ACADEMIC CURRICULA 2018 - 2022

BACHELOR'S DEGREE PROGRAMME

B. Tech in Computer Science & Communication 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
COMPUTER SCIENCE & COMMUNICATION 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 COMPUTER SCIENCE AND COMMUNICATION ENGINEERING

Programme Educational Objectives (PEOs):

The B. Tech programme in Computer Science and Communication Engineering aims to prepare the graduates with the following objectives:

1. The graduates will be able to provide sound theoretical and practical knowledge in the domain of Computer Science & Communication Engineering for leading successful career in industries, pursuing higher studies or entrepreneurial endeavors.
2. The graduates will be able to perceive the limitations and impact of engineering solutions in social, legal environmental, economical and multidisciplinary contexts.
3. The graduates will be able to demonstrate professional and ethical responsibilities, imbibe lifelong learning, embrace global challenges and make positive impact on environment and society.

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 develop hardware and software in emerging technology environments like Data Analytics, Mobile Computing and Smart Antennas.
n) Ability to carry out research in the field of multidisciplinary engineering such as Artificial Intelligence, Machine Learning, Real Time Systems, Internet of Things and Wireless Sensor Networks.
o) Ability to utilize the knowledge in solving practical real life technological problems in the field of Computer Science & Communication Engineering.

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 COMPUTER SCIENCE AND COMMUNICATION ENGINEERING

SEMESTER-I

SCHEME-II

Theory							
Sl. No.	Course Code	Subjects	L	T	P	Total	Credit
1	MA 1003	Mathematics-I	3	1	-	4	4
2	CH 1007	Chemistry	3	-	-	3	3
3	HS 1005	Professional Communication	2	-	-	2	2
4	LS 1001	Biology	2	-	-	2	2
Total of Theory						11	11
Practical							
1	CH 1097	Chemistry Lab	-	-	3	3	1.5
2	CS 1093	Computer Programming	-	2	4	6	4
Sessional							
1	HS 1085	Language Lab	-	-	2	2	1
2	CE 1083	Engineering Graphics	-	1	2	3	2
Total Practical & Sessional						14	8.5
Semester Total						25	19.5

SCHEME-II
SECOND SEMESTER (for all Computer Engineering branches)

Theory							
Sl. No	Course Code	Course Title	L	T	P	Total	Credit
1.	MA 1004	Mathematics – II	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.	EC 1004	Analog Electronic Circuits	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
3.	EC 1094	Analog Electronic Circuits 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						12	6.5
Semester Total						26	20.5
	EAA – 1	Extra Academic Activity					P/NP

SEMESTER – III

Sl. No	Course Code	Course Title	L	T	P	Total	Credit
Theory							
1	CS 2001	Data Structures and Algorithms	3	1	0	4	4
2	EC 2011	Digital Electronics	3	0	0	3	3
3		HS Elective-I	3	0	0	3	3
4	EC 2023	Principles of Signals and Systems	2	0	0	2	2
5	IT 2005	Object Oriented Programming	3	0	0	3	3
6	MA 2011	Probability and Statistics	3	0	0	3	3
Total of Theory						18	18
Practical							
1	CS 2091	Data Structures Laboratory	0	0	2	2	1
2	IT 2095	Object Oriented Programming Laboratory	0	0	2	2	1
3	EC 2093	Digital Electronics Laboratory	0	0	2	2	1
Total of Practical						6	3
Semester Total						24	21

SEMESTER –IV

Sl. No	Course Code	Course Title	L	T	P	Total	Credit
Theory							
1	CS 2002	Operating Systems	3	0	0	3	3
2	CS 2010	Automata and Formal Languages	3	1	0	4	4
3	EC 2016	Communication Engineering	3	1	0	4	4
4	IT 2004	Web Technology	3	0	0	3	3
5	CS 2006	Computer Architecture	3	1	0	4	4
6	MA 2013	Discrete Mathematics	3	0	0	3	3
Total of Theory						21	21
Practical							
1	IT 2094	Web Technology Laboratory	0	0	2	2	1
2	CS 2092	Operating Systems Laboratory	0	0	2	2	1
3	EC 2094	Communication Engineering Laboratory	0	0	3	3	1.5
Sessional							
1	HS 2081	Business Communication	0	0	2	2	1
Total of Practical & Sessional						9	4.5
Semester Total						30	25.5

