ACADEMIC CURRICULA 2018 - 2022

BACHELOR'S DEGREE PROGRAMME

B. Tech in Electronics & Telecommunication Engineering

Curricula & Syllabi

Kalinga Institute of Industrial Technology (KIIT)
Deemed to be University U/S 3 of UGC Act, 1956
Bhubaneswar, Odisha, India

ACADEMIC CURRICULA
2018 - 2022

B. TECH
ELECTRONICS & TELECOMMUNICATION ENGINEERING

Course Structure and Detailed Syllabi
for students admitted in
2018 - 22
Academic Session

Kalinga Institute of Industrial Technology (KIIT)
Deemed to be University U/S 3 of UGC Act, 1956
Bhubaneswar, Odisha, India

B. TECH IN ELECTRONICS AND TELECOMMUNICATION ENGINEERING

Programme Educational Objectives (PEOs):

The B.Tech programme in Electronics and Telecommunication Engineering aims to prepare the graduates with the following objectives:

1. Graduates shall be able to provide to solutions to Electronics and Telecommunication engineering problems and allied areas involving electronic system design, communication network operation and management issues.
2. Graduates shall be able to perceive the limitation and impact of engineering solutions in social, legal, environmental, economical and multidisciplinary contexts.
3. Graduates shall demonstrate professional and ethical responsibilities and thrive to reinforce their knowledge being a part of higher educational programmes.

Programme Outcomes (POs):

The programme outcomes are:

a) Engineering knowledge: Ability to apply the knowledge of mathematics, science, engineering fundamentals, and an engineering specialization to the solution of complex engineering problems.
b) Problem analysis: Ability to identify, formulate, review research literature, and analyze complex engineering problems reaching substantiated conclusions using first principles of mathematics, natural sciences, and engineering sciences.
c) Design/Development of solutions: Ability to design solutions for complex engineering problems and design system components or processes that meet the specified needs with appropriate consideration for the public health and safety, and the cultural, societal, and environmental considerations.
d) Conduct investigations on complex problems: Ability to use research-based knowledge and research methods including design of experiments, analysis and interpretation of data, and synthesis of the information to provide valid conclusions.
e) Modern tool usage: Ability to create, select, and apply appropriate techniques, resources, and modern engineering and IT tools including prediction and modeling to complex engineering activities with an understanding of the limitations.
f) The engineer and society: Ability to apply reasoning informed by the contextual knowledge to assess societal, health, safety, legal and cultural issues and the consequent responsibilities relevant to the professional engineering practice.
g) Environment and sustainability: Ability to understand the impact of the professional engineering solutions in societal and environmental contexts, and demonstrate the knowledge of, and need for sustainable development.
h) Ethics: Ability to apply ethical principles and commit to professional ethics and responsibilities and norms of the engineering practice.
i) Individual and team: Ability to function effectively as an individual, and as a member or leader in diverse teams, and in multidisciplinary settings.
j) Communication: Ability to communicate effectively on complex engineering activities with the engineering community and with society at large, such as, being able to comprehend and write effective reports and design documentation, make effective presentations, and give and receive clear instructions.
k) Project management and finance: Ability to demonstrate knowledge and understanding of the engineering and management principles and apply these to one's own work, as a member and leader in a team, to manage projects and in multidisciplinary environments.
l) Life-long learning: Ability to recognize the need for, and have the preparation and ability to engage in independent and life-long learning in the broadest context of technological change.

Programme Specific Outcomes (PSOs):

The programme specific outcomes are:

m) Ability to design and implement electronic circuits, signal processing and communication systems in industry.
n) Ability to carry out research in fields of embedded systems, wireless and high speed communication, and advanced signal processing.
o) Ability to utilize the knowledge in solving practical problems in real life.

Abbreviations used in describing the category in all the courses are as follows:

BSC:	Basic Science Course
BSLC:	Basic Science Laboratory Course
ESC:	Engineering Science Course
ESLC:	Engineering Science Laboratory Course
HSMC:	Humanities, Social Science & Management Course
PCC:	Professional Core Course
PCLC:	Professional Core Laboratory Course
PEC:	Professional Elective Course
OEC:	Open Elective Course
PROJ:	Project
IEC:	Industry Elective Course

COURSE STRUCTURE FOR B. TECH IN ELECTRONICS AND TELECOMMUNICATION ENGINEERING

SCHEME-I
SEMESTER - I

Theory							
Sl. No	Course Code	Course Title	L	T	P	Total	Credit
1.	MA 1003	Mathematics – I	3	1	0	4	4
2.	PH 1007	Physics	3	1	0	4	4
3.	EE 1003	Basic Electrical Engineering	3	0	0	3	3
4.	ME 1003	Engineering Mechanics	3	0	0	3	3
Total of Theory						14	14
Practical							
1.	PH 1097	Physics Lab	0	0	3	3	1.5
2.	EE 1093	Basic Electrical Engineering Lab	0	0	2	2	1
Sessional							
1.	ME 1083	Basic Manufacturing Systems	0	1	2	3	2
2.	CH 1081	Environmental Science	0	0	2	2	1
Total of Practical & Sessional						10	5.5
Semester Total						24	19.5

SCHEME-I
SEMESTER - II

Theory							
Sl. No	Course Code	Course Title	L	T	P	Total	Credit
1.	MA 1004	Mathematics – II	3	1	0	4	4
2.	CH 1007	Chemistry	3	0	0	3	3
3.	HS 1005	Professional Communication	2	0	0	2	2
4.	LS 1001	Biology	2	0	0	2	2
Total of Theory						11	11
Practical							
1.	CS 1093	Computer Programming	0	2	4	6	4
2.	CH 1097	Chemistry Lab	0	0	3	3	1.5
Sessional							
1.	HS 1085	Language Lab	0	0	2	2	1
2.	CE 1083	Engg. Graphics	0	1	2	3	2
Total of Practical & Sessional						14	8.5
Semester Total						25	19.5
	EAA- 1	Extra Academic Activity					P/NP

SEMESTER - III

Sl. No	Course Code	Course Title	L	T	P	Total	Credit
Theory							
1	MA 2009	Mathematics-III (Electronics)	3	1	0	4	4
2	EC 2019	Electronic Devices and Circuits	3	1	0	4	4
3	EC 2021	Signals and Networks	3	0	0	3	3
4	EC 2011	Digital Electronics	3	0	0	3	3
5	CS 2001	Data Structure and Algorithms	3	1	0	4	4
6		HS Elective-I	3	0	0	3	3
Total of Theory						21	21
Practical							
1	EC 2091	Electronic Circuits & Network Lab	0	0	3	3	1.5
2	EC 2093	Digital Electronics Lab	0	0	2	2	1
3	CS 2091	Data Structures Lab	0	0	2	2	1
Sessional							
1	HS 2081	Business Communication	0	0	2	2	1
Total of Practical & Sesssional						9	4.5
Semester Total						30	25.5

SEMESTER - IV

Sl. No	Course Code	Course Title	L	T	P	Total	Credit
Theory							
1	EC 2024	Advanced Electronic Circuits	3	0	0	3	3
2	EC 2020	Microprocessors, Microcontrollers & Interfacing	3	1	0	4	4
3	EC 2012	Analog Communication Techniques	3	0	0	3	3
4	EI 2010	Principle of Measurements and Instrumentation	3	0	0	3	3
5	EC 2022	Electromagnetic Waves and Antennas	3	1	0	4	4
6	EL 2002	Principle of Control System	3	0	0	3	3
Total of Theory						20	20
Practical							
1	EC 2092	Analog Integrated Circuits Lab	0	0	2	2	1
2	EC 2098	Simulation Lab	0	0	2	2	1
3	EC 2090	Microprocessor and Microcontroller Lab	0	0	2	2	1
Total of Practical						6	3
Semester Total						26	23

SEMESTER - V

Sl. No	Course Code	Course Title	L	T	P	Total	Credit
Theory							
1	EC 3015	Microwave Engineering	3	0	0	3	3
2	EC 3028	Data Communication and Networking	3	0	0	3	3
3	EC 3007	Digital Signal Processing	3	1	0	4	4
4	EC 3005	Digital Communication Techniques	3	1	0	4	4
5		Department Elective-I	3	0	0	3	3
6		Department Elective-II	3	0	0	3	3
Total of Theory						20	20
Practical							
1	EC 2094	Communication Engineering Lab	0	0	3	3	1.5
2	EC 3091	Electronic Measurements and Instrumentation Lab	0	0	2	2	1
3	EC 3093	Microwave and Antenna Lab	0	0	3	3	1.5
Total of Practical						8	4
Semester Total						28	24

SEMESTER - VI

Sl. No	Course Code	Course Title	L	T	P	Total	Credit
Theory							
1	EC 3011	VLSI Design	3	0	0	3	3
2	EC 3036	Cellular Communication	3	0	0	3	3
3		Department Elective-III	3	0	0	3	3
4		Department Elective-IV	3	0	0	3	3
5		Department Elective-V	3	0	0	3	3
6		Open Elective -I / (MI-1)	3	0	0	3	3
Total of Theory						18	18
Practical							
1	EC 3095	VLSI Lab	0	0	2	2	1
2	EC 3099	DSP Lab	0	0	2	2	1
3	EC 3094	Wireless Communication and Networking Lab	0	0	3	3	1.5
Sessional							
1	EC 3082	Minor Project	0	0	4	4	2
Total of Practical & Sesssional						11	5.5
Semester Total						29	23.5

SEMESTER - VII

Sl. No	Course Code	Course Title	L	T	P	Total	Credit
Theory							
1		HS Elective-II	3	0	0	3	3
2	HS 4001	Professional Practice, Law & Ethics	2	0	0	2	2
3		Open Elective-II / (MI-2)	3	0	0	3	3
(4)		(MI-3)	(3)	(0)	(0)	(3)	(3)
(5)		(MI–4)	(3)	(0)	(0)	(3)	(3)
(6)		(HO-1)	(3)	(0)	(0)	(3)	(3)
Total of Theory							8
Sessional							
1	EC 4081	Project -I / Internship					3
2	EC 4083	Practical Training	-	-	-	-	2
(3)		(Project – Minor / Lab)	(0)	(0)	(4)	(4)	(2)
Semester Total							13

SEMESTER - VIII

Sl. No	Course Code	Course Title	L	T	P	Total	Credit
Theory							
(1)		(MI–5)	(3)	(0)	(0)	(3)	(3)
(2)		(MI–6)	(3)	(0)	(0)	(3)	(3)
(3)		(HO-2)	(3)	(0)	(0)	(3)	(3)
(4)		(HO-3)	(3)	(0)	(0)	(3)	(3)
Sessional							
1	EC 4082	Project - II / Internship					10
Semester Total							10

MI – Minor HO - Honors

LIST OF HS ELECTIVES

HS Elective – I

Sl. No	Course Code	Course Title	Credit
1.	HS 2002	Engineering Economics	3
2.	HS 2008	Economic Environment of India	3
3.	HS 2010	Financial Institutions, Markets and Regulations	3
4.	HS 2012	Development Economics	3

HS Elective – II

1.	HS 3006	Entrepreneurship	3
2.	HS 3008	Management Concepts & Practices	3
3.	HS 3002	Organizational Behaviour	3
4.	HS 3004	Human Resource Management	3

LIST OF DEPARTMENT ELECTIVES

Dept. Elective – I

1.	EC 3023	Optimization Techniques in Engineering	3
2.	EC 3029	Optical Communication and Networking	3
3.	EE 3028	Power Electronic Circuits	3
4.	EI 3025	Principle of Analytical Instrumentation	3

Dept. Elective – II

1.	EC 3033	Embedded System Design & Applications	3
2.	EC 3031	ARM and Advanced Processors	3
3.	EL 3024	Industrial Automation and Control	3
4.	EC 3035	High Speed Digital System Design	3

Dept. Elective - III

1.	EC 3021	Neural Networks and Machine Learning	3
2.	EC 6122	Satellite Communication Systems	3
3.	EI 3032	Principle of Sensors and Data Acquisition	3
4.	EC 3062	Smart Antennas	3

Dept. Elective – IV

1.	EC 3050	Internet of Things and its Applications	3
2.	EC 3056	Speech and Audio Signal Processing	3
3.	EC 6112	Communication and Network Security	3
4.	EC 6108	Digital Image Processing	3

Dept. Elective – V

1.	EC 3058	Nanoelectronics	3
2.	EC 3068	Real Time Systems and Application	3
3.	EC 6128	Wireless Sensor Networks	3
4.	EC 3064	Information Theory and Coding	3

HONORS COURSES OFFERED BY ELECTRONICS AND TELECOMMUNICATION ENGINEERING

Area: Communication Engineering

Sl No	Course Code	Course Title	Prerequisite/s
1	EC 4053	Millimeter Wave and Terahertz Technology	Cellular Communication (EC 3036)
2	EC 4056	Mobile Ad-Hoc Networks	Data Communication and Networking (EC 3028)
3	EC 4058	Cognitive Radio and Cooperative Communications	Cellular Communication (EC 3036)

Area: VLSI and Embedded System

SL No	Course Code	Course Title	Prerequisite/s
1	EC 6203	MOS Device Modeling	VLSI Design (EC 3011)
2	EC 6207	Analog CMOS VLSI Circuits	VLSI Design (EC 3011)
3	EC 6248	VLSI Signal Processing	Digital Signal Processing (EC 3007)

Area: Signal Processing

Sl. No	Course Code	Course Title	Prerequisite/s
1	EC 4047	Biomedical Signal Processing	Digital Signal Processing (EC 3007), Math-III (Electronics) (MA 2009)
2	EC 4050	Computer Vision & Pattern Recognition	Digital Signal Processing (EC 3007), Math-III (Electronics) (MA 2009)
3	EC 4052	Machine learning for Digital Signal Processing	Digital Signal Processing (EC 3007), Math-III (Electronics) (MA 2009)

LIST OF OPEN ELECTIVES OFFERED BY SCHOOL OF ELECTRONICS ENGINEERING

Sl. No	Course Code	Course Title	Prerequisite/s
1	EC 2011	Digital Electronics	NIL
2	EC 2021	Signals & Networks	Math-II (MA 1004)
3	EC 3044	Introduction to Communication Engineering	NIL
4	EC 3066	Principles of Microprocessors and Microcontrollers	Digital Electronics (EC 2011)
5	EI 3027	Industrial Instrumentation	Basic Electrical Engineering (EE 1003)
6	EC 3013	Principle of Digital Signal Processing	Math-II (MA 1004)
7	EL 2002	Principle of Control System	Signals & Networks (EC 2021)
8	EC 3011	VLSI Design	Digital Electronics (EC 2011)
9	EC 3033	Embedded system Design and Applications	Microprocessors and Microcontrollers (EC 2020) /Principles of Microprocessors and Microcontrollers (EC 3066)
10	EL 3024	Industrial Automation & Control	Principle of Control Systems (EL 2002) /Linear Control System (EL 2028)
11	EC 6108	Digital Image Processing	Principle of Digital Signal Processing (EC 3013) / Digital Signal Processing (EC 3007)
12	EC 3060	Mobile Communication Engineering	Communication Engineering (EC 2016) /Introduction to Communication Engineering (EC 3044) / Principle of Digital Communication (EC 2004)
13	EC 3050	Internet of Things and its applications	Microprocessors and Microcontrollers (EC 2020) / Principles of Microprocessors and Microcontrollers (EC 3066)

MINOR IN ELECTRONICS & TELECOMMUNICATION ENGINEERING

Sl. No	Course Code	Course Title	Prerequisite/s
1	EC 2025	Principles of Electronics Engineering	Nil
2	EC 2011	Digital Electronics	Nil
3	EC 3066	Principle of Microprocessors and Microcontrollers	Digital Electronics (EC2011)
4	EC 2021	Signals and Networks	Mathematics-II (MA1004)
5	EC 2014	Electromagnetic Theory	Mathematics-II (MA1004)
6	EC 3011	VLSI Design	Analog Electronic Circuits
7	EC 3031	ARM and Advanced Processors	Principle of Microprocessors and Microcontrollers (EC3066)
8	EC 3035	High speed Digital system Design	Digital Electronics (EC2011)
9	EC 3044	Introduction to Communication Engineering	Nil
10	EC 3015	Microwave Engineering	Nil
11	EC 3028	Data Communication and Networking	Introduction to Communication Engineering (EC3044)
12	EC 3060	Mobile communication Engineering	Introduction to Communication Engineering (EC3044)/Principle of Digital Communication (EC2004)/Communication Engineering (EC2016)
13	EC 3050	Internet of Things and its Applications	Principle of Microprocessors and Microcontrollers (EC3066)
14	EC 6122	Satellite Communication Systems	Introduction to Communication Engineering (EC3044)/Principle of Digital Communication (EC2004)/Communication Engineering (EC2016)
15	EC 3029	Optical Communication and Networking	Introduction to Communication Engineering (EC3044)/Principle of Digital Communication (EC2004)/Communication

			Engineering (EC2016)
16	EC 3021	Neural Networks and Machine Learning	Mathematics-I &II (MA1003 and MA1004)
17	EC 1094	Analog Electronic Circuits Lab	
18	EC 2093	Digital Electronics Lab	
19	EC 3095	VLSI Lab	

MINOR IN ELECTRONICS & INSTRUMENTATION ENGINEERING

Sl. No	Course Code	Course Title	Prerequisite/s
1	EC 2025	Principles of Electronics Engineering	Nil
2	EI 2003	Electrical & Electronic Measurement Techniques	Basic Electrical Engineering (EE 1003)
3	EC 2021	Signals and Networks	Mathematics-II (MA 1004)
4	EL 2002	Principle of Control System	Signals and Networks (EC 2021)
5	EI 2012	Sensors and Signal Conditioning	Electrical and Electronic Measurement Techniques (EI 2003)
6	EI 3009	Instrumentation Measurement Techniques	Electrical & Electronic Measurement Techniques (EI 2003)
7	EI 3029	Process Dynamics and Control	Principle of Control System (EL 2002)
8	EI 3025	Principle of Analytical Instrumentation	Chemistry (CH 1007)
9	EI 3030	Power Plant Instrumentation	Instrumentation Measurement Techniques (EI 3009)
10	EI 3032	Principle of Sensors and Data Acquisition	Electrical and Electronic Measurement Techniques (EI 2003)
11	EI 3023	Neural Network & Fuzzy Logic Control	Mathematics-I (MA 1003), Mathematics-II (MA 1004) and Principle of Control System (EL 2002)
12	EI 2095	Electrical & Electronic Measurements Lab	
13	EI 3091	Instrumentation Lab	
14	EI 3092	Process Control Lab	

MINOR IN VLSI AND EMBEDDED SYSTEM

Sl. No	Course Code	Course Title	Prerequisite/s
1	EC 2025	Principles of Electronics Engineering	Nil
2	EC 2011	Digital Electronics	Principles of Electronics Engineering (EC 2025)
3	EC 2005	Semiconductor Devices	Principles of Electronics Engineering (EC 2025)
4	EC 3066	Principle of Microprocessors and Microcontrollers	Digital Electronics (EC 2011)
5	EC 3011	VLSI Design	Digital Electronics (EC2011)
6	EC 3035	High Speed Digital System Design	Digital Electronics (EC2011)
7	EC3033	Embedded System Design and Applications	Digital Electronics (EC2011)
8	EC 3031	ARM and Advanced Processors	Microprocessors, Microcontrollers& Interfacing (EC 2020) / Principle of Microprocessors and Microcontrollers (EC 3066)
9	EC 3068	Real Time Systems and Application	Digital Electronics (EC 2011)
10	EC 6224	Low Power VLSI Design	VLSI design (EC 3011)
11	EC 3058	Nanoelectronics	Principles of Electronics Engineering (EC 2025)
12	EC 2093	Digital Electronics Lab	
13	EC 2090	Microprocessor and Microcontroller Lab	
14	EC 3095	VLSI Lab	

MINOR IN SENSORS & SIGNALS

Sl. No	Course Code	Course Title	Prerequisite/s
1	EC 2025	Principles of Electronics Engineering	Nil
2	EC 2011	Digital Electronics	Nil
3	EC 2021	Signals and Networks	Mathematics-II (MA1004)
4	EC 3066	Principle of Microprocessors and Microcontrollers	Digital Electronics (EC 2011)
5	EI 2003	Electrical & Electronic Measurement Techniques	Basic Electrical Engineering (EE 1003)
6	EI 2012	Sensors & Signal Conditioning	Electrical and Electronic Measurement Techniques (EI 2003)
7	EC 3013	Principle of Digital Signal Processing	Signals and Network (EC 2021)
8	EI 3032	Principle of Sensors & Data Acquisition	Electrical & Electronic Measurement Techniques (EI 2003)
9	EC 3021	Neural Networks &Machine Learning	Mathematics-I and Mathematics-II (MA1003 and MA1004)
10	EC 3050	Internet of Things and its applications	Principle of Microprocessors and Microcontrollers (EC3066)
11	EC 6108	Digital Image Processing	Principle of Digital Signal Processing (EC 3013)
12	EI 3024	Virtual Instrumentation	Sensors and Signal Conditioning (EI 2012),Digital Electronics (EC 2011)
13	EC 3056	Speech and Audio Signal Processing	Principle of Digital Signal Processing (EC 3013)
14	EC 2093	Digital Electronics Lab	-
15	EI 2095	Measurements and Instrumentation Lab	-
16	EC 3099	DSP Lab	-

MINOR IN "COMMUNICATION NETWORKS, INTELLIGENT IOT & CYBER PHYSICAL SYSTEMS"

Sl No	Course Code	Course Title	Prerequisite/s
1	EC 2025	Principles of Electronics Engineering	Nil
2	EC 2011	Digital Electronics	Nil
3	EC 3044	Introduction to Communication Engineering	Nil
4	EC 3066	Principle of Microprocessors and Microcontrollers	Digital Electronics (EC 2011)
5	EC 3033	Embedded System Design and Applications	Principles of Microprocessors and Microcontrollers (EC 3066)
6	EC 3028	Data Communication and Networking	Introduction to Communication Engineering (EC 3044)
7	EC3050	Internet of Things and its applications	Principles of Microprocessors and Microcontrollers (EC 3066)
8	EC 3070	MANET AND WSN	Data Communication and Networking (EC 3028)
9	EC 6112	Communication & Network Security	Data Communication and Networking (EC 3028)
10	EC 3072	Introduction to machine learning	Mathematics-I & II (MA1003 and MA1004)
11	EC 3074	Internet Technologies for cloud & Edge computing	Computer Programming (CS 1093)
12	EC 3076	IoT & Cyber-Physical System Design	Internet of Things and its applications (EC3050)
13	EC 4061	AI and Machine Learning for IoT	Mathematics-I & II (MA1003 and MA1004) & Internet of Things and its applications (EC3050)
14	EC 2093	Digital Electronics lab	

15	EC 2090	Microprocessor and Microcontroller Lab	
14	EC 4099	Internet of Things & connected intelligent systems Lab	
15	EC XXXX	Project	

MINOR IN “APPLIED MACHINE LEARNING”

Sl No	Course Code	Course Title	Prerequisite/s
1	EC 2025	Principles of Electronics Engineering	Nil
2	EC 2011	Digital Electronics	Nil
3	EC 3044	Introduction to Communication Engineering	Nil
4	EC 3066	Principle of Microprocessors and Microcontrollers	Digital Electronics (EC 2011)
5	EC 3033	Embedded System Design and Applications	Principles of Microprocessors and Microcontrollers (EC 3066)
6	EC 3028	Data Communication and Networking	Introduction to Communication Engineering (EC 3044)
7	EC3007	Digital Signal Processing	
8	EC 6108	Digital Image Processing	Digital Signal Processing
9	EC 3072	Introduction to Machine learning	Computer Programming (CS 1093)
10	EC 3078	Signal Understanding Using Machine Learning	Signal and Network
11	EC 3080	Deep Learning	Introduction to Machine learning (EC 3072)
12	EC 4059	Computer Vision and Pattern Recognition	Digital Image Processing
13	EC 2093	Digital Electronics lab	
14	EC 2090	Microprocessor and Microcontroller Lab	
15	EC 4097	Machine learning Lab	Introduction to Machine Learning (EC3072) and Deep Learning (EC3080)
16	EC XXXX	Project	

COURSES OF FIRST YEAR

MA 1003 Mathematics-I

Credit: 4
Category: BSC
Prerequisite(s): Nil

Course Description:

The laws of nature are expressed as differential equations. The construction of mathematical models to address real-world problems has been one of the most important aspects of each of the branches of science. This course is designed to familiarize the prospective engineers with techniques in ordinary differential equations, multivariate calculus and solution for ODEs numerically. This course also focuses on Linear algebra that covers system of linear equations and properties of matrices. The objective of the course is to equip the students with standard concepts and tools at an intermediate to advanced level that will serve them well towards tackling more advanced levels of mathematics and applications that they would find useful in their disciplines.

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

CO1: model and formulate differential equation of Physical problems
CO2: apply different methods to solve 1st and 2nd order ODEs
CO3: apply numerical methods to solve ODEs
CO4: study differential calculus in engineering problems
CO5: use the essential tool of matrices and linear algebra
CO6: analyze Eigenvalue problems

Topics:

- Ordinary Differential Equations.
- Linear differential equations of 2^{nd} order.
- Differential calculus and Numerical methods to solve ODEs
- Vector space and system linear of equations
- Matrix-eigenvalue Problems

Textbook(s):

1. Advanced Engineering Mathematics by Erwin Kreyszig, Wiley, INC, (online) 10^{th} Edition.
2. Differential Calculus, Shanti Narayan and P. K. Mittal, S. Chand, reprint 2009.

Reference Book(s):

1. Grewal B.S., Higher Engineering Mathematics, Khanna Publishers, 36th edition.
2. Dass H.K., Introduction to engineering Mathematics, S.Chand & Co Ltd, 11^{th} edition.
3. Ramana B.V., Higher Engineering Mathematics, TMH, 2007.
4. Sinha Roy and S Padhy, A course on ordinary & Partial Differential Equation, Kalyani Publication, 3rd edition.

