS320C6416 DSK	R Chassaing, and D Reay	Wiley India

Course Code	EC802
Course Title	**HDL based Systems** (Theory)
Type of Course	Elective
L T P	4 0 2
Credits	4
Course Assessment Methods End Semester Assessment (University Exam.) Continuous Assessment (Sessional, Assignments, Quiz)	 50 50
Course Prerequisites	
Course Objectives (CO)	1. To review basic logic design fundamentals. 2. To understand the modelling & simulation & its role in digital evaluation. 3. To learn basic concepts of VHDL language, its different architecture, designing of various combinational & sequential circuits. 4. To study various PLDs & detail study of FPGAs and implementation of various combinational & sequential logic circuits on FPGAs.
Course Outcome	1. Understand the need & application of hardware description language. 2. Modelling & simulations of various basic & advanced digital systems using VHDL. 3. Implementation of various basic & advanced digital systems using FPGAs. 4. Apply knowledge to design & implement combinational circuits & sequential circuits related to research & industry applications.
SYLLABUS	
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SECTION-A	

Review of Logic Design Fundamentals Combinational Logic, Boolean Algebra & algebra simplifications, Karnaugh map, Designing with NAND and NOR gates, Hazards in combinational circuits, Flip-Flop & latches, Mealy Sequential circuits design, Moore sequential circuit design, equivalent states and reduction of states tables, sequential circuit timing, tristate logic and busses.	10
Introduction to VHDL Computer-aided design, Hardware description languages, VHDL description of combinational circuits, VHDL modules, sequential statement and VHDL processes, Modeling flip-flops using VHDL processes, Processing using wait statements, two types of VHDL delays: Transport & Inertial delays, compilation, simulation & synthesis of VHDL code, VHDL data types & operators, simple synthesis example, VHDL models for multiplexers, VHDL libraries, Modeling Register & counters using VHDL processes, Behavioral & structural VHDL, Variables, signals & constants, arrays, loop in VHDL, assert & report statements.	12
SECTION-B	
Introduction to programmable logic devices Brief overview of PLDs, Simple PLDs, Complex PLDs, Field Programmable Gate Arrays (FPGAs)	5
Design examples BCD to 7-segemnts display decoder, ABCD adder, 32-bit adder, Traffic light controller, State graphs of control circuits, A shift & add multiplier, Array multiplier.	7
Designing with FPGAs Implementation functions in FPGAs, Implementation function using Shannon's decomposition, Carry chains in FPGAs, Cascade chains in FPGAs, Examples of logic blocks in commercial FPGAs, Dedicate memory in FPGAs, Dedicate multiplier in FPGAs, cost of programmability, FPGAs and on-hot state assignment, FPGA capacity: maximum gates versus usable gates, Design translation (synthesis), mapping, placement & routing.	11

RECOMMENDED BOOKS

S. No.	NAME	AUTHOR(S)	PUBLISHER
1	Digital System Design Using VHDL	Lizy Kurian John, Charles H. Roth Jr.	Cengage learning, 2nd Edition
2	Introduction to Digital Systems: Modeling, Synthesis, and Simulation Using VHDL	Mohammed Ferdjallah	Wiley Publication
3	Digital Systems Design with VHDL and Synthesis: An Integrated Approach	K. C. Chang	Wiley-IEEE Computer Society Press

Course Title	**HDL based Systems**(Practical)
Type of Course	Elective
Credits	1
Course Assessment Methods Continuous Assessment	50
Course Prerequisites	

LIST OF EXPERIMENTS	
1	To design 4:1 multiplexer using concurrent statements
2	To design J-K and S-R Flip flops using process statements
3	To design excess 3 code converter
4	To design BCD to 7-segemnt display decoder
5	To design a traffic light controller
6	Implementation of combinational circuits on FPGAs
7	Implementation of sequential circuits on FPGAs
8	To design a 4-bit ALU