SEMESTER –V

Sl. No	Course Code	Course Title	L	T	P	Total	Credit
Theory							
1	IT 3003	Software Engineering	3	1	0	4	4
2	IT 3005	Computer Networks	3	0	0	3	3
3	CS 2012	Design and Analysis of Algorithms	3	0	0	3	3
4	CS 2004	Database Management Systems	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	IT 3095	Networks Laboratory	0	0	2	2	1
2	CS 2098	Algorithms Laboratory	0	0	2	2	1
3	CS 2094	Database Management System Laboratory	0	0	2	2	1
Total of Practical						6	3
Semester Total						26	23

SEMESTER –VI

Sl. No	Course Code	Course Title	L	T	P	Total	Credit
Theory							
1	IT 3022	Cloud Computing	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 3094	Wireless Communication and Networking Laboratory	0	0	3	3	1.5
2	CS 3096	Tools and Techniques Laboratory	0	0	4	4	2
Sessional							
1	CC 3082	Minor Project	0	0	4	4	2
Total of Practical & Sessional						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	8
Sessional							
1	CC 4081	Project-I/Internship					3
2	CC 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	CC 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.	CS 3011	Artificial Intelligence	3
2.	CC 3021	Cryptography	3
3.	CS 3031	Computational Intelligence	3
4.	CS 3027	Real Time Systems	3

Dept. Elective – II

1.	EC 3013	Principle of Digital Signal Processing	3
2.	EC 3066	Principle of Microprocessors and Microcontrollers	3
3.	EC 3064	Information Theory & Coding	3
4	EC 6313	Optimization Techniques in Engineering	3

Dept. Elective - III

1.	IT 3034	Multimedia Systems and Architecture	3
2.	CC 3024	Network Security	3
3.	CS 3035	Machine Learning	3
4.	IT 3007	Internet of Things	3

Dept. Elective - IV

1.	IT 3024	Mobile Applications Development	3
2.	IT 3006	Data Analytics	3
3.	IT 3039	Human Computer Interaction	3
4.	IT 3040	Mobile Computing	3

Dept. Elective – V

1.	EC 3062	Smart Antennas	3
2.	EC 3035	High Speed Digital System Design	3
3.	EC 6122	Satellite Communication Systems	3
4.	EC 6128	Wireless Sensor Network	3

HONORS COURSES OFFERED BY COMPUTER SCIENCE & ENGINEERING

Sl No.	Course Code	Course Title	Prerequisite/s
1	CS 4001	Distributed Algorithms	Design and Analysis of Algorithms (CS 2012)
2	CS 4002	High Speed Networks	Computer Networks (IT 3005)
3	CS 4003	Software Defined Network	Computer Networks (IT 3005)
4	CS 4004	Transaction Processing Systems	Database Management System (CS 2004)
5	CS 4005	Pervasive Computing	Cloud Computing (IT 3022)
6	CS 4006	Programming for Multi Core Systems	High Performance Computing (CS 3010)
7	CS 4007	Soft Computing	Probability & Statistics (MA 2011)
8	CS 4008	Advanced Cryptography	Discrete Mathematics (MA 2013)
9	CS 4009	Middleware Technologies	Web Technology (IT 2004)
10	CS 4010	Game Theory	Probability & Statistics (MA 2011)

LIST OF OPEN ELECTIVES OFFERED BY SCHOOL OF COMPUTER ENGINEERING

Sl. No	Course Code	Course Title	Prerequisite/s
1	CS 3040	Data Structures Using C	Computer Programming (CS 1093)
2	IT 2005	Object Oriented Programming	Computer Programming (CS 1093)
3	IT 2004	Web Technology	Object Oriented Programming (IT 2005)
4	CS 3042	Computer Organization	NIL
5	IT 3044	Fundamentals of Software Engineering	NIL
6	CS 3044	Relational Database Management System	NIL
7	CS 2012	Design & Analysis of Algorithm	Data Structures and Algorithms (CS 2001) / Data Structures Using C (CS 3040)
8	IT 4005	Software Testing	Fundamentals of Software Engineering (IT 3044)
9	CS 2002	Operating Systems	Data Structures and Algorithms (CS 2001) / Data Structures Using C (CS 3040)
10	IT 3006	Data Analytics	Relational Database Management System (CS 3044)
11	IT 3005	Computer Networks	NIL