PH 1007 Physics

Credit: 4
Category: BSC
Prerequisite(s): Nil

Course Description:

This course includes the fundamentals of different types of oscillations and its applications; mathematical expression of waves and its physical interpretation; the concept of interference, diffraction and their applications; the principle, construction and working of different Lasers. The course also gives a flavour of Quantum mechanics, which is the founding stone to the state of the art in modern techniques and paves the way towards the world of nano devices. It covers the formulation of Maxwell's electromagnetic equations, and verification of different properties of electromagnetic waves. Mechanical and magnetic properties of different materials and their applications are also covered in this course.
Course Outcomes: At the end of the course, the students will be able to:

CO1: utilize the concept of waves and intensity modulation in day to day life through various applications
CO2: apply the mechanism of LASER technology in different fields
CO3: formulate and solve engineering problems of electricity and magnetism using Maxwell's electromagnetic equations
CO4: apply the principles of quantum mechanics to related problems
CO5: apply the knowledge of magnetic materials in related applications
CO6: analyze the macroscopic behavior of solids and utilize them in future applications

Topics:

- Oscillation and wave
- Interference and diffraction
- LASER
- Quantum mechanics
- Electromagnetism
- Properties of matter (mechanical)
- Magnetism

Textbook (s):

1. Engineering Physics, B. K. Pandey and S. Chaturvedi, Cengage Publication, New Delhi

Reference Book(s):

1. Introduction to Electrodynamics, D J Griffiths, Pearson Education
2. Quantum Mechanics, L. I. Schiff, Tata McGraw-Hill Publications
3. Optics, A K Ghatak, Tata McGraw-Hill Publications
4. Concepts of Modern Physics, A. Beiser, Tata McGraw-Hill Publications
5. Engineering Physics, R K Gaur and S. L. Gupta, Dhanpat Rai Publications, New Delhi.

ME 1003 Engineering Mechanics

Credit: 2
Category: PCC
Prerequisite(s): Nil

Course Description:

The course on Engineering Mechanics is a specialized need-based extension of applied physics which is aimed at developing an understanding of the principle of statics and dynamics. The course focuses on learning methodical and logical idealization and subsequent implementation of corresponding procedures for analysis of rigid body, frame and machine under the action of force system which is highly essential for effective design. The course intends to develop the ability of drawing and analyzing the free body diagram of a system when at rest or motion using scalar/vector techniques. Further, the course serves as a prerequisite to fundamental machine design courses such as mechanics of solids and design of machine elements.

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

CO1: draw complete and correct free-body diagrams and write the appropriate equilibrium equations from the free-body diagram
CO2: use scalar analytical techniques for analyzing forces and moments in mechanical systems
CO3: analyzing forces in statically determinate structures such as trusses, frames and problems related to friction
CO4: determine the centroid and second moment of area
CO5: apply fundamental concepts of kinematics and kinetics of particles to the analysis of simple and practical problems
CO6: solve real-life problems by using mathematics, physical laws and theorems

Topics:

- Concurrent Forces in a Plane
- Friction
- Parallel Forces in a Plane
- Moment of Inertia
- Force analysis of Plane Trusses
- Principle of Virtual Work
- Kinematics of Rectilinear Motion
- Kinematics of Curvilinear Motion
- Rotation of a rigid body

Textbook(s):

1. Engineering Mechanics (Revised 5th edition), TMH by S. Timoshenko, D.H. Young, J.V Rao and S. Pati.

Reference Book (s):

1. Engineering Mechanics (Statics and Dynamics) - Bear and Johnson, TMH
2. Engineering Mechanics (Statics and Dynamics) by I.H. Shames, Prentice Hall
3. Engineering Mechanics –S.S. Bhavikatti, New Age International
4. Engineering Mechanics (Statics and Dynamics)-S. Rajasekaran & G Sankarasubramanian, Vikas Publishing House.

PH 1097 Physics Laboratory

Credit: 1.5
Category: BSLC
Prerequisite(s): Nil

Course Description:

This lab course covers different measurement techniques of various parameters using the instruments i.e. interferometer, spectrometer, spherometer, Screw gauge, vernier calliper, microspope, and telescope. It includes the application of photoelectric effect and photovoltaic effect in photo cell and solar cell respectively. Evaluation of the mechanical strength of materials by calculating elastic constants such as Young's modulus, rigidity modulus and Poisson's ratio are also included. This course provides hands on training for the usage of electrical, optical and mechanical systems for various measurements with precision and analysis of the experimental data by graphical interpretation and error calculation.

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

CO1: calculate appropriate structural members using the fundamental concepts of the elastic behavior of materials
CO2: use the principles of interference and diffraction to find out the wavelength of an unknown monochromatic source of light
CO3: apply the concept of photoelectric emission to calculate the Planck's constant and analyze some aspects of electron-photon interaction through characteristic curves
CO4: explore the efficiency in terms of power output of a green energy source i.e. solar cell
CO5: calculate the acceleration due to gravity 'g' by using the concept of a compound pendulum

Topics:

- Estimation of elastic constants such as Young's modulus, rigidity modulus and Poisson's ratio
- Determination of wavelength of unknown source using Newton's rings and Michelson's interferometer
- Precision length measurement up to the order of 6 A° (distance between sodium D-lines) using Michelson interferometer
- Determination of grating element using a diffraction grating
- Study of photo cell and solar cell by analyzing their characteristic curves
- Determination of acceleration due to gravity using a bar pendulum

EE 1093 Basic Electrical Engineering Laboratory

Credit: 1
Category: BSLC
Prerequisite(s): Nil

Course Description:

Basic Electrical Engineering lab comprises of various equipments and loads i.e voltmeters,ammeters, wattmeters, single phase and three phase transformer, induction motors etc. It is a specialized practical oriented course which intends to develop and understand various principles like Ohm's law and Kirchoff's law. The course focused on learning methodical and logical idealization of various theorems which is highly essential for solving a network. The course intends to make the students familiar with various parts of DC machines and AC machines. The course intends to develop the ability of problem solving by analyzing RL and RLC series circuits. This lab helps the students to understand the principle of operation of a single phase transformer with its no load calculation.

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

CO1: recall the safety practices in the laboratory and the associated work areas
CO2: comprehend the skills for working in a team with common objective
CO3: apply different theorems to find the parameters in DC and AC circuit
CO4: analyse the different parts of DC and AC machines to describe operational features thereof
CO5: apprise the experimental results in systematic manner
CO6: discuss about determination of resistance in incandescent lamp and power factor in fluorescent lamp

Topics:

- measurement of resistance of tungsten filament lamp
- measurement of inductance of a choke coil
- study and use of megger
- study of different parts of dc machine and three phase induction motor
- layout of power system analysis
- determination of voltage ratio of a single phase transformer
- measurement of no load current and core loss of a single phase transformer
- verification of KCL and KVL
- verification of voltage and current ratio of star and delta connection
- study & determine the power factor of the RLC series circuit
- study, connection & determine the power factor of fluorescent tube
- verification of the superposition theorem
- transient analysis of series RL and RC circuit using matlab-simulink with dc excitation

Textbook(s):

1. Basic Electrical Engineering by D.C. Kulshreshtha, Tata Mcgraw publication, 1st Edition 2011.
2. Basic Electrical Engineering, T.K. Nagasarkar and M.S. Sukhija, Oxford University press, 2nd Edition 2011.

Reference Book(s):

1. Basics Electrical Engineering Sanjeev Sharma, I.K. International, New Delhi.(Third Reprint 2010).

EC 1094 Analog Electronic Circuits Laboratory

Credit: 1
Category: PCLC
Prerequisite(s): Nil

Course Description :

Analog Electronics laboratory course is basically designed to provide essential practical knowledge on basic electronic components and its associated circuits for first year undergraduate Computer Science Engineering students. Hardware experiments are designed to provide an introduction to Electronics engineering. This will help students to understand and design various electronic circuits such as rectifiers, amplifiers and oscillators using discrete components are essential building blocks for any electronic system. Major equipments in this Lab includes function generator, CRO, multimeter, voltmeter, ammeter and breadboard trainer kit etc. A well-organized systematic procedure is included in each experiment to facilitate the hardware testing. This course imbibes the students with necessary practical knowledge to use the techniques, skills to function in multidisciplinary teams.

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

CO1: identify the different active and passive components & apply different measuring devices and instruments for the measurement and testing of the various circuit parameters
CO2: generate the different types of waveforms and calculate their amplitude & frequency
CO3: study the characteristics of P-N junction diode
CO4: analyze clipper, clamper and rectifier circuits using P-N junction diode
CO5: study the input and output characteristics of transistor and analyze its operation as an amplifier
CO6: implement integrator, differentiator and multi-vibrator circuits using operational amplifiers
.

Topics:

- P-N junction diode,Zener diode and their applications
- Transistors (BJT and JFET)
- CE amplifier and RC-coupled amplifier
- Operational Amplifier
- Monostable and Astable multivibrator

ME 1083 Basic Manufacturing Systems

Credit: 2
Category: PCLC
Prerequisite(s): Nil

Course Description:

This laboratory practice is designed to impart students the basic knowledge on manufacturing or developing a given object irrespective of their branch of engineering. While furnishing the given object, students will familiar with various mechanical operations and the respective tools or machines. This course involves four different sections namely Fitting, Welding, Turning and Sheet metal which covers both conventional and advanced tools to provide students the updated manufacturing experience. Students are also advised with various safety precautions to be followed during a specific manufacturing practice. At the end, students will also gain knowledge on different advanced machines such as CNC and 3D printing.

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

CO1: practice different operations related to fitting shop
CO2: use different welding tools to prepare a given type of joint
CO3: demonstrate various turning operations including taper turning and knurling using a conventional lathe machine
CO4: design a tray and prepare it using sheet metal equipment involving soldering
CO5: appraise different operations using a CNC machine
CO6: interpret different advanced machines such as 3D printing/additive manufacturing

Topics:

- Turning operations
- Sheet metal operations
- Fitting
- Welding

CH 1081 Environmental Science

Credit: 1
Category: BSLC
Prerequisite(s): Nil

Course Description:

The course is designed to make the students aware of different environmental components and their composition. It will make the students understand different pollutants, their sources and management. It will also help students to apply the principles of Green Chemistry and implement them in synthesis of advanced materials required for engineering applications. It also outlines the basic steps for developing the EIA statements

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

CO1: understand the different components and composition of the environment
CO2: rationalize the different pollutants, their sources, effects and controlling measures
CO3: quantify water quality parameters
CO4: apply the systematic environmental impact assessment (EIA) requirements before setup of any project
CO5: understand and implement the principles of solid waste management
CO6: conceptualize the principles of green chemistry and implement them in synthesis of advanced material, so as to reduce the pollution

Topics:

- Overview on environment
- Environmental pollution: air pollution, water pollution
- Pollution management

Textbook(s):

1. Environmental Chemistry, A. K. De, New Age International Publishers.

Reference Book(s):

1. Environmental Chemistry- S. Chakroborty, D. Dave, S.S. Katewa, Cengage Publishers
2. Environment Science and Engineering, Aloka Debi. Second Edition ;Universities Press
3. Text Book of Environment studies for under graduate courses, Erach Bharucha : 2nd Edition, Universities Press
4. Fundamentals of Environment and Ecology, D. De, D. De; 2013, S. Chand Group
5. Engineering Chemistry, Jain and Jain, Dhanpat Rai Publishing Company

MA 1004 Mathematics-II

Credit: 4
Category: BSC
Prerequisite(s): Nil

Course Description :

The course is to familiarize the students with series solutions of ODEs, Laplace Transforms, Fourier series, vector calculus, and numerical integration. For the ODEs with variable coefficients, the situation is more complicated to get their solutions in elementary functions. Legendre and Bessel's equations are important ODEs of this kind and their solutions, the Legendre polynomials and Bessel functions play an important role in engineering applications. Laplace transforms can be used as a mathematical toolbox for engineers to solve linear ODEs and related initial value problems. The Fourier series and vector calculus play a very important role in many engineering areas such as solid mechanics, aerodynamics, fluid flow, heat flow, quantum physics. The applied mathematician, engineer, physicist, or scientist must become familiar with the essentials of numerics and its ideas, such as interpolation and numerical integration.

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

CO1: understand application of Power series and solution of ODEs
CO2: use Power series solutions to Legendre and Bessel's equations
CO3: comprehend Laplace transform and IVPs
CO4: study periodic and non-periodic functions and their Fourier series expansion
CO5: develop vector differential and integral calculus and the applications of Green's theorem, Gauss Divergence Theorem & Stokes Theorem
CO6: apply numerical techniques in interpolation and evaluation of the definite integral

Topics:

- Series Solution of Differential Equations
- Laplace Transforms
- Fourier Series
- Vector Differential and Integral Calculus
- Interpolation and Numerical Integration

Textbook(s):

1. Advanced Engineering Mathematics by Erwin Kreyszig, Wiley, INC, 10^{th} Edition.

Reference Book(s):

1. Higher Engineering Mathematics, Grewal B.S., Khanna Publishers, 36th edition.
2. Introduction to engineering Mathematics, Dass H.K., S.Chand& Co Ltd, 11^{th}edition.
3. Higher Engineering Mathematics, Ramana B.V., TMH, 2007.
4. A course on ordinary & partial differential Equation, Sinha Roy and S Padhy, Kalyani Publication, 3rd edition.

CH 1007 Chemistry

Credit: 3
Category: BSC
Prerequisite(s): Nil

Course Description:

The course is designed to enrich the students with basic concepts in Chemistry to strengthen their fundamentals which will support them for pursuing education and research in engineering. It will help them to develop the idea on feasibility and mechanism of different chemical processes, conceptualize alternative sources of energy, give an exposure for handling instrumental techniques to explore structure of organic molecules and an idea of different methods for synthesis of advanced materials.

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

CO1: rationalize bulk properties and processes using thermodynamic consideration and apply the knowledge to decide the feasibility of a given process
CO2: analyze the kinetics of simple and multistep reactions as well as theories of reaction rates
CO3: evaluate some properties such as pH, solubility product etc. by using electrochemical cell and understand the working of modern batteries
CO4: able to understand the mechanism of corrosion and its different controlling measures
CO5: distinguish the different electromagnetic radiations used for exciting different molecular energy levels in various spectroscopic techniques to evaluate the structure of molecules
CO6: get an exposure to different methods used for synthesis of nanostructured materials

Topics:

- Chemical Equilibrium and Thermodynamics
- Chemical Kinetics
- Electrochemistry
- Spectroscopy
- Chemistry of Nano Materials

Textbook(s):

1. Engineering Chemistry: Fundamentals and Applications- Shikha Agarwal, Cambridge University Press, 2016

Reference Book(s):

1. Textbook of Engineering Chemistry: Sashi Chawala, Dhanpat Rai and Co, 2016
2. Principles of Physical Chemistry- B.R. Puri, L.R Sharma, M.S. Pathania; 42nd Edition, Vishal Publishing Co.
3. Spectrometric Identification of Organic compaunds,7th Edition -Robert M. Silverstein, Fransis , Webster, Dravid j. Kiemle; Jhon Wiley& Sons, INC.
4. Nanostructures &Nanomaterials: Synthesis, Properties and Applications- G. Cao and Y. Wang, World Scientific Pvt. Ltd.; 2nd Edition

HS 1005 Professional Communication

Credit: 2
Category: HSMC
Prerequisite(s): Nil

Course Description:

Professional Communication is more emphasized on enhancing the four LSRW skills like Listening, Speaking, Reading and Writing in order to improve students' professional communication. It is basically designed to enhance speaking skills through pronunciation, stress and tone. This course is prepared to improve reading skills through reading, comprehending and retaining information.This course is basically expected to provide the learner an approach to communicate using all the four skills

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

CO1: understand the communication process and practical implementations in the workplace
CO2: apply verbal and non-verbal modes of communication effectively in practical situations
CO3: apply effective conflict management strategies
CO4: use English grammar correctly and unambiguously in technical writing
CO5: bridge the gap between native language and target language i.e. English
CO6: retain a logical flow while drafting reports and other technical pieces of writing

Topics:

- Communication: Process and Methods of Communication
- Basics of Grammar: Time & Tense, Subject-Verb Agreement, Analogy, Active & Passive Voice, Error Detection in Sentences
- Writing Skills: Paragraph Writing-Techniques & Skills, Use of Punctuation, Business Letter-Enquiry, Claim/ Complaint, Order
- Basic Sounds of English: Hearing & Listening, Introduction to Basic Sounds of IPA, Problem Sounds & MTI

Textbook(s):

1. Technical Communication Principles & Practices. Meenakshi Raman and Sangeeta Sharma OUP. Second Edition-2011

Reference Book(s):

1. A Communicative English Grammar. Geoffrey Leech and Jan Svartvik. Third Edition. Routledge Publication.New York.2013.
2. Effective Technical Communication. MAshraf Rizvi TMH 2005
3. The Oxford Grammar (English) Sidney Greenbaum, Oxford University Press India. 1st Edition. 2005
4. Verbal Ability and Reading Comprehension for the CAT. Arun Sharma and Meenakshi Upadhyay, TMH,New Delhi,2007
5. Better English Pronunciation, Cambridge University Press, J D O'Connor, 2nd Edition (Paper Back) 2013

LS 1001 Biology

Credit: 2
Category: BSC
Prerequisite(s): Nil

Course Description:

Biology is important to everyday life because it allows humans to better understand their bodies, their resources and the potential threats existing in the environment. The engineering undergraduates need to be suitably exposed to the biological mechanisms of living organisms from the perspective of engineers. In addition, the course is expected to encourage engineering students to think about solving biological problems with engineering tools.

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

CO1: comprehend the typical characteristics which distinguish life forms and analyze life process at cellular level
CO2: apply concepts on structure and function of simple biomolecules in life processes
CO3: comprehend different biological process involved in life and to analyze their effect
CO4: understand different biological phenomenon and then relate it with engineering application domains
CO5: comprehend different physiological functions and then relate it to computer based techniques
CO6: understand biology and its relevance to engineering and technology

Topics:

- The Cellular organization of a living Organism
- The molecular and biochemical basis of an organism
- Enzymes, photosynthesis, metabolism and bioenergetics
- Molecular machines, biosensor and bioremediation
- Nervous system, immune system and cell signaling

Textbook(s):

1. Biology for Engineers. S. Thyagarajan, N. Selvamurugan, M.P Rajesh, R.A Nazeer, Richard W. Thilagarajan, S. Bharathi, M.K. Jaganathan. McGraw Hill Education (India) Ed., 2012

Reference Book(s):

1. Biology (Indian Edition), P.H. Raven and G.B. Johnson. McGraw Hill Education (India) Private Limited.
2. Concepts of Biology, Eldon D. Enger, Feederick C, Ross and David B. Bailey. TMH Publications.
3. Biology. Neil A. Campbell and Jane B. Recee, Pearson Education.
4. Biology Concepts and Application, Cecie Starr, Thomson Books.

CS 1093 Computer Programming Laboratory

Credit: 4
Category: PCLC
Prerequisite(s): Nil

Course Description:

The course aims to provide exposure to problem-solving through programming. It aims to train the student to the basic concepts of the C-programming language. This course involves lab component which is designed to give the student hands-on experience with the concepts.

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

CO1: have fundamental knowledge on basics of computers hardware and number systems with concept on basics commands in Linux
CO2: write, compile and debug programs in C language
CO3: design programs involving decision structures, loops, and functions
CO4: understand the dynamics of memory by the use of pointers
CO5: use different data structures and create/update basic data files

Topics:

- Basic linux commands
- Operators and Expressions
- Branching statements (if-else, switch).
- Control statements (looping - for, while, do-while).
- Arrays
- Character Arrays (strings).
- Functions.
- Pointers and Dynamic Memory Allocation.
- Structures and Unions
- File Handling

CH 1097 Chemistry Laboratory

Credit: 1.5
Category: BSLC
Prerequisite(s): Nil

Course Description:

The Chemistry laboratory course is designed to develop basic concepts of quantitative analysis by using volumetric as well as instrumental methods. It includes classical titrations to estimate hardness, alkalinity, dissolved oxygen, ferrous ion content, chloride content in water/solution samples. It also gives hands on training to use advanced titration techniques such as potentiometric, pH metric and conductometric titrations which can be used with turbid and colored solutions in incredibly low concentrations. The course also gives an exposure to extensive use of UV-Vis spectroscopy for estimation of different ions in solution phase.

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

CO1: understand the significance of quantitative chemical analysis
CO2: prepare solutions of different concentrations and do their standardization
CO3: get an exposure to different instrumental techniques such as Conductometry, pH-metry, Potentiometry and Colorimetry
CO4: evaluate the rate constant of pseudo first order reactions
CO5: analyse basic water quality parameters like hardness, dissolved oxygen, alkalinity, ferrous iron contents
CO6: rationalize chemical handling and chemical safety in an advanced modern laboratory

Topics:

- Hardness of water sample
- Alkalinity of water
- Estimation of Fe^{2+} iron
- Dissolved Oxygen
- Potentiometric Titration
- Kinetics of Ester Hydrolysis
- Chloride Estimation
- pH metric Titration
- Conductometric Titration
- Concentration of $KMnO_4$ by Visible spectroscopy

HS 1085 Language Laboratory

Credit: 1
Category: HSMC
Prerequisite(s): Nil

Course Description:

Language Lab is more practical oriented which is designed with an objective to make the learner practice the skills which he/she has learnt in the theory I.e Listening, Speaking, Reading and Writing in order to improve their communication skills. It is basically designed to engage the students to learn to perform group activity or an individual activity. This course is prepared to improve the listening reading, speaking and writing skills . It is expected to orient the students with vocabulary, analogy, sentence completion and sentence correction.

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

CO1: use English grammar correctly and unambiguously in technical writing
CO2: apply verbal and non-verbal modes of communication effectively in practical situations
CO3: have a basic understanding of the communication process and to know the practical implementations in the workplace
CO4: retain a logical flow while drafting reports and other technical pieces of writing
CO5: develop competence in reading and comprehension
CO6: be familiar with English pronunciation and use neutral accent successfully

Topics:

- Reading & Comprehension
- Skit/ Role-Play Practice
- Listening Comprehension
- Time & Tense
- Business Letter
- Business Report
- Subject-Verb Agreement
- Visual Elements in Writing:
- Gadget-Supported Textual Formatting
- Attendance + Lab Record Checking
- Viva Voce

CE 1083 Engineering Graphics

Credit: 2
Category: BSLC
Prerequisite(s): Nil

Course Description:

The course of Engineering Graphics comprises of basics of drafting, projection of points & lines, line inclined to both the planes, projection of planes, Computer Aided Drafting, projection of solids and development of surfaces.

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

CO1: use common drafting tools properly
CO2: select, construct and interpret appropriate drawing scale as per the situation
CO3: draw orthographic projections of points, lines and planes
CO4: draw orthographic projection of solids like cylinders, cones, prisms and pyramids including sections
CO5: develop the sections of solids for practical situations
CO6: communicate ideas effectively using Computer Aided Drafting

Topics:

- Introduction to Engineering graphics
- Lettering
- Projection of points & lines
- Line inclined to both the planes
- Projection of planes
- Introduction to Computer Aided Drafting
- Projection of solids
- Section of solids
- Development of surface

Textbook(s):

1. Engineering Drawing + AutoCAD by K. Venugopal, New Age Publishers, 1st edition, 2011

Reference Book(s):

2. Engineering Drawing with an Introduction to AutoCAD by S. N. Lal, Cengage India Private Limited, 1st edition, 2017

COURSES OF THE PROGRAMME

EC 2005 Semiconductor Devices

Credit: 3
Category: PCC
Prerequisite(s): Analog Electronics Circuit (EC 1004)

Course Description:

This course will give the fundamental concepts of electronics devices that are backbone of all electronics circuits. In this course students will be able to understand the basic semiconductor device physics and how the concepts are used in PN junction, metal semiconductor contacts, BJT, MOSFET, Optoelectronics devices. The course will give in-depth knowledge about the operating principle of the devices with characteristics and how these are related to modern technologies. This course will also helps the students to explore various other domains of electronics like VLSI design, Digital electronics etc.

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

CO1: understand and explain the fundamental semiconductor physics concepts like Fermi level, carrier concentration etc. and analyze them to solve different problems
CO2: analyze and explain different conduction techniques in semiconductor materials and solve relevant problems
CO3: comprehend and analyze the operation of different diodes, metal semiconductor contacts and solve different diode problems
CO4: explain the operation and solve problems associated with of BJT
CO5: analyze and explain the operation of MOS Transistors and solve relevant problems
CO6: comprehend and analyze operating principle of different optoelectronic devices and their applications

Topics:

- Energy bands & Current Carriers in Semiconductors
- P-N Junction
- BJT (Bipolar Junction Transistor)
- Metal-Oxide Field Effect Transistor (MOSFET)
- Optoelectronics devices

Textbook(s):

1. Solid State Electronic Devices: Streetman & Banerjee, 7th Edition, Pearson.

Reference Book(s):

1. Semiconductor Devices: Basic Principles, Jasprit Singh John Wiley & Sons,2000
2. Integrated Electronics: Analog And Digital Circuit Systems, Jacob Millman, Christos Halkias, Chetan D Parikh, 2nd Edition, TMH 2010.
3. Semiconductor Physics And Devices: Donald Neaman and Drubesh Biswas,2012, 4thEdition, TMH 2012.

EC 2011 Digital Electronics

Credit: 3
Category: PCC
Prerequisite(s): Nil

Course Description:

This course covers all basic concepts in digital systems. The course starts with fundamentals of Boolean Algebra-different number systems and inter-conversions, binary codes and K-maps. This will be followed by designing of various combinational circuits such as adders, subtractors, decoders, encoders, magnitude comparators, multiplexer and de-multiplexers. Detail concept about memory elements (flip-flops) will be provided that will help the students to learn about various design techniques of sequential circuits like shift registers, counters and FSMs. Fundamentals of digital logic families, ADC and DAC will also be covered that will help the students to learn digital electronics principles comprehensively in today's perspective.