Course Code	EC 803
Course Title	**Optical Networks (Theory)**
Type of Course	Elective
L T P	4 0 0
Credits	4
Course Assessment Methods End Semester Assessment (University Exam.) Continuous Assessment (Sessional, Assignments, Quiz)	 50 50
Course Prerequisites	Fiber Optic Communication Systems, computer Networks
Course Objectives (CO)	1. To explain the need and significance of optical networks. 2. To study the components and basic building blocks of an optical network. 3. To study various types of optical networks and optical switching. 4. To study various issues related to the management of optical networks and applications of optical networks.
Course Outcome	1. Understand the importance and application areas of different types of Optical Networks. 2. Explain the working concept of different components of optical networks. 3. Understand the working and characteristics of Optical packet and burst switching. 4. Understand the working of different types of optical metro and access networks. 5. Explain the issues related to routing and wavelength assignment in optical networks.

SYLLABUS

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SECTION-A

Optical Networking-Introduction Advantages of optical network, telecommunication network overview and architecture, Introduction to Services, Circuit switching and packet switching, ISDN, Introduction to WDM optical networks, and Evolution of optical networks: Multi mode fiber, Single mode fiber, optical amplifiers and WDM networks.	7

Components: **Multiplexer and Filters:** Working Principle and types (Gratings, Diffraction Patterns Bragg Gratings and Fiber Gratings), **Optical Amplifiers:** Stimulated Emission, Spontaneous Emission, EDFA, Gain flatness, Raman Amplifier and Semiconductor Optical Amplifiers, **Optical transmitters**: Lasers (working principle and Types : DFB and VCSEL), **Photo-detectors:** p-n, p-i-n and APD, **Switches:** Working Principle, Important Parameters and Optical Switch Technologies (Mechanical, MEMS, Liquid Crystals and Electro-optic), **Wavelength Converters:** Working principle of different types of converters e.g. opto-electronic, Optical Gating and Interferometric techniques.	11
Modulation and Demodulation Modulation, Signal Formats (NRZ and RZ), Subcarrier modulation and multiplexing, Demodulation, An ideal receiver, A practical direct detection receiver.	4
SECTION-B	
WDM Network and Elements: Principle and features of WDM, Types of WDM: CWDM and DWDM, Channel Spacing and Spectral Efficiency, Relationship of WDM to SONET/SDH, OADM, Different architectures of OADMs, Working Principle of Optical cross connect, Different Topologies of WDM networks.	6
Optical Access Network Introduction to access network, Network Architecture Overview, Enhanced HFC, FTTC, Broadcast and select TPON, EPON, GPON and WDM EPON, radio over fiber network.	4
Photonic Switching Introduction to Photonic Switching, Optical Time Division Multiplexing: Bit Interleaving and Packet Interleaving, Header Processing, Buffering: Output and Input, contention resolution, optical burst switching, signaling and routing protocols for OBS networks.	7
Routing and wavelength assignment Issues in wavelength routed networks: Routing wavelength Assignment, Classification of RWA algorithms, RWA algorithms: Fixed Routing, Fixed Alternate Routing, Exhaust Routing, Least Congested Path Routing, Joint Wavelength -Route Selection.	6

RECOMMENDED BOOKS

S. No.	NAME	AUTHOR(S)	PUBLISHER
1	Optical Networks	R. Ramaswami and K. Sivarajan,	Â Morgan Kaufmann Publishers, 2nd ed., 2002.
2	WDM Optical Networks	C. Siva Ram Murthy, Mohan Gurusamy	Pearson Publishers
3	Optical Network Series	Biswanath Mukherjee,	Springer, 2006.
4	Optical Switching Networks	Mayer & Martin	Cambridge University Press, 2008.