MINOR IN COMPUTER SCIENCE & ENGINEERING

Sl. No	Course Code	Course Title	Prerequisite/s
1	CS 3040	Data Structures Using C	Computer Programming (CS 1093)
2	IT 2005	Object Oriented Programming	Computer Programming (CS 1093)
3	CS 2002	Operating Systems	Data Structures and Algorithms (CS 2001) / Data Structures Using C (CS 3040)
4	IT 2004	Web Technology	Object Oriented Programming (IT 2005)
5	CS 3042	Computer Organization	NIL
6	IT 3044	Fundamentals of Software Engineering	NIL
7	CS 3044	Relational Database Management System	NIL
8	CS 2012	Design & Analysis of Algorithm	Data Structures and Algorithms (CS 2001) / Data Structures Using C (CS 3040)
9	CS 2094	Database Management System Laboratory	
10	IT 2094	Web Technology Laboratory	

MINOR IN SOFTWARE ENGINEERING

Sl. No	Course Code	Course Title	Prerequisite/s
1	CS 3040	Data Structures Using C	Computer Programming (CS 1093)
2	IT 2005	Object Oriented Programming	Computer Programming (CS 1093)
3	CS 2002	Operating Systems	Data Structures and Algorithms (CS 2001) / Data Structures Using C (CS 3040)
4	IT 2004	Web Technology	Object Oriented Programming (IT 2005)
5	IT 3044	Fundamentals of Software Engineering	NIL
6	IT 4005	Software Testing	Fundamentals of Software Engineering (IT 3044)
7	CS 3044	Relational Database Management System	NIL
8	IT 3038	Object Oriented System Design	Fundamentals of Software Engineering (IT 3044)
9	CS 2094	Database Management System Laboratory	
10	IT 2094	Web Technology Laboratory	

MINOR IN DATA ANALYTICS

Sl. No	Course Code	Course Title	Prerequisite/s
1	CS 3040	Data Structures Using C	Computer Programming (CS 1093)
2	CS 2002	Operating Systems	Data Structures and Algorithms (CS 2001) / Data Structures Using C (CS 3040)
3	CS 3044	Relational Database Management System	NIL
4	IT 3006	Data Analytics	Relational Database Management System (CS 3044)
5	IT 3031	Data Mining and Data Warehousing	Relational Database Management System (CS 3044)
6	IT 3044	Fundamentals of Software Engineering	NIL
7	CS 3031	Computational Intelligence	Nil
8	IT 3096	Data Analytics Laboratory	
9	CS 2094	Database Management System Laboratory	

MINOR IN INFORMATION SECURITY

Sl. No	Course Code	Course Title	Prerequisite/s
1	CS 3040	Data Structure Using C	Computer Programming (CS 1093)
2	IT 2005	Object Oriented Programming	Computer Programming (CS 1093)
3	CS 2002	Operating Systems	Data Structures and Algorithms (CS 2001) / Data Structures Using C (CS 3040)
4	IT 3005	Computer Networks	NIL
5	IT 2004	Web Technology	Object Oriented Programming (IT 2005)
6	CC 3028	Information Security	Computer Networks (IT 3005)
7	IT 3044	Fundamentals of Software Engineering	NIL
8	CC 3024	Network Security	NIL
9	IT 3095	Networks Laboratory	
10	IT 2094	Web Technology Laboratory	

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. 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: ESLC
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: ESLC
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):

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

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.

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.

EE 1003 Basic Electrical Engineering

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

Course description:

This course depicts on generating stations (Thermal, Hydro, Nuclear and Solar Photovoltaic Stations), transmission of powers (overhead transmission lines and underground cable); distribution system (AC and DC), types of wiring, types of batteries, safety measures, necessity of earthing and fuse. The basic concepts of DC and AC (Single Phase and Three Phase Circuits) network analysis, DC transients, AC networks (1-Phse and 3-Phase), AC series circuit resonance and magnetic circuits. This course will also cover single phase transformers, three Phase Induction machines, measuring Instruments and illumination.

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

CO1: explore the electric supply systems, safety measures and illumination
CO2: solve the different parameters in the DC circuits
CO3: solve the different quantities of 1-Phase and 3-Phase AC circuits
CO4: interpret the behavior of magnetic circuits
CO5: illustrate the application of transformer and induction motors
CO6: demonstrate electrical instruments for measurement

Topics:

- Introduction to electrical energy
- Safety measures in electrical system
- Types of wiring, batteries
- DC circuits
- Network theorems
- AC circuits
- Magnetic circuits
- Transformer and induction motors
- Measuring instruments
- Illumination

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, 3rd Edition 2017.