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

CO1: comprehend, simplify and realize Boolean expression
CO2: comprehend and analyze combinational circuits using logic gates
CO3: design various asynchronous & synchronous sequential circuits using Flip-Flops
CO4: design & implement Mealy and Moore model FSMs for different synchronous sequential circuits
CO5: analyze and differentiate between different logic families such as TTL & CMOS chips
CO6: comprehend and analyze the concept of different types of Analog-to-Digital converters and Digital-to-Analog converters

Topics:

- Introduction to Boolean Algebra
- Combinational Circuits
- Sequential Logic
- Finite State Machine (FSM)
- Logic Families
- A/D and D/A

Textbook(s):

1. Fundamentals of Digital Logic – Anand Kumar - PHI, 2nd Edition, 2011
2. Digital Logic and Computer Design – M. Morris Mano – PHI,2011

Reference Book(s):

1. Digital Principles and Applications – Malvino & Leach –TMH, 7th edition, 2011
2. Digital Fundamentals – T. L. Floyd & Jain – Pearson Education, 10th edition, 2011

EC 2012 Analog Communication Techniques

Credit: 3
Category: PCC
Prerequisite(s): Signals and Networks (EC 2021)

Course Description:

This course is offered to 4th semester Electronics and Telecommunication Engineering students. This course provides an adequate knowledge on various analog communication techniques such as amplitude modulation, angle modulation with their spectral characteristics. A conceptual understanding of sampling concept with different analog pulse modulation schemes along with TDM and FDM techniques are also covered in this course. The performance of various analog communication systems in the presence of noise is also analyzed. Moreover this course help the students to perform communication Engineering laboratory and provides a base to understand higher communication based subjects.

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

CO1: comprehend the basic concept of signals and system, analyze Hilbert Transform, pre-envelope, complex envelope for the representation of band pass signal and its canonical form
CO2: explain the time and frequency domain analysis of various amplitude modulation schemes with their modulation and demodulation process as well as understanding the concept of super-heterodyne receiver
CO3: comprehend and analyze the concept of frequency and phase modulation with their spectral characteristics as well as modulation and demodulation processes
CO4: explain and analyze the process of sampling, sampling techniques with different pulse modulation schemes as well as differentiate between TDM and FDM techniques
CO5: analyze the noise performance of different analog modulation schemes by evaluating signal power to noise power ratio (SNR)
CO6: design based problem solving for analog communication system considering different parameters like modulation index, transmitted power, band width and required SNR

Topics:

- Introduction to communication system, concept of Hilbert transform, pre envelope, complex envelope and canonical form of band pass signal representation
- Generation and detection of various amplitude Modulation schemes such as DSB-FC, DSB-SC, SSB-SC, VSB-SC
- Time and frequency domain representation, power calculations of various amplitude modulation techniques, concept of super heterodyne receiver
- Concept of frequency and phase modulation, generation of FM such as direct and indirect method
- FM demodulation using slope detector and Phase locked loop, Concept of pre-emphasis and de-emphasis
- Sampling theorem statement and proof, Various sampling techniques
- Modulation and demodulation of PAM, PWM and PPM, concept of TDM
- Different sources of noise, effect of noise through different filters such as low pass, band pass
- SNR calculation of DSB-SC, SSB-SC, VSB-SC, FM and their comparison

Textbook(s):

1. Modern Digital and Analog Communications Systems, B.P. Lathi, Oxford University Press
2. Communication System, Simon Haykin - John Wiley

Reference Book(s):

1. Principles of Communication System, H. Taub & D.L.Schilling – TMH
2. Analog & Digital Communication, T. L. Singhal - TMH

EC 2014 Electromagnetic Theory

Credit: 3
Category: BSC
Prerequisite(s): Mathematics-II (MA 1004)

Course Description:

The course provides a basic understanding of electrostatics and magnetostatics using the already known knowledge of vector calculus. This course will also cover different aspects of time varying fields and provide insight to Maxwells equations. Concepts on the propagation of the EM waves in different media and under boundary conditions will lead to the understanding of transmission line behaviour and impedance matching circuits.

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

CO1: apply the appropriate coordinate system for a particular vector based problem, and the laws of vector calculus
CO2: analyze and solve numerical problems involving static charges
CO3: analyze and solve numerical problems involving constant currents
CO4: analyze and apply Maxwell's equations for electromagnetism
CO5: analyze and apply wave behavior during its propagation through multiple media in presence of different boundary conditions
CO6: design transmission line sections (Length propagation constant and characteristic impedance) along with feeding mechanism for realizing impedance matched conditions

Topics:

- Orthogonal coordinate systems
- Static electric and Static magnetic fields
- Time varying fields and Maxwell's equations
- Plane Electromagnetic waves
- Transmission Lines

Textbook(s):

1. Elements of Electromagnetics (Fourth Edition) by Matthew N.O Sadiku, Oxford University Press, 2009.
2. Field and Wave Electromagnetics (Second Edition) By David K. Cheng, Pearson Education, 1989.

Reference Book(s):

1. Engineering Electromagnetics (Seventh Edition) by William H. Hayt, Jr and John A. Buck, Tata McGraw- Hill Publishing Company Limited, New Delhi, 2007.
2. Electromagnetic Waves and Radiating Systems by Edward C. Jordan and Keith G. Balmain, Prentice Hall of India, New Delhi, 2nd Edition.

EC 2019 Electronic Devices and Circuits

Credit: 4
Category: PCC
Prerequisite(s): Basic Electrical Engineering (EE 1003)

Course Description:

This course is designed to impart essential background of electronics devices and its associated circuits by incorporating various important topics like semiconductor, junction diodes, transistors & its biasing circuits, small signal analysis of transistors, and their frequency response, feedback and oscillator circuits and power amplifiers. This course prepares the students to analyze analog electronics circuit and empower them to understand the design and working of amplifiers and oscillators. This course will also help students to understand basic concepts of communication systems, VLSI design, Internet of Things etc.

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

CO1: comprehend the concept of semiconductors, diodes and analyze different diode circuits
CO2: analyze and explain the operation of BJT and FET and solve different biasing circuits
CO3: analyze and solve different performance metrics of BJT and FET amplifier circuits with the help of their small signal model
CO4: explain and analyze the performance of amplifier using frequency response and step response method
CO5: analyze and solve different negative feedback topology/circuits and sinusoidal oscillators
CO6: explain and design different power amplifier circuits using BJT

Topics:

- Semiconductor
- PN junction
- Transistors
- Transistor biasing circuits
- Small signal analysis of transistor amplifiers
- Frequency response of transistor amplifiers
- Feedback and oscillator circuits
- Power amplifiers

Textbook(s) :

1. Electronic Devices & Circuits- D. A. Bell- Oxford , 5th edition
2. Integrated Electronics – J. Millman, Halkias & Parikh – MGH , 2nd edition

Reference Book(s):

1. Electronics Devices and Circuits – Robert L. Boylestad and Lewis Nashelsky – Pearson,10th edition

EC 2020 Microprocessors, Microcontrollers & Interfacing

Credit: 4
Category: PCC
Prerequisite(s): Digital Electronics (EC 2011)

Course Description:

The objective of this course is to teach the fundamentals of Microprocessor (like 8085, 8086) and Microcontroller (like 8051) systems to the students. In this course, the students learn about assembly language to program the Microprocessors, Microcontrollers and develop programs to solve simple applications.

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

CO1: comprehend the basic concept of Bus structure, a basic 8-bit Microprocessor (like 8085) system, its architecture, concept of stack, Addressing modes etc.
CO2: explain the architecture of a 16-bit Microprocessor like 8086 including the concept of instruction queue, segmented memory structure and address generation
CO3: explain and analyze the Addressing modes, Assembly language instructions of 8086 and implement them to solve 8086 related design problems
CO4: design Memory Interfacing using memory chips with proper decoder circuits with a 16-bit processor and analyze the interrupt structure of 8086 Microprocessor
CO5: explain the features of the peripherals such as PPI, Programmable interrupt control, USART and their interfacing with a 16-bit processor
CO6: explain and analyze memory organization of a 8-bit Microcontroller (like 8051), its addressing modes, instructions, timers & counters and its serial communication

Topics:

- 8085 (8-bit Microprocessor)
- 8086 (16-bit Microprocessor)
- Interfacing Chips
- 8051 Family of Microcontrollers

Textbook(s):

1. Microprocessors and Interfacing, Programming & Hardware - Douglas V. Hall,McGraw Hill Education Pvt Ltd., 3rd edition.

Reference Book(s):

1. Microprocessor Architecture, Programming and Applications with the 8085 - Ramesh S. Goankar, Penram International Publishing (India).
2. Microprocessors & Microcomputer based System Design - Md. Rafiquzzaman, 2nd edition.
3. Microcontroller Theory & Applications - Deshmukh, McGraw Hill Education Pvt Ltd.

EC 2021 Signals & Networks

Credit: 3
Category: PCC
Prerequisite(s): Mathematics-II (MA 1004)

Course Description:

This course is designed to establish a strong foundation for communication and signal processing. It will enable students to classify various analog and discrete time signals and visualize the signals after various operations. The course will enable the students to represent various signals in terms of singularity functions and find relationships between signals. It will provide the knowledge of various classifications of systems as well as time and frequency domain analysis of signals and systems using in-depth knowledge of Fourier and Laplace transforms. It will provide the knowledge of linear circuit analysis using Laplace transform to find dynamic and steady state responses. It is designed to provide the concepts of fundamental network theorems and network parameters to analyze linear electrical circuits.

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

CO1: understand and classify various continuous and discrete signals, understand sampling process and visualize signals after various operations
CO2: classify and analyze system characteristics and determine output of LTI system in time domain
CO3: analyze continuous time signals and systems in frequency domain using continuous time Fourier series and continuous time Fourier transform
CO4: determine the Laplace Transform of various signals and analyze analog systems characteristics using Laplace transform and its properties
CO5: analyze RLC circuits for AC/DC excitation using Laplace transform
CO6: analyze and apply network theorems and network parameters to various electrical circuits

Topics:

- Introduction to signal classification and operation and sampling process
- Introduction to system classification and time domain analysis of systems
- Analysis of signals and systems in frequency domain using Fourier analysis
- Analysis of signals and system using Laplace transform
- Linear circuit analysis using Laplace transforms
- Network theorems and network parameters and their applications for analyzing linear circuits

Textbook(s):

1. Signals and Systems by Alan V. Oppenheim, Alan S. Willsky,PHI , edition
2. Circuit Theory, Analysis and Synthesis A, Chakrabarti, Dhanpat Rai Publishing Company (P) Limited 5th edition, 2008.

Reference Book(s):

1. Signals & Systems – P. Ramesh Babu –Scitec,4th edition
2. Network Analysis 3rd edition, by M. E. Van Valkenburg, Pearson Education, 2006

EC 2022 Electromagnetic Waves and Antennas

Credit: 4
Category: BSC
Prerequisite(s): Physics (PH 1007)

Course Description:

Electromagnetic Waves and Antennas covers the basic principles of static fields and time varying fields and understanding those in the form of Maxwell's equations. This course highlights the characteristics of wave propagation in different media and thereby extending it in transmission lines and antennas. This course also emphasizes on design aspects of transmission line components and antennas.

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

CO1: comprehend and apply the concept of different coordinate systems and vector calculus in solving numerical problems
CO2: explain and apply concepts of electrostatics and magnetostatics in different contexts and numerical problems
CO3: comprehend, analyze and apply concepts of time varying electromagnetic fields and Maxwell's equations in different contexts and numerical problems
CO4: explain and analyze the concepts associated with wave propagation, polarization and power flow; analysis of wave propagation characteristics in different media; transmission and reflection of waves at the boundary of 2 media
CO5: explain and analyze the transmission line parameters, analysis of lossless lines and design of impedance matching networks
CO6: comprehend and analyze radiation from antennas, importance of radiation potentials, antenna parameters, and apply concepts associated with working and design of antennas, and its arrays

Topics:

- Coordinate Systems
- Static Electric Field
- Static Magnetic Field
- Time Varying Electromagnetic Fields and Maxwell’s Equations
- Plane Electromagnetic Waves
- Transmission Lines
- Electromagnetic Radiation and Thin Linear Antennas
- Antenna Parameters and types of Antennas

Textbook(s):

1. Elements of Electromagnetics (Fourth edition) by M. N.O. Sadiku, Oxford University Press, 2009.

Reference book(s):

1. Antennas for All Applications - J. D. Kraus & R. J. Marhefka, Tata McGraw Hill.
2. Electromagnetic Waves and Radiating Systems by E. C. Jordan and K. G. Balmain, Prentice Hall of India, New Delhi.

EC 2024 Advanced Electronic Circuits

Credit: 3
Category: PCC
Prerequisite(s): Electronic Devices and Circuits (EC2019)

Course Description:

This course is designed to impart essential background of analog electronic circuits by incorporating various important topics like linear wave shaping circuits, OPAMP parameters, OPAMP with negative feedback, frequency response of OPAMP, linear IC applications, negative resistance devices. This course prepares the students to perform the analysis of any analog electronics circuit using op amps and linear wave shaping circuits. It includes measurement of op amps parameters and its frequency response along with its various applications of different linear ICs. It also gives a basic idea of negative resistance devices. This course will also help students to explore various other domains of science and technology like communication systems, VLSI design, Internet of Things etc.

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

CO1: comprehend the fundamentals of linear integrated circuits, negative resistance devices and op-amp
CO2: demonstrate and analyze the linear wave shaping circuits, negative resistance devices, differential amplifiers, constant current bias, current mirror, level translator; determine the DC and AC parameters of OPAMP
CO3: solve different linear wave shaping circuits, open loop and closed loop OPAMP circuits and its performance evaluation by frequency response & stability
CO4: analyze the response of different linear wave shaping circuits, applications of closed loop and open loop OPAMP and performance of negative resistance devices
CO5: comprehend the concept of regulated power supply, PLL, multi-vibrator with its different applications using IC 555 timer
CO6: demonstrate the ability to design practical analog circuits that perform the desired operations

Topics:
- Linear Wave Shaping Circuits
- OPAMP and its parameters
- OPAMP with Negative Feedback
- Frequency Response of an OPAMP
- Linear IC Applications
- Negative Resistance devices

Textbook(s):
1. OPAMP & LIC – R. K. Gayakwad – PHI
2. Pulse, Digital and Switching waveforms –J. Millman & H. Taub – TMH

Reference Book(s):
1. LIC – D. Ray Choudhury & Shail Jain (New Age)
2. Pulse Digital Circuit – Anand Kumar - PHI

EC 2025 Principle of Electronics Engineering

Credit: 3
Category: PCC
Prerequisite(s): Nil

Course Description:

The course objective is to make students of Engineering to understand the efficacy of Electronic principles which are pervasive in engineering applications. Students will be able to understand the essence and applications of electronic components used in different electronic circuit. They will understand the working of diode and transistor and their characteristics, benefits of feedback in amplifier, oscillators, design of simple circuits like amplifiers (inverting and non- inverting), adders, integrator and differentiator using OPAMPS, a digital logic and apply it to solve real life problems.

Course Outcomes: At the end of course the students will be able to:

CO1: understand the properties of semiconductors and current conduction mechanisms
CO2: comprehend the working of P-N junction diodes; identify different diode circuits and analyze them
CO3: understand the working of BJT, different modes and configuration, identify and analyze their biasing circuits, understanding the working of CE amplifier and its properties
CO4: analyze the working of op-amp using either inverting or non -inverting configurations, timing circuit, regulated power supply ICs and their applications
CO5: comprehend the concept of feedback in electronic circuits, types of feedback, their applications
CO6: comprehend the working of different logic gates, combinational and sequential circuits, develop a brief idea about microprocessor and microcontrollers

Topics:

- Semiconductors
- Junction Diodes
- Bipolar Junction Transistor (BJT)
- Feedback Concept
- Operational Amplifiers (OPAMP) and 555 timer
- Digital Electronics

Textbook(s):

1. Electronics- Fundamentals & Applications- D. Chattopadhyay and P.C Rakshit- 11th Edition (New Age International)
2. Electronic Devices and Circuits- D. A. Bell- 5th Edition (Oxford)

Reference Book(s):

1. Electronic Devices & Circuits- R. L. Boylestad- 10th Edition(Pearson)
2. Digital Principles and Applications- A. Malvino and Leach-7th Edition(TMH)

EC 2090 Microprocessor and Microcontroller Laboratory

Credit: 1
Category: PCLC
Prerequisite(s): Digital Electronics (EC 2011)

Course Description:

This lab is utilized by 4th semester Electronics and Telecommunication Engineering, Electronics and Computer Science Engineering students, 5th semester Electronics and Electrical Engineering and Electronics and Instrumentation Engineering students. Students develop Assembly language programming skills on 8085, 8086 and 8051 kits. Students do their experiments in both hardware and software platforms. They use TALK software and design some Interfacing circuits on bread board like seven segment display to glow decimal digits 0-9 and four-way traffic control circuits and design of LEDs to glow in proper sequence. They also Interface with CRO to display square wave and interface with Digital to Analog Converter to display Triangular and Saw tooth wave forms.

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

CO1: develop Assembly language programming skills on 8085, 8086 Microprocessor and 8051 Microcontroller trainer kit
CO2: utilize PCLink communication software for Intel 8085 & 8086 Assembly language programming to execute programs and design practical circuits
CO3: design practical circuits like 4 way traffic light system, generation of square wave using CRO, interfacing of seven segment display using PPI
CO4: utilize 86DRV communication software for Intel 8086 Assembly language programming to execute programs and design practical circuits
CO5: utilize B30DRVM communication software for 8051 Microcontroller & Assembly language programming to execute programs and design practical circuits
CO6: formulate, design and solve real life engineering problems for executing projects

Topics:

- Familiarization with 8085 and 8086 Microprocessor Kit and verification of instruction sets
- Execution of sample Assembly language programs on 8085 MP Kit
- Introduction to TALK communication software and execution of Assembly language programs using Cross Assembler
- Design a circuit and write a suitable program to display decimal digits 0 to 9 using 8085 and seven segment display
- Design a four lane Traffic control system using PC, 8085 MP Kit and additional hardware
- Familiarization with 8051 Microcontroller Kit and execution of basic programs using TALK communication software & Cross Assembler
- Generation of a 2 KHz square wave on Port 1.3 (Pin-4) with Timer 0 interrupt, using TALK software and 8051 MC Kit
- Open Ended Experiments

EC 2091 Electronic Circuits & Network Laboratory

Credit: 3
Category: PCLC
Prerequisite(s): Basic Electrical Engineering (EE 1003), Basic Electrical Engineering Lab(EE 1093)

Course Description:

This laboratory course is basically designed to impart essential practical knowledge of electronic devices and its associated circuits for 3rd semester undergraduate Electronics Engineering students. Hardware and Simulation experiments here are designed specifically for augmented learning . This will help students to understand and design various electronic circuits such as rectifiers, amplifiers and oscillators using discrete components like BJT/FET which are essential building blocks for any electronic system. Major equipment include function generator, CRO, multi-meter, Variac, voltmeter, ammeter, breadboard trainer kit and software's like Tina-TI, Lab VIEW and NI My DAQ v. 2016.A well-organized systematic procedure is included in each experiment to facilitate the hardware testing and simulation. This course imbibes the students with necessary practical knowledge which will help them in making their minor and major undergraduate projects.

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

CO1: identify different discrete components, understand the function of Cathode Ray Oscilloscope ,Function Generator & multi-meter and use these equipment for circuit related learning
CO2: explain and verify basic linear network theorems
CO3: plot and demonstrate the V-I characteristics of a P-N junction diode and the Zener diode
CO4: explain and analyze the input and output characteristics of BJT and JFET
CO5: design and simulate amplifier, oscillator circuits using BJT and JFET
CO6: formulate, design and implement different types of low frequency amplifiers and oscillator circuits using BJT/JFET to solve the real life engineering problems by executing mini projects

Topics:

- Basic linear network theorems
- P-N junction diode and Zener diode
- Transistors (BJT and JFET)
- CE amplifier and RC-coupled amplifier
- CS amplifier and CD amplifier
- LC and RC oscillators
- Open ended experiments

EC 2092 Analog Integrated Circuits Laboratory

Credit: 2
Category: PCLC
Prerequisite(s): Electronic Devices And Circuit (EC 2019), Electronic Circuits & Networks Lab (EC 2091)

Course Description:

This laboratory course focuses on the practical knowledge of operational amplifier (IC 741), IC555, IC 78XX and its associated circuits for the 4th semester undergraduate Electronics& Telecommunication Engineering students that will help the students to have thorough understanding of their workings. Experiments include hardware type, software simulation based (Tina-TI) and hardware-software interfacing type using Lab View, NI My DAQ and My RIO v. 2016. Students can learn the construction of practical circuits in the software as well as the diagnosis of various faults. At the end of the course, an undergraduate student can built various analog circuits using ICs. This laboratory course imbibes the students with practical knowledge which will help them to make their undergraduate projects and to have industry-ready skills and expertise making them a successful professional in the area of Electronics Engineering.

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

CO1: explain the RC circuits for different inputs and design the passive differentiator & integrator circuits for circuit related learning
CO2: explain and analyze the DC and AC parameters of Operational Amplifier
CO3: design and implement the low-pass and high-pass filters, Wien Bridge oscillator, comparators and Schmitt trigger using op-amp
CO4: analyze, design and implement the a stable and monostable multivibrators using IC 555 and voltage regulator using IC 78XX
CO5: design and implement various analog electronic circuits and test them using NI My DAQ and Lab VIEW
CO6: formulate, design and implement different amplifiers and wave generator circuits using op-amp to solve the real life engineering problems by executing mini projects

Topics:

- RC circuits as differentiator and integrator
- DC and AC parameters of Operational Amplifier .
- Low-pass and high-pass Butterworth filter
- Wien Bridge oscillator
- Comparator Circuit and Schmitt Trigger
- Monostable multivibrator and Astable multivibrator using IC 555 timer
- Regulated power supply using IC 7805
- Open ended experiments

EC 2093 Digital Electronics Laboratory

Credit: 1
Category: PCLC
Prerequisite(s): Nil

Course Description:

This lab is utilized by 3rd semester Electronics and Telecommunication Engineering, Electronics & Computer Science Engineering, Computer Science and System Engineering, Computer Science and Communication Engineering students. In this laboratory Analog to Digital converters, Digital to Analog converters, Lab designer Kits, Cathode Ray Oscilloscopes, Function generators and NI-MyRIO Kits are available . The DEC Lab is containing some Verilog simulation experiments along with the hardware implementation of simple digital circuits. Students do their experiments and open ended experiments in both hardware and software platforms. They use discrete components and Xilinx, PSpice, LabVIEW software to design and simulate the combinational and sequential logic circuits. This lab is also used by B. Tech and M. Tech students for executing projects.

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

CO1: comprehend the significance of terminology associated with Verilog HDL and the procedure to Simulate and Verify combinational logic circuits in EDA Playground and TinkerCAD
CO2: simulate and design combinational logic circuits like adder using Logic Gates in association with EDA Playground and TinkerCAD
CO3: simulate and design combinational logic circuits like decoder using Logic Gates in association with EDA Playground and TinkerCAD.
CO4: simulate and design combinational logic circuits like Multiplexer using Logic Gates in association with EDA Playground and TinkerCAD
CO5: simulate and design sequential logic circuits of different Flip-Flops and Flip-Flop conversion in association with EDA Playground and TinkerCAD
CO6: simulate and design sequential logic circuits like Synchronous type counter , Asynchronous type counters and shift registers using flip-flops in association with EDA Playground and TinkerCAD

Topics:

- Logic Gates
- 2-Line-to-4 line Decoder
- 2X1 Multiplexer
- J-K Flip-Flop and D Flip-flop
- 2-bit Synchronous Up Counter
- 2-bit Asynchronous Up Counter
- Serial In-Parallel Out(SIPO) Shift Register
- Open ended experiments

EC 2094 Communication Engineering Laboratory

Credit: 1.5
Category: PCLC
Prerequisite(s): Nil

Course Description:

This lab is utilized by 5th semester Electronics and Telecommunication Engineering students. In this laboratory students are performing experiments based on hardware, software as well as using Trainer Kit. In hardware some design problems are performed by the students using discrete components on breadboard. MATLAB is used for software simulation where the students after conducting the experiment on trainer kit verifying the same using the said software. In this laboratory adequate no of trainer kits, spectrum analyzer and DSO are available for both analog communications and digital communication based Experiments. Moreover this laboratory is also utilized for M. TECH and Ph. D scholars for their research work.

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

CO1: understand the principle of different types of Amplitude Modulation(AM) and demodulation. Also gain knowledge on the principle of Superheterodyne receivers
CO2: generate Frequency Modulated (FM) signals using IC XR2206 with its principle of operation and apply the FM signal to PLL IC 565 circuit for demodulation process
CO3: analyze the process of sampling and quantization with different Pulse modulation techniques and Waveform Coding techniques. Also acquire some knowledge on multiplexing scheme
CO4: explain the operating principles of different digital modulation techniques with respective waveforms representations using Trainer Kit and software platform
CO5: design and implement the Modulator and Demodulator circuits using discrete components
CO6: simulate the modulated signals using Matlab programs. Formulate design and real life engineering problems for executing minor projects

Topics:

- Generation and detection of various amplitude Modulation and demodulation schemes
- Generation and detection of frequency modulation and demodulation
- Generation and detection of Pulse Modulation and demodulation
- Time division multiplexing, modulation and demodulation of PCM system
- Delta modulation technique
- Data formating, different Digital Modulation and Demodulation Techniques such as BASK, BPSK, BFSK, QPSK
- Open ended experiments

EC 2098 Simulation Laboratory

Credit: 1
Category: PCLC
Prerequisite(s): Principle of Signals and Systems (EC 2023), Mathematics-II (MA 1004)

Course Description:

This lab uses Matlab and LABVIEW platform to perform various experiments on generation and analysis of various signals and their behavior to solve different industrial and engineering problems.