Course Code	EC 814
Course Title	**MEMS & Microsystems (Theory)**
Type of Course	Elective
L T P	4 0 0
Credits	4
Course Assessment Methods End Semester Assessment (University Exam.) Continuous Assessment (Sessional, Assignments, Quiz)	 50 50
Course Prerequisites	Physics, Integrated Circuits, VLSI Design
Course Objectives (CO)	1. To understand the importance and advantages of Micro fabricating some electrical and mechanical components on micro-scale. 2. To learn the working principle of micro-sensors and micro-actuators. 3. To learn different micro-machining techniques to design micro-sensors and micro-actuators.
Course Outcome	1. Understand the need and advantages of micro fabrication of mechanical and electrical components. 2. Apply knowledge of various disciplines of engineering and sciences to learn the interdisciplinary aspects of MEMS and Microsystems 3. Understand fabrication processes of microsystem design. 4. Understand packaging and design considerations of microsystems

SYLLABUS

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SECTION-A

Overview of MEMS and Microsystems MEMS and Microsystems, MEMS and Microsystems Products, Evolution of Microfabrication, Multidisciplinary Nature, Microsystems and Miniaturization, Application of Microsystems.	6

Working Principles of Microsystems Microsensors: Acoustic Wave Sensors, Biomedical sensors & Biosensors, Chemical Sensors, Optical Sensors, Pressure Sensors, Thermal Sensors. Microactuation: Actuation using Thermal forces, Actuation using shape-memory alloy, Actuation using Piezoelectric crystal, Actuation using Electrostatic Forces.	6
Scaling Laws in miniaturization Introduction to scaling, Scaling in Geometry, scaling in rigid body dynamics, scaling in electrostatic forces, scaling in electromagnetic forces, scaling in electricity.	6
Materials for MEMS & Microsystems Substrate & wafer, active substrate material, silicon as substrate, gallium arsenide, quartz, piezoelectric materials, polymers, packaging material.	5
SECTION-B	
Microsystems Fabrication Processes Photolithography, Ion implantation, Diffusion, Oxidation, Chemical Vapor Deposition, Physical vapor deposition, epitaxy, etching.	7
Overview of Micromachining Bulk micromachining, surface micromachining, LGA process.	8
Microsystems Design Design Consideration, Process Design, Design of silicon die for micro manufacturing, Computer Aided Design, Introduction to Microsystems Packaging.	7

RECOMMENDED BOOKS

S. No.	NAME	AUTHOR(S)	PUBLISHER
1	MEMS & Microsystems: Design and Manufacture	Tai-Ran Hsu	McGraw Hill
2	MEMS	N Mahalik	McGraw Hill
3	MEMS and MOEMS Technology and Applications	P. Rai Choudhury	PHI
4	Microsensors MEMS & Smart Devices	Gardner	CBS Publishers
5	MEMS: A Practical Guide to Design, Analysis, and Applications	Jan G. Korvink and Oliver Paul	Springer

Course Code	EC 804
Course Title	**Imaging and Additive Manufacturing (Theory)**
Type of Course	Elective
L T P	4 0 0
Credits	4
Course Assessment Methods End Semester Assessment (University Exam.) Continuous Assessment (Sessional, Assignments, Quiz)	 50 50
Course Prerequisites	
Course Objectives (CO)	To understand the complete process of image capturing and developing complex high precision structures through additive manufacturing
Course Outcome	

SYLLABUS

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SECTION-A

Introduction And Digital Image Fundamentals: The origins of Digital Image Processing Examples of Fields that Use Digital Image Processing Fundamentals Steps in Image Processing Elements of Digital Image Processing Systems. Elements of digital image processing, Image model, Sampling and quantization, Relationships between pixels	8
Converting Between data classes and Image Types Introduction to M Function Programming using MATLAB • Image Enhancement in the Spatial Domain: Some basic Gray Level Transformations Histogram Processing, o Discrete Fourier Transform, Discrete Cosine Transform, Haar Transform, Hadamard Transform, Enhancement by point processing, Spatial filtering, Enhancement in the frequency domain, Color Image Processing	9
Image Segmentation, Discontinuity detection, Edge linking and boundary detection, Thresholding, Region oriented segmentation, Use of motion for segmentation	6