Reference Book(s):

1. Basics Electrical Engineering Sanjeev Sharma, I.K.International, New Delhi (Third Reprint 2010).
2. Principles of Electrical Engineering and Electronics- V K Mehta, Rohit Mehta, S Chand and Company, New Delhi (Revised Edition 2013).

EC 1004 Analog Electronics Circuits

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

Course Description:

This course includes analog electronics circuits implementation using diodes, transistors and different transistor amplifiers viz.,power, feedback and operational amplifier. This course also covers different diodes, bipolar junction transistor, field effect transistor, power amplifier feedback amplifiers and operational amplifier and their applications. The skills to analyze circuits using different types of diodes, transistors and amplifiers for solving simple problems in some real time application are also covered.

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

CO1: understand the operation and applications of different types diode and its circuits.
CO2: analyze the operation and characteristics of BJT and FET, and its circuits.
CO3: solve different performance metrics of amplifier circuits using small-signal model.
CO4: identify different types of feedbacks and comprehend their applications
CO5: analyze different power amplifier circuits using BJT
CO6: analyze different electronic circuits using OPAMP, 555 timer, and VCO.

Topics:

- PN Junction diode
- Zener diode
- Bipolar Junction Transistor(BJT)
- Field effect transistor(FET)
- Power amplifier
- Feedback amplifier
- Oscillator
- Operational amplifier(OPAMP) and its application in 555 Timer and VCO.

Textbook(s):

1. Electronic Principles, A. Malvino and D. J. Bates

Reference Book(s):

1. Electronic Devices & Circuits, R. L. Boylestad, 10th edition, Pearson.
2. Integrated Electronics, J. Millman and Halkias, TMH.
3. Linear Integrated Circuits, D. R. Chowdhury and S. B. Jain.

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: ESLC
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).

2. Principles of Electrical Engineering and Electronics- V K Mehta, Rohit Mehta,S Chand and Company,New Delhi (Revised Edition 2013)
3. Basic Electrical Engineering Abhijit Chakrabarti,Sudip Nath,Chandan Kumar Chnada,Tata McGraw Hill Publishing Limited,New Delhi,2007

EC 1094 Analog Electronic Circuits Laboratory

Credit: 1
Category: ESLC
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: ESLC
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

COURSES OF THE PROGRAMME

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 Langsam, Moshe J. Augenstein. Pearson, 1st Edition
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 2002 Operating Systems

Credit: 3
Category: PCC /OEC
Prerequisite(s): Data Structures and Algorithms (CS 2001)

Course Description:

Operating System (OS) describes the tradeoff between performances, functionalities and division of responsibilities between hardware and software by combining languages, hardware, data structures, algorithms and other necessities. The Course covers the classical internal algorithms and structures of operating systems, including CPU scheduling, memory management, and device management. This course also provides a deeper insight into different functionalities of operating system used in modern computers with respect to their performance.

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

CO1: understand the difference between different types of modern operating systems, virtual machines, their structure with implementation and applications
CO2: understand the difference between process & thread, issues in scheduling of user-level processes/threads
CO3:analyze use of locks, semaphores, monitors for synchronization in multiprogramming/multithreaded systems and design solutions for multithreaded programs
CO4: analyze the concepts of deadlock in operating systems and how they can be managed/avoided
CO5: evaluate the design and management concepts along with issues and challenges of main memory, virtual memory and file system
CO6: evaluate and analyze I/O management, disk scheduling in operating systems the protection and security problems faced by operating systems for designing methods to minimize these problems

Topics:
- Introduction
- Process and threads
- Concurrent Processes
- Deadlock
- Memory Management
- File System
- Input / Output Management
- Operating System Protection & Security

Textbook(s):
1. Operating System Concepts by A. Silberschatz, P. B. Galvin and G. Gagne, John Wiley & Sons, 9th Edition, Inc., ISBN 978-1-118-06333-0

Reference Book(s):
1. Operating Systems by M. Deitel, P.J. Deitel and D.R. Choffnes, Pearson, ISBN: 9780131453159.
2. Operating Systems Concepts and Design by Milan Milenkovic, Tata McGraw-Hill Education India, ISBN: 9780074632727.
3. Operating Systems Design and Implementation by Andrew S. Tanenbaum, Albert S. Woodhull, Prentice-Hall,ISBN: 9780131429383.