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

CO1: comprehend the requirement and analyze the different types of signals using mathematical models in MATLAB
CO2: apply different control structures to find out the parameters of a signal like PSD, Amplitude etc.
CO3: simulate and find the transfer function for different circuits to observe the system behavior
CO4: comprehend, analyze and represent digital system design using graphical system methods in LabVIEW
CO5: explain and analyze and represent a system equation using MATLAB
CO6: solve different industrial and engineering problems

Topics:

- Basic familiarization to MATLAB Environment
- Control Flow- conditional and case structure, loop structure
- Finding Correlation and autocorrelation, ESD using MATLAB
- Numerical integration and differentiation using MATLAB
- Implementation of system transfer function and finding the damping factor and natural frequency
- Basic introduction to LabVIEW - Conversion of Celsius scale to Fahrenheit and vice-versa
- Control Flow- conditional and case structure, loop structure with graph and chart, File handling using LabVIEW
- Digital system implementation using LabVIEW
- Open Ended Experiments

EC 3005 Digital Communication Techniques

Credit: 4
Category: PCC
Prerequisite(s) Analog Communication Techniques (EC 2012)

Course Description:

This course deals with the fundamentals for all digital communication schemes. It describes the different techniques to convert information in analog domain to digital domain. Also, it includes transmission of more than one digital signal using time division multiplexing technique. It covers almost all digital modulation techniques in binary and M-ary forms. Further it includes optimum receiver and bit error rate evaluation in different digital transmissions. The objective of this course is to present the engineering principles, theories and practices, which are fundamental to the successful design of a digital communication system.

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

CO1: apply the concepts of random process and various probability density functions, cumulative distribution functions in solving problems associated with noise in communication channel
CO2: understand various blocks in the digital communication system and advantages and disadvantages of digital communication
CO3: comprehend and analyze the principle of sampling, quantization and encoding in various waveform coding techniques like PCM, DPCM, DM, ADM and apply their principle for problem solving. Understand digital multiplexing schemes
CO4: evaluate noise performance of various waveform coding techniques and compare them
CO5: conduct analysis of the modulated signals like ASK, PSK, FSK, MSK, GMSK, QAM,M-ary modulation schemes using or the normal basis functions and signal space representation
CO6: analyze and evaluate optimum receivers for different modulation schemes

Topics:

- PCM, Delta modulation and demodulation
- Noise in PCM and DM
- Multiplexing
- Digital modulation & demodulation techniques
- Data transmissions

Textbook(s):

1. Principles of Communication Systems – H. Taub & D.L. Schilling, G. Saha – 4th edition,2013- McGraw Hill

Reference Book(s):

1. Communication System – Simon Haykin, John Willey - 4th edition,2011
2. Modern Analog & Digital Communication System – B. P. Lathi, Oxford University Press- 4th edition, 2011

EC 3007 Digital Signal Processing

Credit: 4
Category: PCC
Prerequisite(s): Principle of Signals and Systems (EC 2023), Signals and Networks (EC 2021)

Course Description:

This course begins with the mathematical concepts behind digital processing. It includes implementation of signal processing techniques used in hardware and software systems. The course covers Discrete time signals and systems, Z transform, DFT, FFT and properties. The concepts of digital filter design, realization of systems, multi-rate signal processing and introduction to adaptive filters with their applications will be discussed.

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

CO1: determine and understand appropriate transformation technique for signal analysis
CO2: analyze the signal and its properties in its frequency domain
CO3: apply Fourier transform techniques in real time applications
CO4: apply the knowledge of analog filters to digital filters, design and realization of digital filter
CO5: design and implement multi-rate systems and filter banks
CO6: explain and apply the adaptive filtering concepts for system identification, channel equalization, noise cancellation and line enhancer

Topics:

- Fundamental of Signals and System & Z-Transform
- Fourier Transforms
- DFT, IDFT and FFT
- Digital filters
- Multi-rate DSP
- Adaptive filters

Textbook(s):

1. Digital Signal Processing – J. G. Proakis & D. G. Manolakes, 4th edition – PHI
2. Digital Signal Processing – T. K. Rawat, Oxford University Press, 1st edition

Reference Book(s):

1. Digital Signal Processing – Oppenheim & Schafer, PHI, 1st edition.
2. Digital Signal Processing – P. Ramesh Babu, Scitech Publication, 4th edition.

EC 3011 VLSI Design

Credit: 3
Category: PCC
Prerequisite(s): Digital Electronics Circuits (EC 2011)

Course Description:

The VLSI design course introduces students to basic theories and techniques of digital VLSI design in CMOS technology, fabrication and layout techniques pertaining to digital integrated circuits domain. The course enables students to analyze and design different VLSI architectures using the fundamental concepts of digital VLSI systems. The domain specific skill sets include deep understanding of CMOS devices and circuits, CMOS design rules, static and dynamic logic structures, interconnect analysis and low power techniques in ultra-deep sub-micron regime.

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

CO1: understand and explain VLSI design flow, design strategy, role of different methods for chip design and basic fabrication process flow
CO2: analyze different components of threshold voltage, drain current and scaling strategy
CO3: evaluate different performance metrics of MOS inverter architecture
CO4: illustrate the logic design process used for complex combinational circuit and its layout using static CMOS
CO5: analyze different switch based logic involving pass transistor, complementary pass transistor and transmission gate
CO6: create different high performance dynamic CMOS logic

Topics:

- VLSI Methodologies
- Unit process in VLSI IC fabrication
- MOSFET Analysis
- CMOS Inverter and its analysis
- Transient characteristics
- CMOS logic design
- CMOS switch-based logic
- Dynamic Logic Circuit

Textbook(s):

1. CMOS digital integrated circuits by Sung –Mo KANG Y. Lebeleci, 4th edition, Mc-Graw Hill publications

Reference Book(s):

1. CMOS Circuit Design, Layout, Simulation R. Jacob baker, Harry W. Li, David E Boyce,4th edition, Wiley publications.

EC 3013 Principles of Digital Signal Processing

Credit: 3
Category: PEC
Prerequisite(s): Mathematics-II (MA 1004)

Course Description:

This course begins with the mathematical concepts behind digital processing. It includes implementation of signal processing techniques used in hardware and software systems. The course covers Discrete time signals and systems, Z transform, DFT, FFT and properties. Techniques to design FIR and IIR filters are discussed.

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

CO1: comprehend the significance of terminology associated with various components of a digital system
CO2: analyze the different types of digital systems and linear convolution
CO3: analyze and apply the discrete Fourier transform (DFT)
CO4: solve Z-transform and apply it for discrete signals
CO5: analyze and apply the sectional convolutional methods
CO6: design digital filters using different techniques

Topics:

- Difference between analog and digital signals
- Types of digital systems
- Linear time invariant system
- Linear convolution
- Discrete Fourier transform (DFT) and its calculation
- Properties of DFT
- Circulation convolution and its significance
- Sectional convolution using overlap-add and overlap save methods
- Fast Fourier transform (FFT) algorithm for fast computation of DFT
- z-transform of digital signals and its applications
- Design of digital filters

Textbook(s):

1. Digital Signal Processing by T. K. Rawat, Oxford Publication 1 st Edition
2. Principle of Signal Processing and Linear System: B.P.Lathi, First Edition, Oxford University Press

Reference Book(s):

1. Digital Signal Processing – J.G.Proakis and D.G.Manolakis , 4th Edition-PHI
2. Signals & Systems: Alan V. Oppenheim & Schafer-2nd Edition 2011 Pearson
3. Digital Signal Processing: P. Ramesh Babu: Scitech,2nd Edition

EC 3015 Microwave Engineering

Credit: 3
Category: PCC
Prerequisite(s): Electromagnetic Waves and Antennas (EC 2022)

Course Description:

The course is intended to describe the principles of operations and design aspects of microwave sources, devices and components. Course includes the propagation characteristics and design parameters of rectangular waveguide, circular waveguide and cavity resonator. Microwave amplifiers and sources like, Klystron amplifier, travelling wave tubes, Reflex Klystron, Magnetron oscillator, backward wave oscillator are part of this course. The operations of microwave solid state devices, like, Gunn diode, Gunn oscillator, PIN diode, READ diode, IMPATT diode and microwave components are described in the course. Different types of microwave measurement techniques are included in the course.

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

CO1: explain propagation characteristics and design parameters of rectangular waveguide, circular waveguide and cavity resonator
CO2: comprehend the limitations of conventional vacuum tubes at microwave frequencies
CO3: analyze the design aspects of Klystron amplifier and Reflex Klystron oscillators, and slow wave structures
CO4: explain and Analyze the operations of microwave solid state devices, like, Gunn diode, Gunn oscillator, PIN diode, READ diode, IMPATT diode
CO5: explain the principles of operation and design aspects of various types of microwave components
CO6: perform power measurements, frequency and impedance measurements, gain and radiation pattern measurement of antennas

Topics:
- Waveguide and Cavity Resonator
- Microwave Vacuum Type Amplifiers and Sources
- Microwave Solid State Devices & Sources
- Microwave Components
- Microwave Measurements

Textbook(s):
1. Microwave Devices & Circuits. S. Y. Liao, PEA Publication, 2009

Reference book(s):
1. Electromagnetic Waves and Radiating Systems by E. C. Jordan and K. G. Balmain, Prentice Hall of India, New Delhi.
2. Microwaves: Introduction to Circuits, Devices & Antennas. M. L. Sisodia and V. L. Gupta, New Age Publication, 2012.

EC 3021 Neural Networks and Machine Learning

Credit: 3
Category: PEC
Prerequisite(s): Mathematics-I (MA 1003) and Mathematics-II (MA 1004)

Course Description:

This course will cover the history of neural networks, study the fundamental structures and state-of-the-art approaches to machine learning. The course will focus on theory and practice of these models, how they are trained and validated, and how they can be deployed in practice. Students will learn to design neural network architectures and training procedures via hands-on assignments. Students will learn how to use neural networks and machine learning algorithms for identifying, classifying and solving different problems related to pattern recognition, function approximation, data visualization etc.

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

CO1: understand the context of neural networks and develop broad overview of learning strategies
CO2: explain the fundamental neural network models, their learning strategies and apply them for modeling problems
CO3: analyze multi-layer feed forward neural networks, recurrent neural networks, radial basis functions and employ them for different applications
CO4: comprehend the concepts, architecture, training and testing algorithms of associative memory networks and Hopfield networks and apply them to evaluate practical problems
CO5: develop a comprehensive idea on unsupervised learning networks and advanced neural networks
CO6: explain the motivation for architectures and models and select the appropriate architecture for a given problem

Topics:

- Artificial neural network architecture
- Applications of neural networks
- Associative memory networks
- Unsupervised learning networks and advanced networks

Textbook(s):

1. Principles of Soft Computing by S. N. Sivanandam and S. N. Deepa - Wiley

Reference Book(s):

1. Neuro-fuzzy and soft computing by J. S. R. Jang, C. T. Sun and E. Mizutani - PHI Publications
2. Neural networks and learning machines by Simon Haykin - Parson, Prentice Hall

EC 3023 Optimization Techniques in Engineering

Credit: 3
Category: PEC
Prerequisite(s): Mathematics-I (MA 1003) and Mathematics-II (MA 1004)

Course Description:

The objective of this course is to give exposure about the different optimization problems and related algorithms to the students. In this course, the students learn about single and multiple variable constrained optimization algorithms. The course includes formulation of optimal problems for real time applications, simple codes for implementing the same and demonstrates convergence with optimal results.

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

CO1: comprehend the need for optimization, formulate fitness/cost functions for simple problems and identify constraints involved (if any)
CO2: analyze the concepts behind single variable optimization algorithms
CO3: apply gradient based optimization algorithms for problem solving
CO4: comprehend the importance of multivariable optimization, different multi-variable optimization techniques and concept of Pareto-front
CO5: analyze the different techniques for constrained optimization algorithms and their applications
CO6: analyze and apply the algorithms for different nature inspired optimization algorithms

Topics:

- Optimal problem formulation, Design variables constraints, Objective function, Variable bounds,
- Engineering optimization problems, Optimization algorithms
- Single-variable Optimization Algorithm
- Gradient-based Methods
- Multivariable Optimization Algorithm
- Constrained Optimization Algorithm
- Advanced Optimization Algorithms

Textbook(s):

1. Optimization for Engineering Design-Algorithms & Examples – K. Deb, PHI, 2nd edition, 2012.
2. Multi-objective Optimization Using Evolutionary Algorithms-K. Deb, John Wiley & Sons, 1st edition,2001.

Reference Book(s):

1. Optimization: Theory and Applications - S.S. Rao, Wiley Eastern Ltd, 2nd edition, 1979.

EC 3028 Data Communication & Networking

Credit: 3
Category: PCC
Prerequisite(s): Analog Communication Techniques (EC 2012), Digital Communication Technique (EC 3005), Communication Engineering (EC 2016), Introduction to communication Engineering (EC 3044)

Course Description:

Data Communication &Networking course deals with down-to-top approach to TCP/IP protocol stack, OSI layered architecture for packet switched data networks and the TCP/IP stack implements by focusing in details from Physical, Data-Link, Network, Transport, and Quality of Service (QoS) parameters. This course covers different key concepts of networking like physical media dependant layer, MAC, Flow Control, Error Control, IP addressing, Sub-netting, IPv4/ IPv6, Routing, DHCP, ARP, ICMP, NAT, TCP/UDP and QoS.

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

CO1: analyze, compare and contrast OSI layered Architecture and TCP/IP protocol stack
CO2: analyze different techniques and algorithms implemented in Logical Link Control (LLC) Media Access Control (MAC) sub-layers associated with data-link layer
CO3: explain design scenario-specific datagram networks based on IPv4 and IPv6
CO4: investigate various protocols associated with TCP/IP stack
CO5: investigate connection-oriented (TCP) and connection-less (UDP) protocols in transport layers to comprehend design features and functionalities
CO6: analyze data communication networks to differentiate various Quality of Service (QoS) approach

Topics:
- Packet switched network
- OSI Layered Architecture,TCP/IP protocol stack implementation
- Services of Physical Layer, Data-Link Layer
- Error detection and correction techniques, Framing, High level Data-Link Control (HDLC)
- Multiple Access Control (MAC) protocols,Link-Layer Addressing, ARP
- Ethernet IEEE 802.3 Standards Frame format, GIGABIT Ethernet, wireless LAN IEEE 802.11 Architecture, Network Layer
- IPv4 & IPv6 protocol ,IPv4 Addressing , Sub-netting, Super-netting, IPv6 Addressing
- Routing Algorithms and protocols,DHCP,ICMP,NAT
- Transport Layer Services,TCP,UDP,QoS

Textbook(s):
1. Data Communications and Networking, B A Forouzan, McGraw-Hill, 4thEdition, 2011.
2. Computer Networking – A top-down approach featuring the Internet, James F. Kurose and Keith W.Ross, 2nd Edition, Pearson Education, Asia, 2004.

Reference Book(s):
1. Internetworking with TCP-IP: Principles, Protocols and Architecture, D. E. Comer, Vol I, 2nd Edition, Prentice Hall, 1991.
2. Data and Computer Communications, William Stalling, 10th edition, Prentice Hall, 2013.
3. Communication Networking – An analytical Approach, Anurag Kumar, D Manjunath and JoyKuri, Morgan Kaufmann, 2004

EC 3029 Optical Communication and Networking

Credit: 3
Category: PEC
Prerequisite(s): Communication Engineering (EC 2016), Introduction to communication Engineering (EC 3044), Analog Communication Technique (EC 2012), Digital communication techniques (EC 3005)

Course Description:

The course intend to introduce the students to light signal propagation through optical fiber, various optical fiber modes, configurations and various signal degradation factors associated with optical fiber and to study about various optical sources and optical detectors and their use in the optical communication system. This course provides a basic understanding of various measurement techniques used for optical communication system. The optical networking system is also explained with the concept of fiber optic network components, variety of networking aspects, topologies, FDDI, SONET/SDH and operational principles WDM.

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

CO1: comprehend the significance of terminology associated with optical communication, analyze the principle of light propagation through optical fiber with concept of modes and solve problems on this concept
CO2: analyze various types of losses and dispersions in optical fiber and solve related problems associated with the concept
CO3: explain and analyze the structure, principle of operation and the characteristics of optical sources and detectors
CO4: comprehend and analyze the optical communication system link elements and prepare link budget
CO5: comprehend various measurement techniques for optical communication system
CO6: comprehend and analyze the fiber optical network components, variety of networking aspects, FDDI, SONET/SDH and operational principles WDM

Topics:
- Transmission characteristics of optical fibers
- Optical sources and detectors
- Optical Communication System and Measurements
- Optical measurements
- Optical networks

Textbook(s):
1. Fiber Optic Communications, Joseph C. Palais, Pearson Education,5th Edition 2013
2. Optical Fiber Communication, Gerd Keiser, McGraw Hill, Third Edition, 2000.

Reference Book(s):
1. Optical Fiber Communication, John M. Senior, Pearson Education, Second Edition, 2007.
2. Optical Communication System, J. Gower, Prentice Hall of India, 2001.
3. Optical Networks, Rajiv Rama swami, Elsevier ,Second Edition, , 2004.
4. Optical Communication Network, Viswanath Mukherjee, McGraw Hill Publication,2000.

EC 3031 ARM and Advanced Processors

Credit: 3
Category: PEC
Prerequisite(s): Microprocessors, Microcontrollers & Interfacing (EC 2020)

Course Description:

The objective of this course is to teach the higher level concepts of Advanced Microprocessors (like 80286, 80386, 80486 and Pentium) and Microcontroller (like ARM) to the students. In this course, the students learn about Multitasking, Virtual memory, Memory management, Paging, TLB, RISC features, Pipelining and Branch Prediction like concepts. They develop skills for writing programs on ARM to solve simple problems as well as some real time applications.

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

CO1: analyze the concepts implemented in higher level Processors like Multitasking, Virtual Memory, Memory Management etc.
CO2: analyze the mode of Operation of 80286 like Real Address Mode and Protected Virtual Address Mode, Concept of program in visible registers, Segment Descriptors etc.
CO3: explain the Mode of Operation of 80386, Segment Descriptors, Privilege level and Protection,Virtual'86 Mode, Paging
CO4: analyze the RISC features implemented in the design of Pentium Processors, Parallel processing through U&V Pipelines/Superscalar Execution and Branch Prediction Techniques
CO5: analyze the concept of a 32-bit ARM Processor, its RISC features, Registers, Pipelining and Interrupts
CO6: analyze the 32-bit ARM instruction setvis-a-vis16-bit Thumb instructions and its applications

Topics:

- Intel higher level Processors, Concept of Multitasking, Virtual memory & Memory management
- Intel 80286 Microprocessor, Real mode, Protected virtual Address mode, Program Invisible Registers, Segment descriptor, Limitation of 80286
- Intel 80386 & 80486 , 80386 Segment descriptor, Privilege level & protection, Task switching, Virtual 86 mode, Paging, TLB, Enhanced features of 80486
- Pentium Processor: Features of RISC processors & Implementation of RISC features in Pentium, Pipelining, Super scalar execution & Branch prediction
- ARM Microcontroller: Introduction to RISC design philosophy and ARM design, Arm Processor Registers, CPSR, Memory map, Pipelines, Exceptions, Interrupt Vector Table
- ARM Instruction set and Thumb instructions

Textbook(s) :

1. The 8088 and 8086 Microprocessors : Programming, Interfacing, Software, Hardware and Applications by Triebel and Singh-Pearson Education, 4thEdition.

Reference Book(s):

1. Microprocessors & Interfacing, Programming&HardwarebyD.V.Hall-TMH-3rd Edition,2012.
2. The Intel Microprocessors8086/8088, 80186/80188, 80386, 80486, Pentium and Pro-ProcessorbyB.B.Brey-PHI-8thEdition.
3. Microprocessors&MicrocomputerbasedSystemDesignbyMd.Rafiquzzaman-UBS-2ndEdition.
4. An Introduction to the Intel Family of Microprocessors by James L. Antonakos-Pearson Education-3rdEdition.

5. ARM Assembly Language Programming &Architecture- M A Mazidi &others - www.MicroDigital Ed.Com.
6. ARM System Developers Guide Design &Optimizing System Software – Andrew N. Sloss &others-Elsevier

EC 3033 Embedded System Design and Application

Credit: 3
Category: PEC
Prerequisite(s): Microprocessor, Microcontrollers and Interfacing (EC2020)

Course Description:

This course covers fundamentals of embedded system hardware and firmware design. Topics such as embedded processor selection, hardware/firmware partitioning, circuit design, circuit layout, circuit debugging, development tools, firmware architecture, firmware design, and firmware debugging will be discussed. The Intel 8051 and PIC18F series microcontroller with instructions will be studied. The course briefly covers ARM processor architecture, instruction set and programming. The course will culminate with a significant design examples using ARM processor.

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

CO1: understand the architecture, programming, and interface requirements of Embedded System Design
CO2: learn to apply assemblers, compilers, simulators and emulators to help with design and verification for ARM processors
CO3: create Interface of Microcontroller to displays, memories, different I/O ports
CO4: analyse and apply ALP / Embedded C code to solve real-time problems like timers, counters, A2D, Motors, etc. using ARM
CO5: understand and explain RTOS and its functionality, different scheduling for real time application
CO6: design closed and open embedded systems with firmware

Topics:

- Embedded system description and design aspects
- Processor and memory selection for embedded system
- Interrupt service and its uses in the embedded system design
- Embedded system design flow
- Embedded system programming concepts
- Brief introduction to 8051 and PIC18F series architecture and its instruction sets
- ARM architecture and its assembly language programming
- Designing hardware interface with ARM using embedded C programming
- Real Time Operating system and its scheduling

Textbook(s):

1. Embedded Systems: Architecture, Programming & Design, Raj Kamal, TMH, 2011
2. ARM Assembly Language: Fundamentals and Techniques by William Hohl, Christopher Hinds, CRC Press, 2nd Edition, 2015.

Reference Book(s):

1. Embedded System Design : A unified Hardware/Software Introduction by Rank Vahid, Wiley Student Edition, Wiley, 2002
2. Arm Assembly Language Programming & Architecture: Volume 1 by Muhammad Ali Mazidi, Sarmad Naimi, SepehrNaimi, Microdigitaled.com, 2nd Edition, 2016

EC 3035 High Speed Digital System Design

Credit: 3
Category: PEC
Prerequisite(s): Digital Electronics (EC 2011)

Course Description:

This course describes the ASIC design flow and FPGA design flow. It also introduces different design methodology such as top-down and bottom-up methodologies. Here, students will learn different coding styles that can be used in Verilog HDL to design and synthesize digital circuits. Also, it is necessary to verify the correctness of the design by applying different input patterns. Therefore, students will also learn testbench writing strategies to verify the correctness of the design. Several examples that include important arithmetic units of digital systems are covered in this course which demonstrate how to design and test the digital circuits using Verilog HDL. In addition, the course discusses the mapping of Verilog HDL to logic gates. It depicts with examples how Verilog HDL constructs are transformed into logic gates and their interconnections. Finally, a brief introduction on how logic-level circuits are converted into transistor-level circuits is illustrated in this course.

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

CO1: comprehend and analyze the ASIC-based and FPGA-based design flow and VLSI design methodology
CO2: design digital systems using Hardware Description Language (HDL)
CO3: develop test cases to simulate and verify the correctness of the design
CO4: convert Hardware Description Language to a gate-level netlist
CO5: implement optimized digital circuits using different HDL-based mechanisms
CO6: design circuits by using knowledge of translating logic circuits to transistor-level circuits

Topics:

- Digital design methodology
- Coding styles of Verilog HDL
- Synthesis of logic circuits
- Mapping of logic circuits to transistor-level circuits
- Case studies for Verilog HDL

Textbook(s):

1. Verilog HDL: A Guide to Digital Design and Synthesis; Samir Palnitkar; 2nd edition, Pearson Education, 2011.

Reference Books (s) :

1. A System Verilog Primer by J. Bhaskar, BS Publication 2013.
2. Advanced Digital Design with the Verilog HDL; Michael D. Ciletti; 2009,1st edition, PHI,2010.
3. Design Through Verilog HDL by by T. R. Padmanabhan (Author), B. Bala Tripura Sundari, Wiley Student Edition, Wiley, 2012.

EC 3036 Cellular Communication

Credit: 3
Category: PCC
Prerequisite(s): Analog Communication Techniques (EC 2012), Digital Communication Techniques (EC 3005), Communication Engineering (EC 2016)

Course Description:

Cellular communication includes different types of channel allocation strategies, propagation path loss and fading in cellular environment. The course is intended to learn design aspects of cellular networks and cellular system where cell splitting, power control, cell sectoring and handoff. Equalization and diversity techniques, Multiple access techniques, multicarrier communications and multiple antenna techniques for understanding and design of cellular networks are parts of this course. Applications of most recent cellular communication techniques like, MIMO and Massive MIMO are also included in the course.

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

CO1: understand and explain the basics of cellular architecture
CO2: describe basic propagation models and signal degradation in wireless channels
CO3: design channel equalization and implement diversity techniques used for practical cellular systems
CO4: distinguish between different types of multiple access schemes and GSM technology
CO5: evaluate and analyze the multicarrier communication using OFDM technique
CO6: design multiple antenna systems in cellular network including MIMO and Massive systems

Topics:

- Cellular Communication Principle
- RF Propagation & Multi-path Model
- Equalization and Diversity Techniques
- Multiple Access Techniques
- Multicarrier Communication
- Multiple Antennas and Space-Time Communications

Textbook(s):

1. Wireless Communication Principle & Practice – T. S. Rappaport, 2nd edition, Pearson Education, 2012.
2. Wireless Communication – Andrea Goldsmith – Cambridge Press, 1st Edition, 2005.