SECTION-B

Multispectral Image Analysis - Color Image Processing Three Dimensional Image Processing-Computerized Axial Tomography-Stereometry-Stereoscopic Image Display-Shaded Surface Display Image Restoration: A model of The Image Degradation / Restoration Process Project: Part 2 Digital Image Page 6 of 7 Noise Models Restoration in the presence of Noise Only Spatial Filtering Processing Application Some basic morphological algorithms, Extensions to	8

gray level images	
2D & 3D Transformations of geometry: Translations, Scaling, Reflection, Rotation, Homogeneous representation of transformation, Concatenation of transformations, Perspective, Axonometric projections, Orthographic and Oblique projections. Polymer and Photopolymerization, (SLS), LCVD, DMD,	6
Design of Surfaces: Differential geometry, Parametric representation, Curves on surface, Classification of points, Curvatures, Developable surfaces, Surfaces of revolution, Intersection of surfaces, Surface modelling, 16-point form, Coons patch, B-spline surfaces. Design of Solids: Solid entities, Boolean operations, B-rep of Solid Modelling, CSG approach of solid modelling, Advanced modelling methods. Data Exchange Formats and CAD Applications: Data exchange formats, Finite element analysis, reverse engineering, modelling with point cloud data, Rapid prototyping. 3D Scanning and Digitizing Devices CAD Model Construction from Point Clouds, Data handling & Reduction Methods, AM Software (Magics, Mimics, 3Matic, Rhino) Tessellated Models, STL File Problems, STL File Manipulation and Repair Algorithms, Role of Rapid Solidification	8

RECOMMENDED BOOKS

S. No.	NAME	AUTHOR(S)	PUBLISHER
1	Digital Image Processing	Kenneth R Castleman	Pearson Education, 1995
2	Digital Image Procesing	S. Jayaraman, S. Esakkirajan, T. Veerakumar	McGraw Hill Education, 2009
3	Geometric Modeling	Michael E. Mortenson	Wiley, NY, 1997
4	Computer Aided Engineering Design	AnupamSaxena, BirendraSahay	Springer, 2005

Course Code	**EC815**
Course Title	**Wireless Sensor Networks**
Type of Course	Elective
L T P	4 0 2
Credits	4
Course Assessment Methods End Semester Assessment (University Exam.) Continuous Assessment (Sessional, Assignments, Quiz)	 50 50
Course Prerequisites	Computer networks
Course Objectives (CO)	
Course Outcome	1. Design wireless sensor networks for a given application 2. Understand emerging research areas in the field of sensor networks 3. Understand MAC protocols used for different communication standards used in WSN **4.** Explore new protocols for WSN

SYLLABUS

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SECTION-A

Introduction:

Introduction to Sensor Networks, unique constraints and challenges, Advantage of Sensor Networks, Applications of Sensor Networks, Mobile Adhoc NETworks (MANETs) and Wireless Sensor Networks, Enabling technologies for Wireless Sensor Networks (8 hours)

Sensor Node Hardware and Network Architecture: Single-node architecture, Hardware components & design constraints, Operating systems and execution environments, introduction to TinyOS and nesC, Network architecture, Optimization goals and figures of merit, Design principles for WSNs, Service interfaces of WSNs, Gateway concepts.
(7 hours)

Deployment and Configuration: Localization and positioning, Coverage and connectivity, Single-hop and multihop localization, self configuring localization systems, sensor management Network Protocols: Issues in designing MAC protocol for WSNs, Classification of MAC Protocols, S-MAC Protocol, B-MAC protocol, IEEE 802.15.4 standard and Zig Bee,Dissemination protocol for large sensor network. (7 hours)

SECTION-B

Routing protocols: Issues in designing routing protocols, Classification of routing protocols, Energy-efficient routing, Unicast, Broadcast and multicast, Geographic routing. (8 hours)

Data Storage and Manipulation: Data centric and content based routing, storage and retrieval in network, compression technologies for WSN, Data aggregation technique. Operating systems and execution environments,introduction to TinyOS and nesC. (7hours)