CS 2004 Database Management System

Credit: 4
Category: PCC
Prerequisite(s): Data Structures and Algorithms (CS 2001)

Course Description:

This course focuses on concepts and structures required to design and implement a database management system. Various data models, integrity constraints and concurrency are discussed. It also covers the steps of normalization process. File organizations and indexing methods are also been covered. Students will learn to design and implement small projects using SQL.

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

CO1: understand the fundamental elements of relational database management systems and its applications
CO2: conceptualize and depict a database system using ER diagram
CO3: apply query database using relational algebra, relational calculus and SQL
CO4: analyze functional dependencies and design the database using normalization
CO5: evaluate Transaction processing system and concurrency control mechanisms
CO6: evaluate basic database storage structures and access techniques: file organizations, indexing methods including B-tree, and hashing

Topics:

- Introduction
- E/R Model
- Relational Data Model
- Relational Database Design
- Transaction Processing
- Data Storage & Indexing

Textbook(s):

1. Fundamentals of Database System By R. Elmasari & S.B. Navathe, 7th Edition, 2018, Pearson Education

Reference Book(s):

1. Database System Concepts by A. Silberschatz, H.F. Korth & S. Sudarshan, 6th Edition, 2019, McGraw-Hill Education
2. Database Management Systems by R. RamaKrishna & J. Gehrke, 3rd Edition, 2018, McGraw-Hill Education
3. Database System Concepts by P. Rob & C. M. Coronel, Indian Edition, 2011, Cengage Learning
4. Fundamentals of Relational Database management Systems by S. Sumathi & S. Esakkirajan, 2007, Springer.

CS 2006 Computer Architecture

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

Course Description:

This course enables students with a understanding of fundamentals of computer architecture. This also explains the architectural techniques used to build high performance processors. Course topic includes control unit design, memory design and I/O processor. Some emphasis is made on hardware/software interaction to achieve performance. Issues affecting the nexus of architecture, compilers and operating systems touched upon.

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

CO1: remember the functions of each components of computer, and how each components of computer hardware has evolved to meet the requirements of the execution of instructions
CO2: understand Instruction Set Architecture (ISA): Instruction format, types, various addressing modes
CO3: apply the basic components to design the CPU: the ALU and control unit
CO4: analyze the different levels of memory organization: SRAM, DRAM, Cache memory, Virtual Memory
CO5: design the ALU and it's operations: Addition, Subtraction, Multiplication, and Division
CO6: understand the I/O Organization and types of I/O Transfer

Topics:

- Basic Structure of Computers
- Basic Processing Unit
- Memory System
- Arithmetic
- Input/ Output Organization
- Case Study

Textbook(s):

1. Carl Hamacher, Zvonko Vranesic, Safwat Zaky, Computer Organization, TMH, 5th Edition, 2002.

Reference Book(s):

1. M. Morris Mano, Computer System Architecture, Pearson Education India, 3rd Edition
2. Computer Organization & Architecture, William Stallings, 7th Edition, PHI, 2006.

CS 2010 Automata and Formal Languages

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

Course Description:

The course provides an introduction to design of different automata and describes the significance of formal language for these automata. In this course, design of different mathematical models such as Finite automata, Push-down automata and Turing machines are discussed. Further, the limitation of these automata is analyzed by taking their language class as reference. This course not only highlights the design of grammar for each language class but also discusses the properties of each language class. Finally, the course provides an overview of core concepts such as un-decidability and computability relating to theory of computation.