Reference Book(s):

1. Wireless communications – A. F. Molisch-Wiley Publication, 2nd Edition 2010
2. Wireless and Cellular Communication –W. C. Y. Lee – McGraw Hill, 3rd Edition, 2006.
3. Mobile Communication – J. Schiller – Pearson Education, 2nd Edition, 2010.
4. Communication Systems – S. Haykin – John Wiley , 4th Edition, 2001.
5. Fundamentals of Wireless Communication – D. Tse & P. Viswanath –Cambrige, 2010.

EC 3044 Introduction to Communication Engineering

Credit: 3
Category: OEC
Prerequisite(s): Nil

Course Description:

The course covers different types of signals and their analysis in time domain and frequency domain, different analog modulation techniques such as Amplitude Modulation (AM), Frequency Modulation (FM) and Phase Modulation (PM). Sampling technique and its application in Pulse Code Modulation (PCM) is discussed. The course further discusses different digital modulation techniques such as Amplitude Shift Keying (ASK), Frequency Shift Keying (FSK) and Phase Shift Keying (PSK), Binary PSK and Quadrature PSK. Data transmission techniques such as frequency division multiplexing, time-division multiplexing and multiple access techniques are covered. Finally fundamentals of several modern communication system viz. satellite communication system, cellular system are explained.

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

CO1: analyze signals in time domain and frequency domain
CO2:interpret analog modulation techniques, investigate their limitations, advantages and applications
CO3: explain sampling theorem and investigate pulse code modulation
CO4: comprehend digital modulation techniques and multiplexing techniques
CO5: interpret different types of noise, their sources and investigate their effect on communication systems
CO6: analyze several modern communication systems

Topics:

- Representation of signals in time and frequency domains
- Understanding of Fourier series and Fourier Transform, Need of modulation and their types
- Amplitude modulation techniques such as AM, DSB-SC, SSB-SC, VSB
- AM modulators and demodulators, Super-heterodyne radio receiver
- Qualitative concepts of different angle modulation techniques such as FM (Narrowband FM and Wideband FM) and PM
- FM modulators and demodulators
- Sampling theorem and Nyquist rate, sampling types, quantization, Pulse code modulation
- Concept of digital modulation (ASK, FSK, PSK, QPSK) probability of error
- Frequency division multiplexing and Time division multiplexing
- Random processes, concept of noise, different types of noises and their sources
- Representation of white noise in frequency domain, concept of signal to noise ratio
- Introduction to satellite communication, wireless and mobile communication

Textbook(s):

1. Principles of Communication System- H. Taub and D.L. Schilling-TMH, 3rd Edition.

Reference Book(s):

1. Introduction to Analog and Digital Communication System-Simon Haykins, Wiley Student Edition 2011-John Wiley.
2. Electronics Communication System by Kennedy and Davis, Tata McGraw-Hill Publishing Company Limited, 4th Edition.

EC 3050 Internet of Things & Applications

Credit: 3
Category: PEC
Prerequisite(s): Microprocessors, Microcontrollers & Interfacing (EC 2020), Principles of Microprocessors and Microcontrollers (EC 3066)

Course Description:

This course is designed to provide essence and applications of Internet of Things and connected devices. This course establishes solution for real-world applications including appropriate modules and instruments. It also describes the IoT industry, the technologies used to create these types of devices, working principles, information storage and the types of distributed networks required to sustain them.

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

CO1: explain different characteristics of IoT and demonstrate the need of appropriate sensors, microprocessor and microcontroller units and communication networks to develop IoT systems
CO2: identify application specific need of suitable sensors and actuators by analyzing the working of various sensors
CO3: design and evaluate application specific IoT prototypes based on Arduino platform by means of hardware interfaces like Digital IO, Analog In, PWM, UART, SPI, I2C and applications using Arduino IDE
CO4: design and evaluate application specific IoT prototypes based on Raspberry Pi Family development boards and develop small scale applications using python in Linux environment
CO5: apply suitable TCP/IP protocols and networking standards for development of IoT projects
CO6: design IoT application based on Client Server Model, HTTP, ThingSpeak, AWS, Cloud MQTT and evaluate the design specifications and requirements from case studies in the context of various IoT applications

Topics:
- Introduction & Overview of IoT.
- Sensors, Actuators & Signal Conditioning.
- Embedded Platforms & Prototyping (Arduino family and relevant topics)
- Advanced Embedded Development Platforms (PI family and relevant topics)
- Data Communication & Networking
- Cloud, Analytics, User interfaces
- IoT Applications and relevant case studies

Textbook(s):
1. “Internet of Things” by Jeeva Jose, 1st Edition-2018, Khanna Publications
2. “Internet of Things: A Hands-On Approach” by Arshdeep Bahga, Vijay Madisetti

Reference Book(s):
1. “Designing the Internet of Things” by Adrian McEwen, Hakim Cassimally, 1st Edition, Wiley Publishers
2. “Getting Started with the Internet of Things” by Cuno Pfister 1st Edition, O’Reilly Media.
3. “IoT: Building Arduino-Based Projects” by Peter Waher, Pradeeka Seneviratne, Brian Russell, Drew Van Duren, 2016 Edition, Packt Publishing Ltd.
4. “Raspberry Pi IoT Projects: Prototyping Experiments for Makers” by John C. Shovic, 2016 Edition,

EC 3056 Speech & Audio Signal Processing

Credit: 3
Category: PEC
Prerequisite(s): Digital Signal Processing (EC 3007), Principle of Digital Signal Processing (EC 3013)

Course Description:

The aim of this subject is to cover fundamental application research areas such as audio and speech signal processing for separation, recognition, transcription, enhancement, coding, synthesis as well as applications to advanced fixed and wireless communication systems. This course begins with preliminaries to digital signal processing and different transformations. Then the course continues to Speech production, Time domain analysis, Frequency domain analysis, LPC analysis, Speech coding, Speech recognition, Speech enhancement. Signal Processing Models of Audio Perception, Psycho-acoustic analysis, Spatial Audio Perception and rendering, Transform coding of digital audio, audio quality analysis are covered. Applications like speaker verification, identification and enhancement of speech quality are discussed.

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

CO1: determine the digital model of speech production
CO2: analyze the spectral characteristics of the speech signal
CO3: distinguish and analyze between different speech coding techniques
CO4: apply various types of algorithms for speech analysis and synthesis
CO5: design different models for speech recognition
CO6: develop to perform speaker verification, identification and enhance the quality of speech signal

Topics:

- Preliminaries of digital Signals processing and different transform techniques
- Digital modelling of speech signal
- Spectral analysis of speech signal
- Speech coding
- Speech transformation
- Speaker verification, identification and enhancement of speech signal

Textbook(s):

1. Lawrence R. Rabiner and Ronald W. Schafer, Theory and Applications of Digital Speech Processing Pearson, 2010.

Reference Book(s):

1. Thomas F. Quatieri , Discrete-time Speech Signal Processing: Principles and Practice, Prentice Hall, Signal Processing Series, 2002.
2. Philipos C. Loizou, Speech Enhancement – Theory and Practice, CRC Press, 2013.

EC 3058 Nanoelectronics

Credit: 3
Category: PEC
Prerequisite(s): Electronics Devices and Circuits (EC 2019), Analog Electronic Circuits (EC 1004)

Course Description:

Nanoelectronics has emerged as a new advanced discipline due to rapid growth in Integrated Circuit (IC) Industry. This course imparts knowledge and understanding of physical background and application of nanoelectronics. To describe electrons at the nanoscale, the course starts with an introduction to the principles of quantum mechanics, including quantization, the wave-particle duality, wave functions and Schrödinger's equation. The course will further discuss different properties of materials and nanostructures, fabrication of nanostructures, nanoelectronic devices including resonant-tunneling devices, transistors, and single-electron transfer devices. The course will also focus on MEMS and NEMS and its applications in Sensors.

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

CO1: understand the basic and advanced concepts of nanoelectronics
CO2: understand and evaluate the use of fundamental science of quantum mechanics in nanoelectronics
CO3: get an idea on nanoelectronics materials and will be able to distinguish from other materials
CO4: analyze the different fabrication and characterization techniques of nanostructure materials
CO5: learn the concepts of few nano electronics devices
CO6: analyze and evaluate the idea of single electron transistors and its further applications

Topics:

- Introduction to Particles and waves
- Nanoelectronics Materials
- Tunnel junction and applications of tunnelling
- Growth, fabrication, and measurement techniques for nanostructures
- Nano structure devices: MEMS AND NEMS
- The Single-Electron Transistor

Textbook(s):

1. Stephen D. Sentaria, Microsystem Design, Kluwer Academic Press, 2005
2. Marc Madou, Fundamentals of microfabrication & Nanofabrication, CRC Press, 2011.
3. T. Fukada &W.Mens, Micro Mechanical system Principle & Technology, Elsevier, 1998

Reference Book(s):

1. WR Fahrner, Nano Technology and Nano Electronics – Materials, devices and measurement Techniques, Springer, 2004.

EC 3060 Mobile Communication Engineering

Credit: 3
Category: PEC
Prerequisite(s): Communication Engineering (EC 2016), Introduction to communication Engg.(EC 3044)

Course Description:

The course covers the evolution of mobile communication from first generation to third generation digital communication. The concept of Frequency reuse, handoff, trunking and the interference between mobiles and base stations which are the core of mobile communication for providing service to the subscribers are explained in this course. This course also explains different type of propagation path loss, fading and modulation techniques used in mobile communication, Inter Symbol Interference (ISI) by multipath propagation within time dispersive channel and its mitigation technique by Equalizer. Implementation of different diversity techniques for the compensation of fading is elaborated here. This course also explains various type of multiple access techniques and impacts on capacity for a cellular architecture.

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

CO1: define and explain basic Cellular Architecture, Different propagation models, various modulation schemes, multiple access schemes and GSM technology
CO2: classify different generation of mobile communications and improvements, different types of Handoff Strategies, different types of System capacity Improvement Techniques , various fading in multipath propagation, Different modulation techniques, various diversity techniques and different type of multiplexing
CO3: identify different parameters required to improve channel capacity, requirement of Handoff in mobile communication, reasons of Fading, development of transmitter and receiver using different modulation schemes and the requirement of multiplexing
CO4: analyze improvements in different generation of mobile communications, the reason of considering cellular architecture, generation of ISI (Inter symbol Interference) due to multipath propagation, different modulations e.g. QPSK, Offset QPSK, $\pi/4$ QPSK, MSK, GMSK, QAM and spread spectrum modulation and its properties
CO5: compare various technologies implemented among different generation of mobile communications
CO6: solve problems related to different aspects of mobile communication

Topics:

- Mobile Communication Principle
- RF Propagation & Multi-path Model
- Modulation Techniques
- Equalization and Diversity Techniques
- Spread Spectrum modulation
- Multiple Access Techniques

Textbook(s):

1. Wireless Communication – T.S. Rappaport , Pearson Education, 2nd edition, 2012
2. Wireless Communication – Andrea Goldsmith, Cambridge Press, 1st edition, 2005

Reference Book(s):

1. Wireless and Cellular Communication – C. Y. Lee, McGraw Hill, 3rd edition, 2006
2. Mobile Communication – Schillar, Pearson Education, 2nd edition, 2010
3. Wireless Communication-Tse and Viswanath, Cambridge Press, 2010

EC 3062 Smart Antennas

Credit: 3
Category: PEC
Prerequisite(s) Electromagnetic Waves and Antennas (EC 2022)

Course Description:

The course is intended to describe the design principles of Smart antenna used in cellular communication. The course starts with the descriptions and design aspects of different types of antenna arrays and adaptive processing of signal. For a large antenna array used in Smart antenna system the mutual coupling effect is important which is analyzed in this course considering jamming effect. The compensation methods of mutual coupling during antenna array design are also included. The methods of adaptive signal processing for smart antenna design and the different methods of direction of arrival estimation are described in this course.

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

CO1: analyze linear and circular antenna arrays
CO2: classify adaptive processing for smart antenna using different methods
CO3: solve design problems on smart antenna in presence of mutual coupling between the antennas
CO4: compensate mutual coupling in presence of jammers
CO5: solve design problems on smart antenna by estimating direction of arrival (DOA) of signal
CO6: investigate different types of DOA estimation methods

Topics:

- Introduction to Antenna Arrays of Different Kinds and Principles of Smart Antenna
- Direct Data Domain Least Square Approaches to Adaptive Processing
- Mutual Coupling in Adaptive Smart Antennas
- Direction of Arrival (DOA) Estimation and Adaptive Signal Processing for Smart Antennas

Textbook (s):

1. Smart Antennas – T. K. Sarkar, M. C. Wicks, M. Salazar-Palma and R. J. Bonneau, Wiley-Interscience, 1st edition., 2003.

Reference book(s):

1. Smart Antenna Engineering - Ahmed El-Zooghby, Artech House, 1st Ed., 2005.
2. Smart Antennas for Wireless Communication: With MATLAB- F. Gross, McGraw Hill, 1st edition., 2005.

EC 3064 Information Theory and Coding

Credit: 3
Category: PEC
Prerequisite(s): Digital Communication Techniques (EC 2005)

Course Description:

The course will help in forming a strong foundation for the broad areas of information theory, coding and cryptography. It emphasizes on the basic concepts, lays stress on the fundamental principles and motivates their application to practical problems. This course starts with the basics of information theory and source coding. The theory of linear block codes (including cyclic codes, BCH codes, RS codes), convolutional codes are explained. Basics of secure communications including cryptography and physical layer security are covered.

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

CO1: explain the mathematical definitions of information, using conditional and unconditional probability theorem
CO2: demonstrate and differentiate different sources of information and coding techniques
CO3: explain and analyze channel coding schemes and Shannon's information theory
CO4: distinguish between various error decoding schemes
CO5: design and simplify different codes such as cyclic codes, CRC codes (cyclic Redundancy Codes) and BCH codes
CO6: generate Convolution codes

Topics:
- Source Coding
- Channel Capacity & Coding
- Speech Coding
- Error control coding
- Cyclic codes
- BCH Codes and convolutional Codes

Textbook(s):
1. Information Theory, Coding and Cryptography- Ranjan Bose, Tata Mcgraw Hill, 2nd edition, 2011
2. Principle of Digital Communication- J. Das, P. K. Chatterjee & S. K. Mullick, New age Internationals, 2008

Reference Book(s):
1. Elements of Information Theory- T. M. Cover & J. A. Thomas, Wiley-Interscience-2nd edition 2010.
2. Digital Communication- J. G. Proakis, McGraw Hill Education, 4th edition

EC 3066 Principle of Microprocessors and Microcontrollers

Credit: 3
Category: PEC
Prerequisite(s): Digital Electronics (EC 2011)

Course Description:

This subject deals with Microprocessors 8085, 8086, 8255 PPI, 8259 PIC and 8251 USART and basics of 8051 Microcontroller. In this course, the students learn about assembly language programming on Microprocessors, Microcontrollers and develop programs for simple applications.

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

CO1: understand and explain the concept of Bus structure, a basic 8 bit Microprocessor system
CO2: explain the architecture of a 16 bit Microprocessor like 8086 including the concept of instruction queue, segmented memory structure and address generation technique
CO3: explain and analyze the Addressing modes, Assembly language instructions of 8086 and implement them to solve 8086 related design problems
CO4: design Memory Interfacing using memory chips with proper decoder circuits with a 16-bit processor and analyze the interrupt structure of 8086 Microprocessor
CO5: explain the peripherals such as PPI, Programmable interrupt control, USART and their interfacing with a 16 bit processor
CO6: analyze memory organization of a 8 bit Microcontroller (like 8051), its addressing modes, instructions

Topics:

- Semiconductor Memory Chips, Tristate Concept & Bus Structure, A Basic Microprocessor based system
- 8 bit Processor, Bus Structure, 8085 Microprocessor Architecture, Concept of stack, Instructions & Addressing Modes
- 8086 (16 bit Microprocessor) Architecture, Pins & Signals, Minimum & Maximum Mode Configuration, Timing Diagrams; 8086 Addressing Modes and Instructions, Memory Interfacing, Interrupts
- Interfacing chips : 8255 (PPI), 8259 (PIC), 8251 (USART)
- 8051 Family of Microcontrollers, Overview of MCS-51 Family of Microcontrollers Memory Organization Pins & Signals, Addressing Modes, 8051 Instruction set, Interrupts

Textbook(s):

1. Microprocessors and Interfacing, Programming & Hardware - Douglas V. Hall, McGraw Hill Education Pvt Ltd., 3rd Edition

Reference Book(s):

1. Microprocessors & Microcomputer based System Design - Md. Rafiquzzaman, 2nd Edition
2. Advanced Microprocessor and Peripherals - Architecture, Programming and Interfacing by A. K. Ray and K. M. Bhurchandi - McGraw Hill Eduction Pvt Ltd - 3rd Edition.
3. 8051 Microcontroller - Hardware, Software & Applications - V Udayshankara & M. Mallikarjunswamy - TMH - 1st edition.

EC 3068 Real Time Systems and Application

Credit: 3
Category: PEC
Prerequisite(s): Nil

Course Description:

This course covers the principles of real-time systems, modeling of a real-time system, task assignment and scheduling, resource management, real-time operating systems, RTOS services. Programming language with real-time support, system design techniques, inter task communication, fault tolerant techniques, reliability evaluation methods, performance analysis, and case studies of real-time systems applications are also covered.

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

CO1: differentiate between a real time system and other systems
CO2: identify the different parts of hardware needed for real time system
CO3: analyse and design to interface a microprocessor to displays, memories, different I/O ports
CO4: analyse and use RTOS for Real Time System design
CO5: design and Evaluate the function of a real time System
CO6: apply the knowledge to different real time System for solving engineering and social problems

Topics:

- Basic overview of Operating System
- Real Time concepts and hardware considerations.
- Real Time Operating Systems
- Software requirements and Design process
- Application of Real time systems
- Case study

Textbook(s):

1. Real-Time Systems Design and Analysis by Phillip A. Laplante John Wiley & Sons, Inc. Publication,3rd edition, 2011.

Reference Book(s):

1. Embedded and Real-Time Operating Systems by K.C. Wang, Springer, 2017
2. Real-Time Systems: Theory and Practice by Rajiv Mall, Pearson Publisher, 1st edition,2017

EC 3070 MANET and WSN

Credit: 3
Category: PEC
Prerequisite(s): Communication Engineering (EC 2016)

Course Description:

The objective of the course is to provide the basic knowledge of MANET and WSN, identify and analyze the goals, challenges, protocols and the issues involved in designing and implementing MANET and WSN for providing a good quality of service.

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

CO1: comprehend the working and features of MANET
CO2: comprehend and explain the goals, challenges, protocols and issues involved in designing MANET and the quality of service required
CO3: comprehend the fundamentals of WSN
CO4: explain the working principles of physical layer of WSN
CO5: explain and analyze the different protocols, transport layer features and routing of WSN
CO6: identify the challenges in WSN and cross layer solutions

Topics:
- MANET
- MAC, routing and QoS in MANET
- Introduction to WSN
- Physical, MAC & Routing for WSN
- Challenges in WSN and cross layer solutions

Textbook(s):

1. C.Sivaraman Murthy and B.S.Manoj, “Ad Hoc Wireless Networks” , Person Education, Second Edition, India,2001
2. Ian F. Akyildiz and MehmetCan Varun, “Wireless Sensor Networks”, John Wiley and Sons Ltd, Publication 2010

Reference Book(s):

1. K Toh, “Adhoc mobile wireless networks, protocols and Systems”, 2nd Edition, Pearson Education,2009
2. Stefano Basangi, “ Mobile Adhoc Networking”, Wiley Inter science, IEEE Press, 2004
3. George Aggelou, “Mobile Adhoc Networks”, McGrawHill, 2004
4. Jun Zhny and Abbos Jama, “ Wireless Sensor Network - a networking perspective” 2009
5. C. Raghavendram, K.Sivalingam and T.Znati, “Wireless Sensor Network”,Springer,ISBN:1-4020-7883-8,August,2005

EC 3072 Introduction to Machine learning

Credit: 3
Category: PCC
Prerequisite(s): Nil

Course Description:

The course objective is to make students of Engineering to understand the basics of machine learning algorithms which are pervasive in engineering applications. Students will be able to understand the essence and applications of various clustering and classification techniques. Further, they will understand how it can be applied in real world problems. Then, the course covers the detailed analysis on artificial neural network along with few ensemble methods.

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

CO1: develop appreciation for various concepts involved in learning models
CO2: comprehend a wide variety of learning algorithms
CO3: analyze and evaluate ML models
CO4: apply ML algorithms to real-world problems
CO5: optimize the models and report on the expected accuracy
CO6: comprehend the concepts of bagging and boosting

Topics:

- Foundations for ML
- Clustering
- Classification
- Artificial Neural Networks
- Ensembles methods

Textbook(s) :

1. Shai Shalev-Shwartz and Shai Ben-David “Understanding Machine Learning” Cambridge University Press. 2017.
2. Christopher Bishop “Pattern Recognition and Machine Learning” Springer. 2006.

Reference Book (s):

1. Neural Networks, C.M. Bishop, Oxford Press, 1995.
2. Machine Learning for Audio, Image and Video Analysis, F. Camastra, Vinciarelli, Springer, 2007.

EC 3074 Internet Technologies for Cloud & Edge Computing

Credit: 3
Category: PEC
Prerequisite(s): Computer Programming (CS 1093)

Course Description:

The course objective is to introduce various aspects of internet, cloud computing and edge computing. Through this course student can learn about TCP/IP stack implementation for internet. The objective deals with analyses of could and edge applications and its requirement in the real world. Several tools for application specific cloud and edge computing models are discussed in this subject.

Course Outcomes: At the end of course the students will be able to:

CO1: comprehend the idea of TCP/IP stack implementation for application specific requirements of Internet
CO2: comprehend the cloud computing concepts and differentiate between different cloud based services
CO3: comprehend the design aspects of edge computing and analyze the application specific resource requirements
CO4: analyze various cloud & edge application design aspects and software technologies
CO5: evaluate the select tools for application specific cloud and edge computing models
CO6: design cloud and edge computing frameworks for scenario specific IoT applications

Topics:

- Cloud computing
- Edge Computing
- Feedback Concept
- Cloud & Edge application design aspects
- Application specific design aspects for IoT

Textbook(s):

1. Janakiram, “Grid and Cloud Computing”, TMH, 2016
2. Shailendra Singh, “Cloud Computing”, Oxford University Press, 2018

Reference Book(s):

1. Perry Lea, “IoT and Edge Computing for Architects: Implementing edge and IoT systems from sensors to clouds with communication systems, analytics, and security”, 2nd Edition. Packt.
2. R. Buyya, C. Vecchiola and S. T. Selvi, Mastering Cloud Computing Foundations and Applications Programming, Morgan Kaufmann, Elsevier, 2013.
3. R. Buyya, S.N Srirama “Fog & Edge computing Principles & Paradigms”: Wiley , 2019.
4. R. Buyya, High Performance Cluster Computing: Architectures and Systems, Volume 1, Pearson education, 2008.

EC 3076 IoT & Cyber-Physical System Design

Credit: 3
Category: PEC
Prerequisite(s): Internet of Things and its applications (EC 3050)

Course Description:

The course objective is to introduce the fundamentals of Internet of Things (IoT) and Cyber Physical System (CPS). This course covers identification and evaluation of different entities pertaining to IoT and CPS. This course enables student to model IoT and CPS in general. The course envisages discussing IoT and CPS components from the various perspectives including design, networking, communication protocols and standards. The course objective is to evaluate the highly complex infrastructure of CPS using several parameters such as security, privacy, integrity, reliability and resiliency. Different data analytics and platform have also been introduced in the course.

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

CO1: comprehend IoT and Cyber-Physical Systems components and design blocks
CO2: analyze IoT and Cyber-Physical Systems design issues and challenges
CO3: analyze Sensors, Actuators & Embedded System, Network & protocol design aspects and select appropriate components for designing IoT & Cyber-Physical Systems
CO4: evaluate the performance of various scenario specific requirements of IoT & Cyber-Physical Systems
CO5: evaluate and select appropriate computing & analytics platforms for IoT & Cyber-Physical Systems
CO6: design application specific IoT & Cyber-Physical Systems

Topics:

- IoT and CPS Design issues and challenges
- Sensors, Actuators & Embedded System design aspects
- Network & Protocol design aspects
- Computing platforms and Analytics
- Scenario specific applications of CPS

Textbook(s):

1. Complexity Challenges in Cyber Physical Systems, Saurabh Mittal, Andreas Tolk, Wiley.
2. Cyber-Physical Systems: A Computational Perspective, Gaddadevara Matt Siddesh, et. Al, CRC Press.
3. Scalable Computing and Communications: Theory and Practice, Samee U. Khan, et. al., Wiley-IEEE Press

Reference Book(s):

1. Principles of Cyber-Physical Systems, Rajeev Alur, the MIT Press.
2. Security and Privacy in Cyber-Physical Systems: Foundations, Principles, and Applications.
3. Data Analytics for IT Networks: Developing Innovative Use Cases, First Edition, John Garrett, CISCO press
4. Cyber-Physical Systems, Fei Hu, CRC Press

EC 3078 Signal Understanding Using Machine Learning

Credit: 3
Category: PCC
Prerequisite(s): Signals and Networks (EC 2021)

Course Description:

This course gives students a broad knowledge on, and techniques used in contemporary research on computer vision and pattern recognition. It provides an introduction to computer vision including fundamentals of image formation, feature detection and matching, motion estimation and tracking, and classification. Foundations of pattern recognition algorithms and machines learning methods for feature selection, and classification based on supervised and unsupervised learning methods.