Applications: Detecting unauthorized activity using a sensor network, WSN for Habitat Monitoring.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 (8 hours)

TEXT BOOKS			
S. No.	Title	Author(s)	Publisher
1	Wireless Sensor Network: Technology, Protocols and Application	Kazem, Sohraby, Daniel Minoli, Taieb Zanti	John Wiley and Sons 1st Ed., 2007 (ISBN: 978-0-471-74300-2).
2	"Protocols and Architectures for Wireless Sensor Networks	Holger Karl and Andreas Willig	John Wiley & Sons, Ltd, 2005.
RECOMMENDED BOOKS			
1	A survey of routing protocols in wireless sensor networks	K. Akkaya and M. Younis,	Elsevier Ad Hoc Network Journal, Vol. 3, no. 3, pp. 325—349
2	"Wireless Sensor Network Designs",	Anna Ha´c,	John Wiley & Sons Ltd,

Practical :

Experiments related to Wireless Sensor networks and motes

Course Code	**EC 805**
Course Title	**Advanced Mobile Communications**
Type of Course	**Elective**
L T P	**4 0 0**
Credits	**4**
Course Assessment Methods End Semester Assessment (University Exam.) Continuous Assessment (Sessional, Assignments, Quiz)	 50 50
Course Prerequisites	Wireless & Mobile Communication
Course Objectives (CO)	
Course Outcome	1. Understand the evolution of mobile communication standards developed over the years. 2. Perform computations and solve numerical problems on different frequency division multiple access techniques. 3. Assess how softwarization of network functions helps in scalability and ease of operations. 4. Evaluate the use of advanced techniques in cellular communications.

SYLLABUS

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SECTION-A

Mobile Communications Overview: **(12)**

Evolution from 1G to 5G, Analog voice systems in 1G, digital radio systems in 2G, voice and messaging services, TDMA based GSM, CDMA, 2.5G (GPRS), 2.75G (EDGE); IMT2000, 3G UMTS, W-CDMA, HSPA, HSPA+, 3G services and data rates, IMT Advanced, 4G, LTE, VoLTE, OFDM, MIMO, LTE Advanced Pro (3GPP Release 13+), IMT2020, enhancements in comparison to IMT Advanced.

Introduction to 5G Communication: (11)

5G potential and applications, Usage scenarios, enhanced mobile broadband (eMBB), ultra reliable low latency communications (URLLC), massive machine type communications (MMTC), D2D communications, V2X communications, Spectrum for 5G, spectrum

access/sharing, millimeter Wave communication, channels and signals/waveforms in 5G, carrier aggregation, small cells, dual connectivity.

SECTION-B

5G Network: (11)

New Radio (NR), Standalone and non-standalone mode, non-orthogonal multiple access (NOMA), massive MIMO, beam formation, PHY API Specification, flexible frame structure, Service Data Adaptation Protocol (SDAP), centralized RAN, open RAN, multi-access edge computing (MEC); Introduction to software defined networking (SDN), network function virtualization (NFV), network slicing; restful API for service-based interface, private networks.

Current state and Challenges ahead: (11)

5G penetration in developed countries; deployment challenges in low-middle income countries, stronger backhaul requirements, dynamic spectrum access and usage of unlicensed spectrum, contrasting radio resource requirements, large cell usage, LMLC, possible solutions for connectivity in rural areas (BharatNet, TVWS, Long-range WiFi, FSO); non-terrestrial fronthaul / backhaul solutions: LEOs, HAP/UAV.

Reference Books

S. No.	Title	Author(s)	Publisher
1	Mobile Communications	Jochen Schiller	Financial Times / Imprint of Pearson
2	Mobile Cellular Telecommunications: Analog and Digital Systems	William Lee	McGraw Hill Education
3	Mobile Communications Design Fundamentals	William Lee	Wiley India Pvt. Ltd
4	Wireless Communications: Principles and Practice	Theodore S. Rappaport,	Pearson
5	Fundamentals of 5G Mobile Networks	Jonathan Rodriguez	Wiley