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

CO1: acquire a fundamental understanding of the core concepts in automata theory and describe how they relate to formal languages
CO2: design automata as acceptors and understand their properties for different class of languages
CO3. design the design of grammar of each language class and identify the limitation of each language class
CO4: test the equivalence of pushdown automata and CFL
CO5: analyze and evaluate core concepts relating to the theory of computation and computational models
CO6: develop a computational model using Turing machine for a given problem

Topics:

- Regular Languages
- Context-Free Languages
- Turing Machines and other relevant Topics

Textbook(s):

1. An Introduction to Formal Language and Automata, Peter Linz, Jones & Bartlett Publishers, 5th Edition.

Reference Book(s):

1. Introduction to automata theory, languages and computations, John E.Hopcroft, Jeffery D.Ullman, Pearson Education, 3rd Edition.
2. Elements of the theory of computation, Lewis, Harry R. and Christos H. Papadimitriou Prentice-Hall Englewood, 2nd Edition.
3. The Theory of Computation, Bernard M. Moret, Pearson Education, 1st Edition.
4. Introduction to the Theory of Computation, Michel Sipser, Thomson Brooks/Cole, 2nd Edition.
5. Theory of computer science by KLP Mishra & N. Chandra Sekharan, PHI, 3rd edition.

CS 2012 Design and Analysis of Algorithms

Credit: 3
Category: PCC / OEC
Prerequisite(s): Data Structures and Algorithms (CS 2001)

Course Description:

The course covers main approaches to design and analysis of algorithms including important algorithms and data structures, and results in complexity and computability. Different algorithms for a given computational task are presented and their relative merits evaluated based on performance measures.

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

CO1: analyze the asymptotic performance of algorithms
CO2: understand different algorithm design techniques
CO3: apply important algorithmic design paradigms and methods of analysis
CO4: demonstrate familiarity with major algorithms and data structures
CO5: evaluate different classes of problems: P, NP , NP Complete and NP Hard
CO6: create algorithms to apply in common engineering design situations

Topics:

- Introduction
- Divide-and-Conquer Method
- Dynamic Programming
- Graph Algorithms
- Complexity Classes

Textbook(s):

1. T. H. Cormen, C. E. Leiserson, R. L. Rivest, and C. Stein, "Introduction to Algorithms", Printice Hall of India,3rd Edition.
2. E. Horowitz & S Sahni, "Fundamentals of Computer Algorithms", Galgotial publication; Second edition.

Reference Book(s):

1. J.Kleinberg and E. Tardos, Algorithm Design, Pearson International Edition, 1st Edition.
2. Michael T Goodrich and Roberto Tamassia, "Algorithm Design: Foundations, Analysis, and Internet Examples", Wiley, Students 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

CS 2092 Operating Systems Laboratory

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

Course Description:

The objective of this lab is to give an idea about different components of operating system and their interactions happened in an operating system. Specifically, in this course, we mostly focus on the UNIX operating system, where student can get the practical understanding about how to manage the processes with respect to process creation, process communication process synchronization, threading, manage file, etc.

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

CO1: create multiple processes in UNIX platform, understand different system calls related to process, and analyze the performance of different scheduling algorithms by implementing in UNIX platform
CO2: understand the concepts of inter process communication and implement it using pipe in multi-programming operating system
CO3: understand the concepts of deadlock and implementation of deadlock avoidance algorithm in multi-programming system
CO4: understand the concepts of thread and its implementation using POSIX (P_thread) thread in multi-programming system
CO5: understand the synchronization concept by implementing semaphore and monitor using the existing library provided in the LINUX platform

Topics:

- UNIX commands
  pwd, whoami, mkdir (absolute path/ relative path), mkdir -p, cp, cp -r, rm, rm -r, rmdir, cat, cat>, cat >>, head, tail, ln, nl, grep, cut, echo, set, ls, date, moreMeasurement of inductance and capacitance by using Maxwell's bridge and Schering bridge
- Write and execute a shell program
- Implementation of array in shell script
- Discussion of a generalized way to design and implementation of the CPU scheduling algorithm (FCFS,SJF)
- Discussion of a generalized way to design and implementation of the CPU scheduling algorithm (Preemptive SJF, Round Robin Algo)
- Creation of a process using fork system cal and analyzing its paraent and child processes
- Discussion and implementation about process communication using pipe
- Discuss the thread creation using pthread library
- Discuss different functions related to Mutex lock using POSIX library
- Discuss different functions related to conditional variable using POSIX library
- Discuss different functions related to semaphore using POSIX library
- Producer consumer problem using semaphore / mutex lock
- Dining philosophers problem using semaphore / mutex lock

CS 2094 Database Management System Laboratory

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

Course Description:

This course provides the adequate knowledge to the students related to database concepts, technology and practice to create, modify, and extracting the data from the database based on the application requirement. This course also enables the student to understand different ways of interaction between programming language and different types of databases.