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

CO1: comprehend signal processing basics
CO2: apprehend supervised and unsupervised learning mechanisms
CO3: design machine learning models by using various mathematical tools
CO4: use machine learning models for audio & music processing applications
CO5: use machine learning models for image processing applications
CO6: apply machine learning methods in signal processing and communication

Topics:

- Basic of Machine learning Techniques
- Artificial Neural Networks
- Applications of ML for Audio, Music and Image Processing
- Deep Learning Models and its application for image and signal processing

Textbook(s) :

1. Pattern Recognition and Machine Learning, C.M. Bishop, 2nd Edition, Springer, 2011.
2. Deep Learning, I. Goodfellow, Y, Bengio, A. Courville MIT Press, 2016.
3. Automatic Speech Recognition: A Deep Learning Approach, D. Yu and L. Deng Springer, 2016.

EC 3080 Deep Learning

Credit: 3
Category: PCC
Prerequisite(s): Introduction to Machine learning (EC 3072)

Course Description:

The course objective is to cover advanced topics of machine learning in general and deep learning in specific. Deep learning models such as CNN, RNN, LSTM and GRU are covered. This course also covers the brief description of python libraries for implementation of real world problems.

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

CO1: gain knowledge about the basic concepts of Deep Learning
CO2: identify deep learning techniques suitable for a given problem
CO3: understand deep learning algorithms
CO4: understand the concept of CNN model
CO5: solve the problems using various deep learning models
CO6: design application using deep learning techniques for real-world problems

Topics:

- Deep Learning Architecture
- Convolution Neural Networks
- LSTM, GRU
- Deep Learning Libraries
- Implementation of Deep Learning Models

Textbook(s):

1. Deep learning: An MIT Press book in preparation, Bengio, Yoshua, Ian J. Goodfellow, and Aaron Courville, 2015.
2. Deep Learning, I Goodfellow, Y Bengio and A Courville, 1st Edition

Reference Book (s):

1. Learning deep architectures for AI, Bengio, Yoshua, 2009
2. Automatic Speech Recognition: A Deep Learning Approach, D. Yu and L. Deng, Springer 2016.

EC 3082 Minor Project

Credit: 2
Category: PROJ

Course Description:

Students are required to undertake a minor project either as an individual or in a group in consultation with the project guide which may be completed in one semester. The project work is aligned with the discipline of the student and its allied areas. It is preferably related to certain research objective or advanced technical domain. Students will demonstrate higher level learning outcomes and cognitive skills in the implementation of the project.

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

CO1: perform a background study on certain technical aspect and formulate a project objective
CO2: outline a pathway for the implementation of the project within the time line
CO3: apply fundamental engineering concepts, advanced technical know-how, use modern engineering tools, perform experiments and critically analyze the data
CO4: provide engineering solutions, design system components or processes with consideration of public health, safety, and welfare, as well as global, cultural, social, environmental, and economic factors
CO5: function effectively as an individual, and as a member or leader in a team under multidisciplinary settings following ethical practices
CO6: communicate effectively with a range of audiences and prepare technical reports

EC 3091 Electronic Measurements and Instrumentation Laboratory

Credit: 1
Category: PCLC
Prerequisite(s): Nil

Course Description:

In this EM&I laboratory, experiments will be conducted to measure different parameters such as strain, distance, temperature, level, resistance, inductance, capacitance etc.

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

CO1: differentiate and measure the unknown medium and low resistance
CO2: analyze and measure the inductance and capacitance
CO3: analyze and measure the temperature by different temperature transducers
CO4: analyze and measure the distance and strain by LVDT and Strain gauge
CO5: measure the level in a tank using capacitive transducer
CO6: analyze and measure the Q-factor

Topics:

- Measurement of resistance using Wheatstone and Kelvin's double bridge
- Measurement of inductance and capacitance by using Maxwell's bridge and Schering bridge
- Measurement of strain and displacement
- Measurement of temperature by using different sensors
- Measurement of level in a tank using capacitive type level probe
- Measurement of Q-factor of an unknown coil

EC 3093 Microwave and Antenna Laboratory

Credit: 1.5
Category: PCLC
Prerequisite(s): Microwave Engineering (EC 3015)

Course Description:

This laboratory course will empower the students to apply the knowledge developed in the theory course titled Microwave Engineering. The students will be able to use various microwave components and measure the desired parameters. Students will also get familiar with various antennas and understand their radiation characteristics like radiation pattern, gain and directivity. This laboratory course will also introduce the simulation software named CST studio suite where the students can design various microwave components and antennas.

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

CO1: apply concepts of transmission lines for determination of unknown frequency of microwave source and determination of unknown load impedance
CO2: measure coupling coefficient, directivity & insertion loss of a two-hole directional coupler
CO3: measure the coupling coefficient of waveguide Tees
CO4: measure the radiation characteristics of various antennas
CO5: design transmission line matching networks using high frequency simulation software
CO6: design planar antennas using high frequency simulation software

Topics:

- Measurement of unknown frequency of a microwave source using double minimum method and frequency meter
- Determination of unknown impedance of a given load using shift in the minima method
- Measurement of coupling coefficient, directivity & insertion loss of a two-hole directional coupler
- Measurement of coupling coefficient of E-Plane Tee, H-plane Tee and Magic Tee
- Study the radiation pattern and measurement of gain of wire dipole and Yagi-Uda antenna
- Study the radiation pattern and measurement of gain of pyramidal Horn antenna
- Design of quarter wave transformer for impedance matching in microstrip transmission lines using Electromagnetic simulation platform
- Design of microstrip antenna using Electromagnetic simulation platform
- Open ended experiments

EC 3094 Wireless Communication and Networking Laboratory

Credit: 1.5
Category: PCLC
Prerequisite(s): Data Communication And Networking (EC 3028)
Mobile Communication Engineering (EC 4031), Cellular Communication (EC 3036)

Course Description:

The laboratory course introduces readers to the various aspects of wireless &cellular communication and computer networks. The experiments are performed using open-source and industry accepted simulators such as NS2 and Cisco packet tracer, etc. The experiments cover some of the crucial data communication protocols like TCP, UDP, and CSMA. Both wired and wireless network deployment is performed using CISCO Packet Tracer. Experiments on cellular concept, handoffs, and path loss fundamentals are performed on the simulators.

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

CO1: design, simulate and evaluate the performance of different wired network topologies using NS-2
CO2: design, simulate and evaluate the performance of IEEE 802.11 wireless Local Area Network (LAN) using NS-2
CO3: design, simulate and evaluate the performance of virtual LANs(VLANs)under wired, wireless & heterogeneous network configurations using CISCO® Packet Tracer
CO4: analyze and comprehend the frequency reuse concepts and effects of handover (Mobility Management) in mobile cellular networks (MCN)
CO5: analyze and comprehend effect of shadowing on path-loss formula
CO6: analyze the application and scenario-specific network requirements based on case-study/client requirement, and design and simulate networks using the learned utilities

Topics:

- Design, simulation & calculation of throughput for a star connected network with two TCP and one UDP connection using NS2 Simulator
- Design and simulation of an IEEE 802.3 Ethernet Local Area Network (LAN) and observation of the TCP window using NS2 Simulator
- Simulation and investigation of the impact of ‘Contention Window’ size on the performance of IEEE 802.11 MAC protocol using NS2 Simulator
- Design, configuration and simulation of multiple VLANs implemented using CISCO Packet Tracer
- Design, configuration and simulation of wired and wireless (heterogeneous) networks and traffic analysis using CISCO Packet Tracer
- Understand the cellular frequency reuse concept
- Study the effect of handover (Mobility Management) threshold and margin on SINR and call drop probability and handover probability
- Study the effect of shadowing on path loss formula
- Open ended experiments

EC 3095 VLSI Laboratory

Credit: 1
Category: PCLC
Prerequisite(s): Digital Electronics (EC 2011)

Course Description:

The prime objective of this laboratory is to provide a compact idea about recent trends in digital system design, ASIC design and FPGA based hardware design and implementations. The hardware description language (HDL) such as Verilog is used in this lab for FPGA programming. This lab provides exposure to CAD tools used in analog system design.

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

CO1: understand the basics of XILINX VIVADO tools and HDL for implementation of digital logic
CO2: implement different combinational circuits using different modeling style
CO3: implement sequential logic circuit such using Verilog HDL
CO4: analyze and implement of memory using Verilog
CO5: model finite state machines (FSM) using HDL and real time applications using HDL and FPGA
CO6: model of CMOS logic circuits using SPICE

Topics:

- Introduction to XILINX VIVADO tools and Verilog HDL, design flow
- Gate level and data flow modelling
- Behavioral modelling of sequential logic circuits
- Modelling of Finite state machines
- Modelling of memory
- Real time application: Traffic light controller design
- Design and SPICE simulation of MOSFET, CMOS inverter, NAND and NOR gates

EC 3099 Digital signal processing laboratory

Credit: 1
Category: PCLC
Prerequisite(s): Digital signal processing (EC-3007)

Course Description:

This course is designed to teach implementation methods of various aspects related to digital signal processing on OCTAVE. It imparts the knowledge of discrete time LTI signals and systems and theoretical concepts are analyzed on software platforms. Design concepts on various kinds of filters based on the requirements and specifications are also covered. The implementation of basic concepts of multirate signal processing is also explained.

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

CO1: apply the fundamentals of OCTAVE programming to simulate discrete time signals and systems and compute Circular convolution, linear convolution and correlation of discrete time signals
CO2: find solution to the causal difference equations and compute step response and impulse response, compute transfer function, poles and zeros and determine stability of the system
CO3: analyze the signal and its properties in its frequency domain using MATLAB Simulation environment. Use the Discrete time Fourier transform (DTFT) and Discrete Fourier Transform (DFT) in a variety of applications including: signal analysis, circular convolution and long data filtering
CO4: design digital FIR low pass, high pass and band pass filters using OCTAVE after determining the required specifications for a given scenario
CO5: design digital FIR low pass, high pass and band pass filters using OCTAVE after determining the required specifications for a given scenario
CO6: design sampling rate converters, and analyze the effects of the change of sampling rate in the frequency spectrum of the signals

Topics:

- Analysis of an LTI system in time domain using OCTAVE
- Analysis of discrete time signals and system in frequency domain using DFT and DTFT in OCTAVE
- Design of FIR and IIR filters in OCTAVE
- Analysis of multirate signal processing using OCTAVE

EC 4059 Computer Vision & Pattern Recognition

Credit: 3
Category: PEC
Prerequisite(s): Digital Image Processing (EC 6108)

Course Description:

This course gives students a broad knowledge on, and techniques used in contemporary research on computer vision and pattern recognition. It provides an introduction to computer vision including fundamentals of image formation, feature detection and matching, motion estimation and tracking, and classification. Foundations of pattern recognition algorithms and machines learning methods for feature selection, and classification based on supervised and unsupervised learning methods. We focus less on the machine learning aspect of CV and image classification as that is really classify the theory best learned in an ML course.

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

CO1: understand basic concepts, terminology, and theories in the field of computer vision
CO2: become familiar with the major technical approaches involved in computer vision
CO3: identify various approaches of computer vision and pattern recognition, and design the components for it
CO4: understand a wide variety of learning algorithm for pattern recognition
CO5: apply machine learning techniques to solve problems of image classification
CO6: exposure to advanced concepts leading to object categorization and segmentation in images

Topics:
- Introduction
- Motion Estimation
- Computer Vision
- Pattern Recognition
- Image Processing
- Segmentation
- Machine Learning Techniques
- Applications: Surveillance, Object detection, classification etc.

Textbook(s):
1. Computer Vision: Algorithms and Applications by Richard Szeliski.
2. Pattern Recognition and Machine Learning, B. Christopher Bishop, Springer, 2008

Reference Book(s):
1. Computer Vision: A modern Approach, David Forsyth and Jean Ponce, Prentice Hall India, 2004
2. Pattern Classification, Richard O. Duda, Peter E. Hart, and David G. Stork, 2nd edition, Wiley Asia, 2002.

EC 4061 AI and Machine Learning for IoT

Credit: 3
Category: PEC
Prerequisite(s): Mathematics-I (MA 1003), Mathematics-II (MA 1004), Internet of Things and its applications (EC 3050)

Course Description:

The course objective is to explain the data sciences including different types of data acquisition methods using IoT and to their statistical analysis. The course describes the fundamentals of machine learning, artificial intelligence, artificial neural network and deep learning. Understanding the rising importance of IoT it intends to design various IoT based applications using artificial intelligence and machine learning.

Course Outcomes: After completion of course, the students would be able to:

CO1: comprehend data acquisition using IoT and its analysis using mathematical and statistical tool using Machine learning approach
CO2: analyze & apply different techniques and algorithms used in machine learning like regression, clustering, classification & decision trees
CO3: analyze fundamentals of artificial neural network (ANN) techniques and apply it
CO4: analyze fundamentals of AI & deep learning techniques and apply it
CO5: analyze fundamentals of convolutional neural network (CNN) techniques and apply it
CO6: design application specific ML & AI modeling on data acquired through IoT & CPS for intelligent system design

Topics:
- Data science, AI and ML
- ML fundamentals
- Artificial Neural Networks
- Deep Learning
- Application of AI and ML for IoT

Textbook(s):
1. Understanding Machine Learning, Shai Shalev-Shwartz and Shai Ben-David, Cambridge University Press, 2017.
2. Deep learning, Bengio, Yoshua, Ian J. Goodfellow, and Aaron Courville, MIT Press, 2015.

Reference Book(s):
1. Pattern Recognition and Machine Learning, Christopher Bishop, Springer, 2006.
2. Machine Learning, Tom Mitchell, McGraw Hill, 1997.

EC 4081 Project-I

Credit: 3
Category: PROJ

Course Description:

Students are required to undertake a final year major project either as an individual or in a group in consultation with the project guide which may be completed in one year. The project should be related to certain research objective or advanced technical domain. The work encompasses two semesters and to be carried out in two phases (Project-I and Project-II). In Project-I, students are expected to complete detailed literature review, identify their objective and start working on the same; perform experiments, carry out analyses and report their findings to their supervisors and the panel.

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

CO1: conduct a detailed research survey or background study and summarize the theory and findings
CO2: formulate a research question or a general objective of the project
CO3: propose and outline the solution to the research question or a pathway for the implementation of the project with consideration of public health, safety, and welfare, as well as global, cultural, social, environmental, and economic factors
CO4: conduct appropriate experimentation, analyze and interpret data, and use engineering judgment to draw conclusions
CO5: function effectively as an individual, and as a member or leader in a team under multidisciplinary settings following ethical practices
CO6: communicate effectively with a range of audiences and prepare technical reports

EC 4082 Project-II

Credit: 10
Category: PROJ

Course Description:

Project-II is a continuation of Project-I, the second phase of final year major project. Students should complete all related experiments, develop a final solution, product or system and validate the applicability of the same under real time scenario with consideration of public health, safety, and welfare, as well as global, cultural, social, environmental, and economic factors. They produce a detailed technical report on their work as well as individual contribution reports. Throughout the implementation of the major final year project, students should demonstrate all cognitive skills and attainment of all program outcomes and student outcomes.

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

CO1: readily apply fundamental concepts in their area of study for executing the projects
CO2: demonstrate skill in using modern technical tools, apply advanced technical knowledge, integrate information from different sources, perform complex experiments and critically analyze the findings to draw conclusions
CO3: provide engineering solutions to predefined research question or project objective; design system components or processes with consideration of public health, safety, and welfare, as well as global, cultural, social, environmental, and economic factors
CO4: function effectively as an individual, and as a member or leader in a team under multidisciplinary settings following ethical practices
CO5: communicate effectively with a range of audiences and prepare detailed technical reports
CO6: demonstrate knowledge and understanding of the management principles in executing their project as a member or leader of the team, and willingness to engage in life-long learning

EC 4097 Machine Learning Laboratory

Credit: 1
Category: PCC
Prerequisite(s): Introduction to Machine learning (EC 3072), Deep Learning (EC 3080)

Course Description:

Machine Learning is concerned with computer programs that automatically improve their performance through experience. This course covers the theory and practical algorithms for machine learning from a variety of perspectives. This laboratory introduces the Python software which is very helpful for implementation of machine learning and deep learning techniques. Familiarization of various important machine learning libraries such as NumPy, Pandas, Matplotlib and Keras will be done followed by implementation of clustering and classification problems using traditional machine learning techniques. Further, the lab covers the implementation of solving real life problems using deep learning techniques.

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

CO1: gain knowledge about basic functions of Python
CO2: identify various useful machine learning libraries
CO3: understand the implementation procedures for the machine learning algorithms
CO4: identify and apply machine learning algorithms to solve real world problems
CO5: analyze basic operation on data such as accessing, plotting etc.
CO6: design application using deep learning techniques for real-world problems

Topics:

- Python fundamentals
- Machine learning libraries: NumPy, Pandas, Matplotlib, Keras
- Basic operation such as data accessing, data manipulation, plotting etc.
- Implementation of classification using traditional machine learning techniques
- Clustering using different clustering techniques
- Implementation of classification using deep learning techniques

EC 4099 IoT & Connected Intelligent Systems Laboratory

Credit: 2
Category: PCLC
Prerequisite(s): Internet of Things & its Applications (EC3050), Internet technologies for cloud and Edge Computing (EC 3074), Introduction to Machine Learning (EC 3072), AI & Machine Learning for IoT (EC 4061), IoT & Cyber-Physical System Design (EC 3076)

Course Description:

This laboratory is to provide hands-on exposure in IoT and AI-ML based connected-intelligent systems for industry readiness by bolstering the hands-on aspects of technical-Know-how and practical-skill in IoT & ML based a connected intelligent system that is highly demanded in industry. This lab deals with experiments on IoT-based intelligent systems design. Experiments on IoT-based system design using Embedded systems like NodeMCU, Raspberry Pi etc. along with the complete data communication framework based on TCP/IP protocol stack implementation for various application-specific intelligent connected sensors & actuators are covered. It also provides hands-on exposure to IoT and connected intelligent framework with protocols like MQTT/CoAP with sensor and application based device control technique with machine perception techniques (AI & ML) for scenario-specific application requirements of real-world engineering problems on Smart healthcare, smart city, smart home and smart sustainable IoT-based systems.

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

CO1: design different application-specific sensor data acquisition for IoT-cloud using TCP/IP stack
CO2: implement sensor-data acquisition system and intelligent actuator control application using cloud and MQTT protocol for intelligent IoT-based systems
CO3: implement computing on Raspberry Pi and equivalent embedded development platform for intelligent IoT-based systems
CO4: simulate appropriate Machine learning (ML) techniques on acquired sensor data for intelligent application-specific IoT-based systems
CO5: design intelligent Machine perception technique on cloud data for intelligent IoT-based systems
CO6: analyze of AI & ML based techniques on acquired IoT-based Sensor data

Topics:

- Data acquisition for IoT-cloud using TCP/IP stack using NodeMCU and Arduoino IDE
- Application- sensor data for IoT-cloud using TCP/IP stack, and Raspberry Pi
- Intelligent actuator control application using cloud and MQTT
- Apply Machine learning (ML) techniques on acquired sensor data
- Analyze and implement of AI & ML based techniques on acquired IoT-based Sensor data and intelligent inference management and actuator control for application-specific requirements of real-world Smart healthcare application
- Implement of AI & ML based techniques on Sensor data and intelligent inference management and actuator control for application-specific requirements of real-world smart city, smart home and smart sustainable IoT-based systems
- Open Ended Design problems

EC 6108 Digital Image Processing

Credit: 3
Category: PEC
Prerequisite(s): Digital Signal Processing (EC 3007), Introduction to Digital Signal Processing (EC 3013)

Course Description:

This course introduces the concept of Digital image formation, representation and processing of digital image using digital devices such as computers. The processing or manipulation of digital image is achieved via both spatial and frequency domain with an aim to improve pictorial information for better human interpretation, storage, transmission and representation. Towards this goal the course provides both basic and in-depth coverage of image processing techniques such as image enhancement, restoration, color image processing, compression, segmentation, morphological processing and different mathematical transforms.

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

CO1: analyze different image processing applications and learn different techniques to create and apply on digital image for better interpretations of an image
CO2: implement various enhancement and restoration techniques
CO3: explain and analyze the concept of color image processing
CO4: evaluate different image compression techniques for various applications
CO5: explain the concept of morphological operations and image segmentation
CO6: interpret the effect of applying different image transforms

Topics:

- Fundamentals of image processing
- Spatial domain methods of image enhancement
- Frequency domain methods of image enhancement
- Image degradation model and restoration via Inverse filter, Weiner filter and constrained least square approach
- Color image processing via different color models and inter conversion between them
- Different image transforms such as DFT, DCT, Hadamard, KL and SVD and its importance in processing of a digital image so that different types of redundancy can be overcome ,hence an adequate of image compression can be occurred
- Morphological processing through dialation, erosion, opening and closing and discussion on few applications
- Region and edge based method of image segmentation and discussion on few applications
- Review of matrix algebra, 2-D convolution

Textbook(s) :

1. Digital Image Processing, R. C. Gonzalez and R. E. Woods, Prentice Hall, 3rd edition, 2008

Reference Book(s):

1. Fundamentals of Digital Image Processing, A.K. Jain, Prentice Hall
2. Digital Image Processing, S.Jayaraman, S. Esakkirajan, T. Veerakumar, TMH, 2009.
3. Digital image processing and Analysis, B. Chanda, D. Dutta Majumder, PHI, 2004.

EC 6112 Communication and Network Security

Credit: 3
Category: PEC
Prerequisite(s): Data Communication and Networking (EC 3028)

Course Description:

This course is intended to explain various communication security attacks and counter mechanisms. Design and implementation of the security services and mechanisms are also covered.

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

CO1: analyze different security threats and attacks with reference to ISO/OSI model security
CO2: differentiate between various cryptography, watermarking, steganography methods
CO3: analyze different symmetric and asymmetric cryptographic algorithms
CO4: differentiate various key distribution and digital signature
CO5: analyze the working of various communication security protocols with respect to OSI layer
CO6: analyze different network security systems implementation in wireless systems

Topics:

- Ciphers &Algorithm
- Cryptographic Key distribution system
- Communication Security layer classification
- Network security

Textbook(s):

1. Cryptography & Network Security, B A Forouzan and D Mukhopadhyay, Mc-Graw Hill, India, 2nd edition, 2010.
2. Security of Information and Communication Network, S V. Kartalopoulos, Wiley-IEEE Press, 2009.

Reference Book(s):

1. Handbook of Information and Communication Security, Stavroulakis Peter, Springer, 2010.
2. Secure Broadcast communication in Wired and Wireless Communication, Adrian Perrig & Doug Tygar, Kluwer Publication, 2002.
3. Modern Cryptography: Theory and Practice, W Mao, Pearson Education, India, 1st edition, 2003.

EC 6122 Satellite Communication Systems

Credit: 3
Category: PEC
Prerequisite(s): Electromagnetic Waves and Antennas (EC 2022)

Course Description:

The course offers basic concepts of satellite communication. The satellite subsystems, orbital parameters, orbital placement of satellites, LEO, MEO, GEO, and HEO satellite systems are also covered under this course. The satellite link budget preparation and various satellite communication applications are also explained.

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

CO1: comprehend basic parameters for satellite communication
CO2: explain satellite launching methods and orbital control mechanisms
CO3: comprehend different types of losses in satellite link and satellite link design
CO4: differentiate between different types of noises and interferences associated with satellite link
CO5: evaluate the stability of a satellite in orbit and different satellite sub-systems
CO6: investigate different types of multiple access techniques for digital satellite communication

Topics:

- Frequency spectrum for satellite communication, Types of orbits, Kepler's Laws of planetary motion, Orbital perturbations, Geostationary orbit, Satellite launching, General satellite communication, Block diagram uplink, Downlink frequencies, Types of modulation techniques used orbits, and altitude control Satellite launch vehicles - Arian, SLV space shuttle
- Signal loss on transmission through earth's atmosphere, Atmospheric losses, Ionospheric effects, Rain attenuation, Satellite link budget: Transmission losses, Interference, System noise temperature, Link power budget
- Antenna sub-systems, Altitude and orbit control sub-system, Power sub-system, Communication sub-system, TTC&M sub-systems
- Satellite application in TV, Internet, Mobile telephony, Receive only home TV, Master Antenna, TV, Low earth orbit satellite systems and uses. Multiple access techniques - FDMA, TDMA, SS-TDMA, Interference in FDMA systems

Textbook(s):

1. Satellite Communications, T. Pratt & C.W. Bostia, Wiley, 2003
2. Satellite Communication, D. Roddy, McGraw Hill, 2006

Reference Book(s) :

1. Digital Satellite Communications, T.T. Ha, McGraw Hill, 1990

EC 6128 Wireless Sensor Network

Credit: 3
Category: PEC
Prerequisite(s): Data Communication and Networking (EC 3028)

Course Description:

The course gives an overview of wireless sensor network and its applications in military, environment, health care and industrial automation. It describes various physical layer and MAC layer protocols with emphasis on basic requirements of WSN. It further deals with network and transport layer protocols also with emphasis on basic requirements of WSN. Various cross layer effects and optimization techniques are also discussed. Further, localization techniques viz. Range based Localization Protocols and Range free Localization Protocols. Finally, the challenges associated with time synchronization and some protocols are discussed.

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

CO1: find the architecture of WSN and network design factors
CO2: interpret the physical and MAC layer issues in WSN
CO3: choose routing mechanisms in applicable in specific WSN
CO4: analyze logical communication between application processes running on different hosts and interlayer and cross layer effects and solutions for WSN
CO5: estimate localization, ranging techniques and ranging based protocols for WSN
CO6: adapt the concepts of Time Synchronization and challenges involved therein

Topics:

- Basic Concepts, Platforms, Standardization, Architecture, Protocols, Applications, PHY layer standard (IEEE 802.15.4), MAC challenges, MAC protocols, S-MAC, B-MAC, CC-MAC, TRAMA, Zebra MAC, Routing challenges, SPIN, LEACH, MECN, SAR, Challenges of Transport layer, PSFQ, CODA, Interlayer Effects, MAC-Network, MAC-Application, Network - PHY, Transport –PHY, Challenges in localization, Ranging Techniques, Range based Localization Protocols, Range free Localization Protocol, Challenges for Time synchronization, TPSN, TDP, RDP

Textbook(s):

1. Wireless Sensor Networks – Ian F. Akyildiz and Mehmet Can Vuran, John Wiley and Sons Ltd, Publication, 2010.

Reference Book(s):

1. Wireless Sensor Network - a Networking Perspective, Jun Zheng and Abbas Jamalipour,Wiley, 2009.
2. Wireless Sensor Network, C. Raghavendram, K Sivalingam and T. Znati, Kluwer Academic Publishers, 2004.