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

CO1: create database with different types of integrity constraints and use the SQL commands such as DDL, DML, DCL, TCL to access data from database objects
CO2: use database security & authorization in order to access database for the different kinds of the user
CO3: access and manipulate data using PL/SQL blocks
CO4: connect database to front end using JDBC and ODBC driver

Topics:

- Fundamentals of SQL
- Data Definition Language and Data Manipulation Language Commands in SQL
- Operators used in where clause
- Built in functions used in SQL
- Constraints in SQL
- Grouping, and Ordering of data
- Join and Set Theory operations
- Subqueries
- Data Control Language, and Transaction Control Commands
- Use of Programming Language blocks in SQL i.e. PL/SQL

CS 2098 Algorithm Laboratory

Credit: 1
Category: PCLC
Prerequisite(s): Data Structures Laboratory (CS 2091)

Course Description:

This course aims at providing different algorithm techniques for designing efficient algorithms and classify different algorithms based on asymptotic notation.

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

CO1: understand the basic graph algorithms for the fundamental knowledge of graph problem solving
CO2: understand and analyze the different technique of program writing and their comparisons
CO3: to study about various designing paradigms of algorithms for solving real world problems
CO4: have the knowledge of different graph programming
CO5: understand the geometric algorithms
CO6: understand the string programming

Topics:

- Review of Fundamentals of Data Structures
- Fundamentals of Algorithmic Problem Solving-I:
  Analysis of time complexity of small algorithms through step/frequency count method
- Fundamentals of Algorithmic Problem Solving-II:
  Analysis of time complexity of algorithms through asymptotic notations
- Divide and Conquer Method:
  Binary Search, Merge Sort, Quick Sort, Randomized Quick Sort
- Heap & Priority Queues:
  Building a heap, Heap sort algorithm, Min-Priority queue, Max-Priority queue
- Greedy Technique:
  Fractional knapsack problem, Activity selection problem, Huffman’s code
- Dynamic Programming:
  Matrix Chain Multiplication, Longest Common Subsequence

CS 3008 Compiler Design

Credit: 3
Category: PEC
Prerequisite(s): Computer Programming (CS 1093), Data Structures and Algorithms (CS 2001)

Course Description:

This course introduces students to the design and implementation of compilers for programming languages. Specifically, students will learn how to systematically translate modern, high-level, programming languages into efficient, assembly language code. This self-paced course will discuss the major ideas used today in the implementation of programming language compilers, including lexical analysis, syntactic analysis, recursive descent parsing, LL(1) parsing, LR parsing: SLR, Canonical LR, LALR parsing, syntax-directed translation, intermediate code generation, code generation, As a result , student will able to understand , implement and demonstrate the systematic translation of a program to machine level.

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

CO1: analyze the design of a compiler and the phases involved in program translation from source code to executable code along with the intermediate files produced by the phases
CO2: evaluate lexical analysis phase and its underlying formal models to design lexical analyzersthrough regular expressions and finite automaton
CO3: analyze syntax analysis phase, identify the similarities and differences among various parsing techniques to design parsers for any context free grammar
CO4: evaluate formal attributed grammars for specifying semantics of programming languages and design semantic rules to facilitate translation process
CO5: identify the effectiveness of optimization and learn various machine independent and machine dependent optimization techniques
CO6: analyze register allocation and target code generation algorithms used by the compiler

Topics:
- Overview of Compilation
- Lexical Analysis
- Syntax Analysis
- Semantic Analysis
- Code Optimization
- Code Generation

Textbook(s):
1. Compilers Principles, Techniques and Tools by Alfred V. Aho, Monica S. Lam, Ravi Sethi, Jeffery D. Ullman, Pearson Education, 2nd Edition, 2009.

Reference Book(s):
1. Compiler construction principles and practice by K. C. Louden, Brooks/Cole - Thomson Learning.
2. Engineering a Compiler by Keith Cooper, Linda Torczon, ISBN: 978-0-12-088478-0, Elsevier, Inc.
3. Introduction to Compiler Construction With Unix by Axel T. Schreiner, H. George Friedman, ISBN: 978-0134743967, Prentice-Hall software series.
4. The Compiler Design Handbook by Y.N. Srikant , Priti Shankar, ISBN:978-1420043822, Taylor and Francis.