EC 6224 Low power VLSI Design

Credit: 3
Category: PEC
Prerequisite(s): VLSI Design

Course Description:

This course describes the factors that are responsible for power dissipation in MOSFET devices and circuits. It also teaches how to estimate the average and maximum power dissipations in a circuit. In addition, different design techniques to reduce the power dissipations in VLSI circuits are outlined in this course.

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

CO1: comprehend and analyze different MOS Logic circuits and power dissipation concept
CO2: differentiate and apply scaling techniques in different toplology
CO3: optimize the power dissipation in CMOS circuits through switched capacitance minimization approach
CO4: optimize the power dissipation in CMOS circuits through different lower power minimization techniques in architecture level
CO5: optimize the power dissipation in CMOS circuits through different lower power minimization techniques in gate level
CO6: design different low power memory logic

Topics:

- Power dissipation and its types.
- Scaling methods.
- Switched capacitances.
- Leakage power optimization in architecture design.
- Leakage power optimization in design.
- Circuit level implementation for optimum performance

Textbook(s):

1. Low-Power CMOS VLSI Design, Kaushik Roy and Sharat C. Prasad, Wiley-India, 2011.
2. CMOS Digital Integrated Circuits, Sung-Mo Kang and Yusuf Leblebici, 3rd edition, TMH, 2011.

Reference Book(s):

1. CMOS VLSI Design: A circuits and Systems Perspective, West, Harris and Banerjee, 3rd edition, Pearson Education.
2. Low Power VLSI CMOS Circuit Design, A. Bellamour, and M. I. Elmasri, Kluwer Academic Press.
3. Low Power Digital CMOS Design, Anantha P. Chandrakasan and Robert W. Brodersen, Kluwer Academic Publishers, 2002.
4. Essentials of VLSI Circuits and Systems, Eshraghian, Puckness and Eshraghian, 2nd edition, Pearson Education.
5. Digital Integrated Circuits: A Design Perspective, J. M. Rabaey, Anantha Chandrakasan and Borivoje Nikolic, 2nd edition, PHI, 2001.

COURSES OF OTHER PROGRAMMES

CS 2001 Data Structures And Algorithms

Credit: 4
Category: PCC
Pre-requisite(s): Computer Programming (CS 1093)

Course Description:

This course explores several fundamental algorithms and data structures of computer science. Some of the data structures include arrays, linked lists, stacks, queues, trees, heaps, hash tables, and graphs. Students also study and analyze algorithms for searching, traversing trees, hashing, sorting, finding shortest searching, and much more.

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

CO1: understand the concepts of data structure, data type, abstract data type (ADT) and compute the complexity of different algorithms
CO2: understand, distinguish and implement Array and Linked data structure on different types of problems
CO3: apply different linear data structures such as Stack and Queue to solve various problems
CO4: apply and Evaluate different non-linear data structures such as Tree and Graph on various computing problems
CO5: apply and Evaluate standard algorithms for searching, sorting and hashing
CO6: create the data structure that efficiently models the information in a problem

Topics:

- Introduction
- Arrays
- Linked List
- Stacks and Queues
- Trees
- Graphs
- Sorting
- Searching

Textbook(s):

1. Fundamentals of Data Structures in C, 2nd edition, Horowitz, Sahani, Anderson-Freed, Universities Press.

Reference Book(s):

1. Data Structures, Schaum's OutLines, Seymour Lipschutz, TATA McGRAW HILL
2. Data Structures using C by Aaron M. Tenenbaum, Yedidyah
3. Data Structures A Pseudocode Approach with C, 2nd Edition, Richard F. Gilberg, Behrouz A. Forouzan, CENGAGE Learning, India Edition
4. Data Structures Using C, Second Edition, Reema Thereja, Oxford University Press
5. Data Structures and Algorithm Analysis in C, Mark Allen Weiss, Pearson Education, 2nd Edition.

CS 2091 Data Structures Laboratory

Credit: 1
Category: PCLC
Prerequisite(s): Computer Programming (CS 1093)

Course Description:

The data structure lab is to develop skills for the design, analysis and implementation of operations like search, insertion, deletion, traversal, and other specified problem definition on various linear and nonlinear data structures. It improves the ability to define, apply the appropriate data structure for the real world problem and various techniques for representation of the data in the real world. In addition, it helps them to gain knowledge of data structure applications related to industry.

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

CO1: understand the importance of structure, unions and abstract data type, and their basic usability in different applications through C programming language
CO2: analyze, differentiate and implement different algorithms based on their time and space complexity
CO3: understand and implement the linked implementation, and its uses both in linear and non-linear data structure
CO4: understand and implement various data structures such as stacks, queues, trees, graphs, etc. to solve various computing problems
CO5: understand and implement various kinds of searching and sorting techniques, and know when to choose which technique
CO6: decide and implement the suitable data structure and algorithm to solve a real world problem

Topics:

- Array, pointer with Dynamic Memory Allocation
- Structure, Single Linked List
- Doubly Linked List, Circular Linked List
- Polynomial Representation, Addition & Multiplication, Sparse Matrix Représentation, Addition & Multiplication
- Stack
- More on Stack & Applications of Stack
- Queue
- Tree
- Graph
- Searching & Sorting

EE 3028 Power Electronic Circuits

Credit: 3
Category: PEC
Prerequisite(s): Analog Electronic Circuits (EE 2013)

Course Description:

Elements of Power Electronics, Thyristor characteristics, Power BJT, Power MOSFET and IGBT, TRIAC and DIAC Characteristics and applications, controlled rectifiers with R, R-L, R-L-E load and effect of freewheeling diode, Dual converters, Effect of source Inductance, 3-phase half wave and full wave controlled rectifiers Step up and Step Down choppers, 2nd and 4th quadrant choppers for control of DC motor, Switch Mode Power Supply, Fly back converter, Single phase Half Bridge and Full bridge inverters, Concept of multi level inverters, Cyclo-converter with R-L Load, Concept of 3-phase cyclo-converter.

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

CO1: remember the working principles of various power electronic semiconducting devices
CO2: interpret the concepts of single phase and three phase controlled rectifiers
CO3: apply the semiconducting devices for the control of single phase and three phase Inverters
CO4: compare different topologies of DC to DC converters
CO5: evaluate the performance of various single-phase AC to AC converters
CO6: choose a proper converter configuration for industrial suitability

Topics:
- Introduction to Power Electronics
- Power Electronic Devices
- AC to DC Converters
- DC to DC Converters
- Switch Mode Power Supply SMPS
- Inverters
- AC to AC Converters

Textbook(s):
1. Power Electronics By M. H. Rashid, Pearson Education, 3rd Edition, 2014.
2. Power Electronics by P S Bhimbhra, Khanna Publishers, 4th Edition, 2012.

Reference Book(s):
1. Power Electronics by M. D. Singh and K. B. Khanchandani, Tata McGraw-Hill publishers, Second Edition, 2007.
2. Power Electronics, Converters, Applications and Design N. Mohan, Undeland& Robbins, John Wiley and Sons, Third Edition, 2002.
3. Modern Power Electronics by P C Sen, S.Chand Publication 2013
4. Fundamental of Power Electronics by S K Bhattacharya, Vikas Publishing, 1st edition-2005.

EI 2003 Electrical & Electronic Measurement Techniques

Credit: 3
Category: PCC
Prerequisite(s): Basic Electrical Engineering (EE 1003)

Course Description:

The objective of the course is to provide the basic knowledge of Instruments and Measurement techniques providing an in-depth understanding of errors in measurement techniques, Bridge measurements, Function Generator and Spectrum Analyzer, Display devices, watt meters, energy meters and analytical instruments.

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

CO1: comprehend and explain different measurement techniques and universal instruments
CO2: explain different measurement techniques for measuring the parameters of various electrical components
CO3: explain and analyze construction of instruments used for measuring current, voltage, frequency and spectrum
CO4: measure the power, energy and power factor using watt-meters and energy-meters
CO5: apply the CRO for various electronic measurements
CO6: analyze spectral analysis of the signals on spectrum analyzers

Topics:

- Introduction to instrumentation and measurements
- Classification and characteristics of Instruments.
- Overview of electrical and electronic measuring instruments
- DC and AC bridges
- Measurement of Power, Energy
- Function generator and Spectrum analyzer

Textbook(s):

1. A Course in Electrical and Electronic Measurements and Instrumentation, A K Sawhney, Dhanpat Rai & Co, Reprint, 2013.
2. Modern Electronic Instrumentation and Measurement Techniques, Helfrick & Cooper, 2nd Edition, PHI.

Reference Book(s):

1. Electrical Measurements and Measuring Instruments, Golding & Widdis , 5th edition, Reem Publication.
2. Electronic Instrumentation, H S Kalsi, 3rd Edition, TMH.
3. Electronic Instrumentation &Measurements, David A. Bell, 3rd Edition, Oxford University press.
4. Elements of electronic instrumentation and measurement, Joseph J. Carr, 3rd edition

EI 2010 Principles of Measurement and Instrumentation

Credit: 3
Category: PCC
Prerequisite(s): Nil

Course Description:

The objective of the course is to provide the basic knowledge of Instrumentation and Measurement, identify and correct errors in measurement techniques, Bridge measurements, Function Generator and Analyzer, Display devices, sensors/transducers and Analytical instruments.

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

CO1: estimate different types of errors in measurements and interpret the instrument data sheet
CO2: measure the unknown electrical quantities by selecting the appropriate bridge circuit
CO3: explain and analyze the working principle of various sensors and transducers
CO4: comprehend the basic principles of operation for various electrical and electronic measuring instruments
CO5: describe the operation of wave shaping circuits and spectrum analyzer
CO6: apply appropriate analytical instruments for measuring and analyzing materials

Topics:

- Introduction to instrumentation and measurements, basic requirements & methods of measurement
- Classification and characteristics of Instruments
- Overview of electrical and electronic measuring instruments
- DC and AC bridges
- Introduction to various types of sensors & transducers
- Function generator and Spectrum analyzer
- Analytical instrumentation: Chromatography, Spectrophotometer, pH meter

Textbook (s):

1. Electrical and Electronic Measurements & Instrumentation By A.K. Sawhney – Dhanpat Rai, 2013.
2. Electronic Measurement & Instrumentation By H. Cooper – PHI, 2nd edition.

Reference Book (s):

1. Electronics Instruments & Measurement by David A. Bell –Oxford, 3rd edition

EI 2012 Sensors & Signal Conditioning

Credit: 3
Category: PCC
Prerequisite(s): Electrical & Electronic Measurement Techniques (EI 2003)

Course Description:

The main aim of introducing this course is to provide the basic concept of instrumentation and its characteristics. It covers the details on identification, classification, construction, working and domestic as well as industrial applications of various transducers. The course also includes sensing principle for the measurement of motion, force, torque using analog, digital transducers and methods for signal conditioning and analysis.

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

CO1: comprehend the concept of various transducers, sensors and their brief performance specifications
CO2: analyze different types of errors in measurement and instrumentation
CO3: explain the principle of operation for various transducers used to measure temperature and pressure
CO4: explain the principle of operation for various transducers used to measure force, acceleration, displacement etc.
CO5: analyze various signal conditioning techniques
CO6: apply various transducers for domestic and industrial uses

Topics:

- Introduction to Sensor and Transducer
- Resistive Transducer
- Displacement transducer
- Proximity sensor
- Digital transducer
- Voltage generating transducer
- Magnetic type transducer
- Signal conditioning circuit
- Transducers for Miscellaneous measurement

Textbook(s):

1. Transducer & Instrumentation, MurthyDVS,2001,Prentice Hall of India.
2. Principle of Measurement Systems- J.P. Bentley 4th edition, Pearson eduation.

Reference Book(s):

1. Sensors & Transducers, Patranabis. D, 2003,PHI.
2. Introduction to Measurement and Instrumentation- AK.Ghosh, 2012, PHI.

EI 2095 Electrical & Electronic Measurements Laboratory

Credit: 1
Category: PCLC
Prerequisite(s): Nil

Course Description:

In this E&EM laboratory, experiments will be conducted to measure different parameters such as strain, distance, temperature, level, resistance, inductance, capacitance etc.

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

CO1: calibrate the ammeters and voltmeters using DC potentiometer
CO2: measure and analyze unknown electrical parameters such as medium and low resistances using DC bridges
CO3: measure and analyze unknown electrical parameters such as capacitance and inductance using AC bridges
CO4: measure the frequency of an unknown periodic signal
CO5: determine the accurate quality factor of an unknown coil
CO6: analyze and measure of 3-Phase power using 2-wattmeter method

Topics:

- Measurement of resistance using Wheatstone and Kelvin's double bridge
- Measurement of inductance using Maxwell's bridge, Hay's bridge
- Measurement of Capacitance using Schering's bridge
- Measurement of frequency using Wien's bridge
- Calibration of ammeter and voltmeter by using DC potentiometer
- Measurement of 3-Phase power using 2-wattmeter method

EI 3009 Instrumentation Measurement Techniques

Credit: 3
Category: PCC
Prerequisite(s): Electrical & Electronic Measurement Techniques (EI 2003)

Course Description:

Students will analyze the construction and operating principles with applications of Industrial Instruments used for measurement of parameters like temperature, pressure, level, flow, viscosity & humidity and its safety precautions during process measurement.

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

CO1: explain and analyze the construction and working principle of Industrial Instruments for Temperature, Level, Pressure, Flow, Viscosity & Humidity
CO2: explain sensor, transducer and their performance specifications for measurement of different process variables
CO3: apply different measurement techniques of instruments in industry
CO4: apply specific instruments for the measurement of different process variables
CO5: analyze the industrial application and calibration of Industrial Instruments
CO6: analyze the use of Industrial Instruments in hazardous locations

Topics:

- Temperature measurement
- Pressure Measurement (Gauge and vaccum)
- Level measurement, Flow measurement
- Viscosity, density, conductivity and humidity measurements
- Instrumentation in hazardous locations

Textbook(s):

1. Industrial Instrumentation & Control, S. K. Singh, 3 rd Edition, TMH.
2. Industrial Instrumentation, K.Krishnaswamy, S.Vijayachitra, 2nd edition, New age international.

Reference Book(s):

1. Instrument Engineers Handbook,Vol1,B.G Liptak, CRC Press
2. Measurement System Application and Design E.O Doeblin, 5th edition, TMH

EI 3023 Neural Network and Fuzzy Logic Control

Credit: 3
Category: PEC
Prerequisite(s): Mathematics-I (MA 1003), Mathematics-II (MA 1004) and Control Systems (EL 3001)

Course Description:

This course is about Artificial Neural Network & Fuzzy Logic models to handle uncertainty and solve engineering problems. Objective of this course is to impart adequate background knowledge so that in future students will be able to design and implement various machine learning algorithms in a range of real-world applications. The course covers learning based solutions for regression and classification, by using error minimization, concept of association, competitive learning, and fuzzy rule based methods. The course The course also covers applications of ANN and fuzzy logic for solving pattern recognition and control system.

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

CO1: analyze supervised and unsupervised learning for regression, classification and clustering
CO2: comprehend the concepts of feed forward neural networks
CO3: identify and describe appropriate Artificial Neural Network techniques in building intelligent machines
CO4: demonstrate the concept of fuzziness involved in various real world phenomena and need of fuzzy set theory
CO5: comprehend fuzzy rule based or expert system
CO6: analyze applications of Neural Network and Fuzzy logic in image processing

Topics:

- Introduction to Machine Learning
- Feed Forward Neural Network and Back-Propagation
- Pattern Association and Adaptive Resonance models
- Learning of ANN models based on Competition
- Fuzzy Set Theory and Fuzzy Membership
- Fuzzy-Inference-Systems
- Applications of Neural Network and Fuzzy Logic

Textbook(s) :

1. Fundamentals of Neural Networks, Laurene Fausett, Pearson Education, 2004
2. Fuzzy Logic with Engineering Applications, Timothy Ross, McGraw-Hill, 1998

Reference Book(s):

1. Introduction to Neural Networks Using Matlab, Sivanandam , S. N , Sumathi, S. and Deepa, S. N, 2005, TMH.
2. Fundamentals of Artificial Neural Networks, Mohammad H. Hassoun, 1st edition, 2019, PHI
3. Neural Networks and Fuzzy Systems, Bark Kosko, 1st edition, PHI

EI 3024 Virtual Instrumentation

Credit: 3
Category: PEC
Prerequisite(s): Digital Electronics (EC 2011)

Course Description:

The objective of the course is to provide the basic knowledge of PC based instrumentation systems and to develop concepts of designing virtual instruments along with its applications in various fields ranging from signal processing, image processing to motion control.

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

CO1: explain the components of Virtual instrumentations and use them for PC Based Measurement
CO2: develop programming skills on application development software
CO3: simulate with LabVIEW software for instrument control, measurement, data acquisition and data handling
CO4: differentiate between different data acquisition techniques on virtual instrumentation
CO5: implement different controllers and conduct testing using industry standard software
CO6: differentiate between various Industrial network components and protocols

Topics:

- Sensors and Transducers
- PC Based Measurement
- Introduction to LabVIEW
- Organization of the LabVIEW system and software
- Program elements of LabVIEW
- Data Acquisition & Signal Conditioning
- Remote laboratory for Electrical experiments
- Examples of real time control and measurement applications
- Communication networked modules

Textbook(s):

1. Virtual Instrumentation Using LabView, Jerome, 1st edition, PHI
2. LabView Graphical Programming, Gary W. Johnson, Richard Jennings, 4th edition, TMH

Reference Book(s):

1. Practical Data Acquisition for Instrumentation and Control Systems, John Park and Steve Mackay, 2003, Newnes
2. LabVIEW based advanced instrumentation system, Psumathi, 1st edition,2007, Springer science Elsevier.

EI 3025 Principle of Analytical Instrumentation

Credit: 3
Category: PEC
Prerequisite(s) Chemistry (CH 1007)

Course Description:

This course covers analytical instruments are , different types of Spectrophotometers such as Infrared Spectrophotometers and Flame Photometers with their instrumentation are discussed. Gas Chromatograph and Liquid Chromatography, pH Meters and Ion Analyzers are covered. It also includes Spectrometers, Radiochemical Instruments and Pollution Monitoring Instruments. This course enriches the knowledge of students about analytical instruments used in industries.

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

CO1: differentiate between various techniques involved to determine the concentration of each component from a mixture
CO2: demonstrate methods to measure the pH level of a liquid using pH meters
CO3: demonstrate how different gas analyzers are used in industry
CO4: analyze the different spectrums using spectrometers
CO5: comprehend the operating principle of instruments used for radiation detection
CO6: analyze the operating principle of instruments used for pollution monitoring

Topics:

- Fundamentals of Analytical Instruments
- Spectrophotometry
- Chromatography
- pH Meters and Ion Analyzers
- Analyzers
- Spectrometers
- Radiochemical Instruments:
- Pollution Monitoring Instruments

Textbook (s):

1. Handbook of Analytical Instruments – by R.S. Khandpur, 2nd edition, TMH

Reference Book(s):

1. Instrumental Methods of Analysis, Hobart H. Willard, 2012, 7th edition, CBS publisher
2. Principles of Industrial Instrumentation, D. Patranabis, 3rd edition, TMH.

EI 3027 Industrial Instrumentation

Credit: 3
Category: PEC
Prerequisite(s): Nil

Course Description:

This course is designed to improve knowledge and skills by providing a better understanding of process variables, control systems, sensors, transmitters, and more. It also provides the basic overview of power plant instrumentation and control techniques.

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

CO1: explain sensor, transducer and their performance specifications for measurement of different process variable
CO2: analyze the construction and working principle of instruments used in various industries for measurement of different process variables like Temperature, Level and Pressure
CO3: analyze various instrumentation and control used in power plant
CO4: identify appropriate analytical instrument for measuring, analyzing and establishing the composition of materials
CO5: solve design problems of the power plant and its various control mechanisms
CO6: perform measurements and control of turbine systems and its safety

Topics:

- Principles of various temperature, pressure, and level sensors used in industrial instrumentation
- Analytical measurements
- Basics of power plant instrumentation – water circuit, air-fuel circuit
- Turbine monitoring and control

Textbook(s):

1. Power plant Instrumentation-K. Krishnaswamy, M. Ponnibala, 2ndedition,PHI publication
2. Industrial instrumentation & control, S. K. Singh, 3rd Edition, TMH publication.

Reference Book(s):

1. Instrument Engineers Handbook, Vol-1, B.G Liptak, CRC press.
2. Handbook of Analytical Instruments- by R. S. Khandpur, 2nd edition, TMH

EI 3029 Process Dynamics and Control

Credit: 3
Category: PEC
Prerequisite(s): Principle of Control System (EL 2002)

Course Description:

This course covers the fundamental aspects of process dynamics and control, which includes developing dynamic models of processes, control strategies for linear time-invariant systems and instrumentation aspects. The course deals with the development of models for control system design.

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

CO1: develop mathematical model and process
CO2: analyze dynamic behavior of different processes
CO3: design basic control schemes using hydraulic, electronic and pneumatic methods
CO4: tune PID controller to improve the performance
CO5: design various complex control schemes for SISO systems
CO6: design controller for multivariable processes

Topics:

- Process dynamics and modelling
- Dynamic response of processes
- Basic control schemes
- Controller tuning
- Complex control schemes
- Controller design for multivariable process

Textbook(s):

1. Process control: Principles and applications, Surekha Bhanot, Oxford,2008.

Reference Book(s):

1. Modern control engineering, K.Ogata, 5th edition, PHI
2. Process control, Dynamic concepts and applications, S.K.Singh, PHI,2007

EI 3030 Power Plant Instrumentation

Credit: 3
Category: PEC
Prerequisite(s): Nil

Course Description:

This course provides a knowledge of the instruments that are used to measure and control the processes of electric power generation, processes of the generation of electricity from tradition fuel sources. The course covers an overview of power generation covering the various conventional and non-conventional energy sources , instrumentation and control of boilers and turbine monitor.

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

CO1: comprehend various components of thermal power plants and their operations
CO2: measure the water flow, steam flow and pressure in the water circuit
CO3: design control schemes for the water circuit
CO4: measure flow, pressure, temperature and level in air fuel circuit
CO5: measure electrical, mechanical and process turbine parameters
CO6: design the control schemes for turbines

Topics:

- Overview of Power Generation
- Instrumentation and Control in Water Circuit
- Instrumentation and Control in Air-Fuel Circuit
- Turbine–Monitoring and Control

Textbook(s):

1. Power Plant Instrumentation – K.Krishnaswamy, M.Ponnibala, 2nd edition, PHI publications.
2. Power Plant Engineering - P.K Nag, 3rd edition, Tata McGraw-Hill.

Reference Book(s):

1. Standard Boiler Operations - S.M. Elonka and A.L Kohal, Tata McGraw-Hill.
2. Mechanical and Industrial Measurements - R.K Jain, 2008, Khanna Publishers.
3. Power Plant Engineering – EL. Wakil, Tata McGraw-Hill.

EI 3032 Principle of Sensors & Data Acquisition

Credit: 3
Category: PEC
Prerequisite(s): Electrical & Electronic Measurement Techniques (EI 2003),Principle of Measurement & Instrumentation (EI 2010)

Course Description:

The main aim of introducing the course is to demonstrate a critical understanding of elements of signal conditioning necessary for a number of sensors and transducers. This course includes operation of analog to digital and digital to analog converters. This course includes appropriate techniques and devices for realizing a data acquisition system and function of output drivers and devices also.

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

CO1: comprehend working principle of sensors & transducers
CO2: characterize and calibrate the sensors & transducers
CO3: comprehend the design of motion transducers used for measuring rotational displacement and velocity
CO4: understand the working of industrial automation systems such as PLC, SCADA
CO5: design amplifiers used for signal conditioning
CO6: understand the application of different data acquisition and conversion systems

Topics:

- Introduction to sensors and transducers
- Rotational displacements
- Rotational velocity
- PLC and SCADA
- Signal Conditioning
- Data acquisition systems
- Instrument calibration concepts

Textbook(s):

1. Electronics measurements and Instrumentation, R.K.Rajput, S.Chand, 2nd revised edition,2011

Reference Book (s):

1. Digital control and state variable methods: Conventional and Intelligent control systems, M.Gopal, 4th edition, 2012.

EI 3091 Instrumentation Laboratory

Credit: 1
Category: PCLC
Prerequisite(s): Basic Electrical Engineering (EE 1003), Analog Electronics (EC 2027)

Course Description:

This lab will deal with various sensors, their operations, different interfacing techniques with microcontrollers and use of LCDs for output.

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

CO1: analyze characterization of strain and force sensors
CO2: measure the level of fluid by capacitive transducers
CO3: design flow sensors for flow measurement
CO4: analyze characterization of temperature sensors
CO5: analyze characterization of the displacement, pressure sensors
CO6: interface sensors with micro-controller for precise measurement

Topics:

- Strain and force sensor
- Capacitive transducers
- Flow sensor
- Temperature sensors
- Displacement, pressure sensors
- Interfacing sensors with microcontroller for precise measurement

EI 3092 Process Control Laboratory

Credit 1
Category: PCLC
Prerequisite(s): Process Control (EI 3010)

Course Description:

Process control lab deals with automation(PLC/DCS) and different controllers(P, PI, PID) for understanding the characteristics and performance of the level, temperature and flow. PLC platform with HMI is also available through which different on-board applications like conveyor belt control, temperature control, dc motor speed control using ladder logic can be performed. Experiments on pc based level, pressure, flow, temperature loop stations with air compressor using digital PID controller are also conducted.

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

CO1: determine the characteristics of open and close loop systems using PID controller
CO2: apply the concepts of interacting and non-interacting liquid level system
CO3: apply the concepts of PLC, DCS & SCADA and its interfacing with real time system
CO4: control traffic light, water level in tank, speed of DC motor and control conveyor belt with PLC using ladder logic programming
CO5: obtain the response using P, PI & PID controller for a typical flow, level, pressure & temperature process station with air compressor
CO6: analyze the characteristics of control valve, I/p & P/I converter

Topics:

- Introduction to Basic Ladder Logic Programming
- Development of Ladder Logic Using Universal PLC Platform With HMI
- Hardware Verification of Open and Closed Loop Performances of Tank Filling Process Using E-906 PID Controller
- Hardware Verification of Open and Closed Loop Performances of Flow Rate Regulatory Process Using E-906 PID Controller
- Hardware Verification of Open and Closed Loop Performances of Heat Furnace Process Using E-906 PID Controller
- Hardware Verification of Level Control Loop Performance Using Digital PID with Air Compressor
- Hardware Verification of Flow Control Loop Performance Using Digital PID with Air Compressor
- Hardware Verification of Pressure Control Loop Performance Using Digital PID with Air Compressor
- Hardware Verification of Temperature Control Loop Performance Using Digital PID with Air Compressor

EL 2002 Principle of Control Systems

Credit: 3
Category: PCC
Prerequisite(s): Principle of Signals and Systems (EC 2023), Signals and Networks (EC 2021)

Course Description:

This course covers concepts of open- and closed-loop systems, mathematical modeling of physical system, transfer functions, signal flow graphs, feedback theory, time domain analysis, design specifications & performance indices. This course also deals with time response of 2nd order systems, stability analysis using Routh-Hurwitz criteria and root-locus methods, Nyquist plots, frequency responses, Proportional, PI, PID controllers and Lead-lag compensators.

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

CO1: comprehend open and closed loop control systems
CO2: compare various time domain specifications and describe their significance
CO3: explain the concept of P, PI and PID Controller
CO4: analyze stability using root locus and Routh stability criterion
CO5: determine the stability of the given control system by constructing Nyquist Plot
CO6: plot Bode plots for stability analysis and design lag, lead, lag-lead compensators based on its specifications

Topics:

- Mathematical modeling of physical system
- Feedback Theory
- Time domain analysis, design specification & performance indices
- Time response of Second order system
- Stability Criteria
- Frequency domain Analysis
- Cascade Compensation in Frequency Domain

Textbook(s):

1. Control System Engg, I. J. Nagrath & M. Gopal, New Age International (P) Ltd, 2nd edition, 1996.

Reference book(s):

1. Modern Control Engg, K. Ogata, PHI. 3rd edition, 1997.
2. Control Systems Engineering, Norman Nise, Wiley, 3rd Edition.
3. Automatic Control Systems, Benjamin C. Kuo, Prentice Hall.

EL 3024 Industrial Automation and Control

Credit: 3
Category: PEC
Prerequisite(s): Principle of Control System (EL 2002), Linear Control System (EE 2028)

Course Description:

The course discusses a wide range of topics for different types of sensors, actuator, and signal conditioning circuits. This course also discusses about the different types of controllers and its tuning technologies used in the industry. Different automation techniques like PLC including ladder programming, SCADA, DCS are also covered. Different advanced control techniques have also been discussed.

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

CO1: comprehend the working of sensors in signal conditioning circuits and actuators
CO2: determine the effect of gain constant on system performance
CO3: understand different components of PLC and design of the ladder logic
CO4: analyze DCS hardware, its merits/demerits in an industrial automation in comparison with PLC
CO5: analyze SCADA hardware-software and its merits/demerits in industrial automation in comparison with PLC and DCS
CO6: comprehend advanced control techniques

Topics:

- Sensors, Actuators and Signal conditioning
- Controller
- Automation
- PLC
- SCADA
- DCS
- Advanced control techniques

Textbook(s):

1. Computer-Based Industrial Control, Krishna Kant,2nd edition Prentice Hall of India Ltd.
2. Chemical Process Control – Theory and Practice, Stephanopoulous, Prentice Hall of India Ltd, 1984.
3. Fundamentals of Industrial Instrumentation and Process Control, William C. Dunn, Tata McGraw Hill, 2009.

Reference Book(s):

1. Modern Automation Systems, Muhammad Abdelati, University Science Press, 2009.
2. Modern Control Engineering, 4th edition, Ogata, Prentice Hall of India

HS 2002 Engineering Economics

Credit: 3
Category: HSMC
Prerequisite(s): Nil

Course Description:

The course on Engineering Economics is a specialized need-based extension of applied Economics which is aimed at developing an understanding of the principles governing Economy's vital parameters like market, finance, Production,consumption and distribution.. The course focuses on learning methodical and rational conceptualization and developing the knowledge for effectively implementing these market principles in actual organizational activities and forums. The course intends to develop the ability of taking decisions related to project selection and implementation, optimization of market vitals like sales, revenue, profit, cost etc. It serves as the base of learning all Economics related elective papers offered in higher semesters as well as preparation for any competitive exams like civil services, MAT etc.

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

CO1: apply economic theory for optimisation of the economic variables of demand, supply,sales,profit, cost and revenue
CO2: apply the budgeting principles in making economic decisions during project appraisals
CO3: develop awareness towards all the economic issues related to the financial market, Budget, Money, Credit and Fiscal Policies etc.
CO4: relate and apply theoretical concepts in Economics with contemporary/modern business practices
CO5: understand the vitals of the financial market, know the source and methods of raising capital for an organization
CO6: understand the depreciation of asset principles and efficient inventory/resource management

Topics:

- An Introduction to Economics and Engineering Economics
- Basic Concepts of Economics: Market equilibrium and Consumers and Producer's equilibrium
- Elasticity and Demand Forecasting
- Optimization of Profit and cost
- Break Even Analysis
- Evaluation of Projects: Economic Appraisal Techniques
- Depreciation calculation and Inventory management
- Vitals of Money and capital market

Textbook(s):

1. Managerial Economics: Principles and Worldwide Applications. Dominick Salvatore,Siddartha K.Rastogi,8th Edition,Pub.Oxford University Press.ISBN: 9780199467068.
2. Engineering Economics –James L.Riggs, DavidD.Bedworth and Sabah U.Randhawa,4thEdition, McGraw Hill Education(India) Private Limited, New Delhi,2016.

Reference Book(s):

1. Principles of economics, Deviga Vengedasalam and Karunagaran Madhavan, Oxford University Press, New York,3rd Edition,2013.
2. Managerial Economics-Principles and Worldwide Applications-Dominick Salvatore, Adapted by Ravikesh Srivastava,7thEdition, Oxford University Press,2012.

3. Micro ECON-A South-Asian Perspective-by William A. McEachern and Simrit Kaur, Cengage Learning, 2013.
4. Engineering Economy-Zahid A. Khan, Arshad Noor Siddiquee, BrajeshKumar, Pearson Publication, 2012.
5. Engineering Economics – R.Panneerselvam, Pub: PHI Learning Private Limited, New Delhi, 9thEdition, 2008.

HS 2008 Economic Environment of India

Credit: 3
Category: HSMC
Prerequisite(s): Nil

Course Description:

The Course on Economic Environment of India is designed to cater encompassing discernment of Indian Economy to the students. The course precisely highlights the role of different sectors in Indian economy and also touches upon the normative aspect of striking balance among different sectors. It covers the status of public economics in Indian context. Besides, it ensures the students to have knowledge on the role of foreign sector.

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

CO1: develop the analytical understanding of the economic situation of the country
CO2: develop the skill to interpret the economic indicators during steady growth path and economic crisis
CO3: acknowledge the role of different policy making bodies in India related to economic affairs
CO4: develop the ability to analyze the occupational structure of the country and sectoral contribution to growth
CO5: examine the extent and role played by foreign sector in the form of exchange rate, FDI etc in the domestic economy
CO6: develop a critical understanding of the fiscal position of the country

Topics:

- Economic Crises and Way out: Economic Crisis of early 1990s-Macro Economic Reforms since 1991
- Primary Sector and Secondary Sector: Agriculture during the Reform Period; New Industrial Policy
- Tertiary Sector and Foreign Sector: Service sector as the engine of growth in India; Trade reforms
- Public Finance: Fiscal reforms in India post 1991; Centre-State Fiscal relationship

Textbook(s):

1. Dutt and Sundaram.Indian Economy. latest edition.

Reference Book(s):

1. Uma Kapila (2019), Indian Economy since Independence, New Delhi, Academic Foundation.
2. Balakrishnan, P. (2010): 'Economic Growth in India: History and Prospect'. Oxford
3. University Press, New Delhi.
4. Bhagwati Jagdish and Arvind Panagariya(2012): ' India's Tryst with Destiny'. Collins Business, Noida, India.
5. Jean Dereze and Amartya Sen (1996): 'Indian Development: Selected Regional
6. Perspectives'. Oxford University Press, New Delhi.
7. Ajijava Raychaudhuri and Prabir De (2012), International Trade in Services in India, New Delhi, Oxford University Press.

HS 2010 Financial Institutions, Markets and Regulations

Credit: 3
Category: HSMC
Prerequisite(s): Nil

Course Description:

The course on Financial Institutions, Markets and Regulations is a specialized need-based extension of Financial Economics. This course is designed to present the fundamental concepts and theories in financial market and promote the application to the workplace and professional practice. It introduces current financial concepts and tools towards money management in organizations participating in the local and global economies. The course covers the current best practices in financial analysis and planning through the application of financial concepts in a nutshell. These include financial vitals relate to money and capital markets, time value of money, cost of capital, risks and return, long-term financial budgeting. Inaddition, the course also introduces topics on lease financing, hybrid securities and derivatives, trust funds, mergers and acquisitions and related issues in current financial sector.

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

CO1: have comprehensive understanding of the nature and functions of the several types of financial institutions operating in the market
CO2: develop critical skills in applying the principles of finance and financial inter-mediation to the real world situations
CO3: effectively interact with the financial markets they need to approach for their future economic endeavors and/or in their place of employment
CO4: make economic decisions and analysis of issues related to security market transactions and policies
CO5: develop the understanding of the structure and functions of Indian financial institutions, instruments and policies
CO6: take decisions regarding saving, investments, portfolio contents and diversification to maximize their return and reduce associated risks

Topics:

- Financial systems: Significance of banks and all other Financial institutions
- Financial Innovations
- Overview of Structure of Financial Debts and Equity markets
- Functions of Financial Intermediaries
- Monetary authority: Reserve Bank of India: Its role, structure and functioning
- Subprime crisis
- Derivative markets
- Capital market authority: structure and functions
- Regulation of Capital market, Role of SEBI

Textbook(s):

1. Madura, Jeff (2008), Financial Markets and Institutions, 8th edition, Thomson Publications.

Reference Book(s):

1. Fabozzi, Frank, Modigliani, Franco, Jones, Frank (Feb 2009), Foundations of Financial Markets.
2. Eakins, Stanley G. (2005), Financial Markets and Institutions (5th Edition), Addison Wesley.
3. Howells, Peter, Bain, Keith (2007), Financial Markets and Institutions, 5th Edition.

4. Barth, James R., Caprio, Gerard, and Levine, Ross (2008), Bank Regulations are Changing: For Better or Worse?, Association for Comparative Economic Studies.
5. Goldstein, Morris (2006), Financial Regulation after the Subprime and Credit Crisis, Washington: Peterson institute.

HS 2012 Development Economics

Credit: 3
Category: HSMC
Prerequisite(s): Nil

Course Description:

The course on Development Economics is a specialized need-based extension of Economics dealing with issues related to economic growth and development. It provides an in depth discussion of the different economic description of development and underdevelopment. It will put a deep insight into the most challenging economic issues of poverty, inequality and underdevelopment faced by the humanity. It will deal with the various existing, modern and developing strategies and policies to tackle these issues and foster the economy onto the path of development. The students will be able to assess the pros and cons of a proposed development intervention and its likely impact on the target population.

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

CO1: develop the understanding of issues related to economic growth and economic development
CO2: relate and apply the major growth theories in their related academic projects
CO3: develop the familiarity with major economic issues faced by the country like poverty, inequality, underdevelopment etc.
CO4: analyse and compare the development paths adopted across countries of the globe
CO5: analyse the empirical evidence on the pattern of growth and development
CO6: develop critical understanding of the existing, adopted and needed policies and strategies for sustainable growth and development

Topics:

- Concepts and difference between growth and development.
- Measures of growth and development
- Models of growth and development
- Poverty and Inequality : Perceptions, estimation and measures of improvement
- Impact of poverty and inequality on growth and development
- Cross country perspectives of development

Textbook(s):

1. Todaro, M. P. & Smith, S. C. (2015), Economic Development, Pearson (12^{th} Edition).
2. Thirlwall A. P. Growth and Development (6 th and 7 th edition)

Reference Book(s):

1. Debraj Ray : Development Economics
2. Meier and Rauch,: Leading Issues in Economic Development, OUP, Latest Edition
3. Kaushik Basu :Analytical Development Economics , OUP
4. Human Development Reports, various years
5. Bagchi A. K. The Political Economy of Underdevelopment, Cambridge University Press 1982.

HS 2081 Business Communication

Credit: 1
Category: HSMC
Prerequisite(s): Nil

Course Description:

This course is designed to give students a comprehensive view of communication, its scope and importance in business. This is an interactive course with a view to enhance language and soft skills with the aid of live demonstration within the framework of the syllabus. It is a foundation building measure to enable the students to excel in the corporate world and in day to day life.

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

CO1: develop competence in reading and comprehension, develop skimming skills for extracting the main idea(s) from the text, and scanning for keywords
CO2: enrich the fluency of the students with Collocations and Phrasal Verbs
CO3: use Email effectively and efficiently as per the organization hierarchy. To retain a logical flow while drafting emails, make aware students about the importance of succinct written expression in modern Business Communication
CO4: write standard and effective Cover Letters and Resume
CO5: bridge the gap between native language and target language i.e. English, make students communicative competent and develop their fluency in public speaking
CO6: prepare effective Power Point Slides. Maintain and arrange proper data structure in presentations. To learn skills of making effective presentation (verbal and non-verbal aspects)

Topics:

- Reading Comprehension – Activity based on BEC Training – Matching, Multiple Choice Questions, Open Close, Giving Appropriate Headings
- Collocation – Activity based on Word-Stock, Phrasal Verbs & Vocabulary Building
- E-mail – Activities based on Writing Appropriate Salutation, Paragraphs & Conclusion
- Resume Writing
- Thematic Discussions
- Speaking in Pairs – Everyday Activities & Detailed Introduction
- Activity based on PowerPoint Presentation

HS 3006 Entrepreneurship

Credit: 3
Category: HSMC
Prerequisite(s): Nil

Course Description:

The course has been designed for the students in order to provide basic knowledge of an entrepreneur and opportunities for new entrepreneurship. To provide idea about various financial sources available for small and medium enterprise by different financial institutions. To provide knowledge how to manage working capital of an organization in an efficient manner. To have an idea about motivational tools for increasing the productivity of employees in an enterprise.

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

CO1: know the contribution of an entrepreneur in growth and development of socioeconomic condition of our country
CO2: understand the role of SSI units in growth and development of socioeconomic condition of our country
CO3: learn market survey, sales promotions and management of working capital through costing and book keeping
CO4: know different decision making technique and benefit of personal management system.
CO5: learn motivational methods of an enterprise
CO6: learn how to prepare a project report and knowledge about different tax system of an enterprise

Topics:
- Introduction to entrepreneurship
- SSI Units
- Market survey and research
- Marketing mix
- Financial management
- Working capital management
- Personnel management
- Motivation

Textbook(s):
1. Entrepreneurial Development, S.S.Khanka, S.Chand

Reference Book(s):
1. Industrial Organisation and Engg. Economics, Sharma & Banga, Khanna Publication
2. Entrepreneurship New Venture Creation, David H. Holt, Prentice Hall, PHI

HS 3008 Management Concepts And Practices

Credit: 3
Category: HSMC
Prerequisite(s): Nil

Course Description :

The course curriculum is designed for student in order to provide fundamental knowledge in management area. The students will be able to know about general management concepts and various specialization in management area like marketing, finance, production and strategy management. The marketing management portion of the course will benefit the students to develop their career in marketing line, as most of the organisations give priority for marketing skills. Finance and production management will help the students in their respective domain and serve as a guide in their corporate career. The strategy management portion of this course will serve as a guide for the students to contribute in strategy formulation of the organization and how to achieve that strategy within a stipulated time period.

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

CO1: perform the critical management functions effectively and develop ideas about implementing principles and theories of management in organizations efficiently
CO2: develop various marketing skills in order to be successful in corporate world
CO3: utilize different financial techniques for better management and control of organisational financial resources
CO4: take strategic decision for day to day operation through proper working capital management.
CO5: have competency in production planning as well as control measures will become easy in their professional career
CO6: do strategy formulation of the organization and how to achieve that strategy within a stipulated time period

Topics:
- Introduction to management
- Marketing mix
- Market research
- Financial management
- Working capital management
- Production planning and control
- Inventory management
- Strategy management

Textbook(s)
1. Modern Business Organisation and Management. Sherlekar & Sherlekar, Himalaya Publishing House.
2. Business Organisation and Management. M. C. Shukla, S. Chand

Reference Book(s)
1. Principles & Practices of Management. L. M Prasad
2. A framework for marketing management, Philip Kotler
3. Financial Management. I. M Panday
4. Production and Operation Management, Everett E. Adam Jr. Ronald J. Ebert

HS 3002 Organisational Behaviour

Credit: 3
Category: HSMC
Prerequisite(s): Nil

Course Description:

The course has been designed for the students to provide an understanding about the behaviour of individuals, groups and the system in the organization. The course will help the students how to develop personality and leadership style for achievement of individual and organizational objective. To know about the benefit of motivation for increasing individual and organizational productivity. To Provide knowledge to work in groups and develop techniques for group decision making for organizational development.

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

CO1: know about organization, organizational behaviour its nature, scope and significance
CO2: develop their personality as per industry requirement
CO3: apply motivational techniques to make the employees work with confidence and satisfaction
CO4: develop different leadership style to adjust themselves in different organizational situations
CO5: improve the knowledge of group behaviour and techniques of group decision making
CO6: apply the concepts for managing changes in organization as well as the development of an organization's human resources

Topics:

- Introduction to Organisation and organisational behaviour
- Personality
- Motivation
- Leadership
- Group dynamics
- Organisational change
- Organisational development

Textbook(s) :

1. Organisational behaviour. Stephen P. Robbins, Timothy A. Judg, S. Sanghi, Pearson
2. Organizational Behaviour and Work, F. M. Wilson, Oxford University Press.

Reference Book(s):

1. Organizational Behaviour, Dipak Kumar Bhattacharya, Oxford University Press
2. ORGB, Organizational Behaviour, Nelson, Quick, Khandelwal, Cengage
3. Organisational Behaviour. Dr. S. S Khanka, S. Chand
4. Managing Organisational Behaviour, Moorhead & Griffin, Cengage Learning.

HS 3004 Human Resource Management

Credit: 3
Category: HSMC
Prerequisite(s): Nil

Course Description:

The course has been designed in order to provide knowledge and idea about human resource management and how to become a professional human resource manager. It will help the students to follow different HR processes like recruitment, training, performance appraisal effectively in organizational level. The students will able to learn how to manage industrial dispute and develop industrial relation in corporate sector. The course will enable the students to understand the workers participation in management concept through employee discipline and the process of effective bargaining system in the organisation.

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

CO1: develop personal and professional qualities of a manager in order to manage human resource of an organization effectively
CO2: meet the human resource requirement of the organization for achieving its objective effectively
CO3: follow different HR processes like recruitment, selection, training, performance appraisal effectively in organizational level
CO4: inculcate the sense of inter personal relation required in professional front in handling employer-employee relation effectively for achievement of organizational objectives
CO5: achieve strategic objectives of the organizations, by optimizing the potentiality of the human resource through workers participation in management
CO6: know the technique of managing and being managed by the organisation

Topics:

- Human resource management
- Human resource planning
- Recruitment
- Selection
- Training
- Performance appraisal
- Industrial relation
- Industrila dispute
- Collective bargaining
- Workers participation in management

Textbook(s):

1. Human Resource Management, P. Jyoti & D. N. Venkatesh, Oxford Publication, 2016
2. Human Resource Management, B. Varkkey & G. Dessler, Pearson, 2017

Reference Book(s):

1. Human Resource Management. K. Aswathappa, Mc Graw Hill Education, 2013.
2. Human Resource Management. S. S. Khanka, S. Chand, 2019
3. Human Resource Management. P. Subba Rao, Himalaya Publishing House, 2018.

HS 4001 Professional Practice, Law and Ethics

Credit: 2
Category: HSMC
Prerequisite(s): Nil

Course Description:

The course on Professional Practice, Law and Ethics is designed to cater comprehensive insight of law and ethics to the students for practicing in their professional life. The course incisively highlights the role of morals and ethics in leading a sustainable profession. Besides, by containing different relevant laws like laws of contracts, intellectual property law and information technology law, the course provides foundation in law to the students which will help them a lot to face the real life situations with ease.

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

CO1: select appropriate engineering decisions in consideration of professional ethics in realization of more critical impact of engineering compared to general experiments
CO2: evaluate and prescribe risk reducing measures
CO3: comprehend the dynamics in engineers' roles and responsibilities with emerging issues in global scene
CO4: know the various compliance requirements and the regulatory bodies to protect environment
CO5: have a fair idea to protect their engineering inventions from unauthorized exploitation under intellectual property rights system and laws relating to information communication technologies
CO6: understand, analyze and prevent misuse of IT related transactions

Topics:

- Morals and ethics in engineering
- Engineering as social experimentation
- Engineer's responsibility for safety
- Global issues
- Law of contracts and law of torts
- Environmental laws
- Intellectual property law
- Information technology law

Textbook(s):

1. R. Subramaniam, Professional Ethics, Oxford University Press, 2013
2. Indian Contracts Act 1872
3. Patents Act 1970 (Unit-3)
4. Designs Act 2000 (Unit-3)
5. Information Technology Act 2000 (Unit-4)

Reference Book(s):

1. Mike Martin and Ronald Schinzinger, "Ethics in Engineering", McGraw Hill New York, 2005.
2. Charles E Harris, Michael S Pritchard and Michael J Rabins, "Engineering Ethics Concepts and Cases", Thomson Learning, 2000

HS 4003 Legal Issues and Requirements in Engineering

Credit: 1
Category: HSMC
Prerequisite(s): Nil

Course description:

It depicts on law of contracts and law of torts, Consumer Protection Act 1986, Environmental Protection Act 1986, Environmental Impact Assessment 2006, standards for emission, discharge of environmental pollutants from various industries, Intellectual Property Law, Protecting engineering invention, the U.S Utility model approach and need for Utility model in India, Protecting Software and other engineering technologies in cyberspace, maintaining data security and technological privacy in Cyberspace, e-contracts, electronic and digital signatures.

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

CO1: understand the various legal requirements in terms of contracts
CO2: interpret the product liability which an engineer is required to take care while processing his engineering innovations
CO3: illustrate the various compliance requirements and the regulatory bodies to protect the environment
CO4: demonstrate to protect their engineering inventions from unauthorised exploitation under intellectual property rights system and laws relating to information communication technologies
CO5: identify Legal Issues in a given case
CO6: analyse and prevent misuse of IT related transactions

Topics:

- Law of contracts and law of torts
- Environmental Laws
- Intellectual Property Law
- Information Technology Law

Textbook(s):

1. Gurdeep Singh “Environmental Laws” Eastern Book Company,2nd Edition 2016.
2. V K Ahuja “Law Relating To Intellectual Property Rights”Lexis Nexis, 3rd Edition. July 2017.
3. Pavan Duggal “Cyber Law”-Indian Perspective”. 2nd Edition 2016.
4. Avtar Singh” Law of Contracts” Eastern Book Company,12th Edition, Reprinted 2020.
5. Dr. R K Bangia “Law of Torts”. Allahabad Law Agency; 24th 2019 edition (2019).

Reference Book(s):

1. Rosencranz “Enviromental Law and policy in india”.Oxford University Press, 2001.
2. Howard b rockman “Intellectual Property Law for engineers and scinentists”.ISBN: 978-0-471-69740-4, Wiley-IEEE Press, June 2004.
3. Mireille Hidebrant “ smart technologies and the end of law”. ISBN: 978 1 78643 022 9.

MA 2009 Mathematics-III

Credit: 4
Category: BSC
Prerequisite(s): Nil

Course Description:

Students are taught Partial differential equations based on the propagation of heat, wave etc to use in solving engineering problems. The concept of Complex analysis, Residual integration are included to get the knowledge on complex plane. Numerical analysis is included to get approximate solutions to difficult problems for which analytical solution is hard to obtain. Students are given common Probability and Statistical knowledge to use statistical analysis of data.

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

CO1: solve the PDE problems by separable method, Laplace transform
CO2: know Complex plane , Complex functions, their differentiation and integration
CO3: find series expansion of complex functions and evaluate real integrals by residue method
CO4: determine roots of algebraic/transcendental equations through Newton and Lagrange method and obtain interpolating Polynomials
CO5: solve ODE numerically by single step and multi step method
CO6: work out problems related to probability distribution and statistical regression and co- relation

Topics:
- Partial Differential Equation
- Complex Analysis
- Numerical Methods
- Probability

Textbook(s):
1. Advanced Engineering Mathematics(10th edition) by E. Kreyszig , Wiley .

Reference Book(s):
1. Engineering Mathematics by S. Pal and S.C. Bhunia, Oxford University Press.

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