CS 3011 Artificial Intelligence

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

Course Description:

Course introduces concept of AI through the idea of an intelligent agent. AI is defined as the study of agents that receive percepts from environment and perform actions. Each such agent implements a function that maps percept sequence to actions. Course covers different ways to represent these functions. It explains problem-solving agents using several blind and heuristic search algorithms including local search algorithms. Course analyzes adversarial search and constraint satisfaction problems. It describes the logical agents and ways to implement these using Propositional Logic and First-order Logic. Course introduces planning as a rational action of AI.

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

CO1: understanding AI definitions, foundations, history of its developments and current state of the art real world applications
CO2: analyze the knowledge of AI from a rational agent approach by understanding the PEAS specifications of the task environments, types of environments and types of agent structures
CO3: evaluate search-based problem-solving agents by knowing the importance of various search strategies, both uninformed (blind) and informed (heuristic)
CO4: analyze local search algorithms, optimization problems, sensor-less problems and exploration problems
CO5: evaluate adversarial search and constraint satisfaction Problems (CSP)
CO6: analyze knowledge of logical agents (Knowledge-based agents), propositional logic, first-order logic, forward chaining and backward chaining and planning problems

Topics:

- Introduction
- Intelligent Agents
- Solving Problems by Searching
- Uninformed search, informed Search and Exploration
- Constraint Satisfaction Problems
- Adversial search
- Logical Agents
- First-order Logic
- Knowledge Representation
- Planning

Textbook(s):

1. Artificial Intelligence: A Modern Approach – Stuart Russel, Peter Norvig, 3rd Edition, Pearson Education, 2018.

Reference Book(s):

1. Artificial Intelligence - Elaine Rich, Kevin Knight and Shivashankar B Nair, 3^{r} Edition, Tata McGraw Hill.,2008
2. Principles of Artificial Intelligence – Nils J. Nilsson,1st Edition, Elsevier, 1982.

CS 3027 Real Time Systems

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

Course Description:

This course presents the fundamental problems, concepts, and approaches in the design and analysis of real-time systems. It also discusses issues related to the design and analysis of systems with real-time constraints.

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

CO1: understand real-life applications of real-time systems
CO2: analyze characteristics and features of real-time system
CO3: apply various strategies to handle the functioning of various real-time features such as resources, tasks etc.
CO4: analysis of commercial real-time operating systems, real-time communications and real-time database
CO5: evaluate different real-time systems
CO6: analysis & compare real-time communications

Topics:

- Introduction
- Real-Time Task scheduling
- Fault-Tolerant
- Real-Time Communication

Textbook(s):

1. Real-Time Systems, R. Mall, Pearson, 1st Edition, 2007

Reference Book(s) :

1. Real-Time Systems, C. M. Krishna and K. G. Shin, McGraw Hill, reprinted 2004.
2. Real-time Systems, J. W. S.Liu, Pearson Education, 6th impression, 2008.
3. Real-Time Systems Design & Analysis, P. A. Laplante, Willey, 3rd Ed, 2004.
4. David B. Kirk, Wen-mei W. Hwu, “Programming Massively Parallel Processors: A Hands-on Approach”, 2010
5. Michael McCool, James Reinders, Arch Robison, “Structured Parallel Programming: Patterns for Efficient Computation”, 2012
6. Jason Sanders, Edward Kandrot, “CUDA by Example: An Introduction to General Purpose GPU Programming”, 2011

CS 3031 Computational Intelligence

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

Course Description:

Computational Intelligence provides a fundamental coverage of the concepts of machine intelligence. This course covers methodologies that can handle imprecision, uncertainty, and partial truth. There are three basic units, i.e. fuzzy logic, neural networks and genetic algorithms. Their application to solve problems of fuzziness, prediction and optimization are discussed. The course also covers combinatorial and hybrid models like fuzzy inference systems, ANFIS (Adaptive Neuro-Fuzzy Inference Systems), multi Layer perceptrons, etc.

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

CO1: understand the basic concepts and characteristics of soft computing and also its associated methodologies
CO2: apply various set theoretic operations in fuzzy sets
CO3: analyze fuzzy rules, fuzzy reasoning and various fuzzy inference systems
CO4: understand derivative free optimization and apply genetic algorithms to optimization problems
CO5: analyze concepts of artificial neural networks and apply neural networks to various classification problems
CO6: analyze some hybrid models such as adaptive Neuro-fuzzy inference systems

Topics:

- Introduction
- Artificial Neural Networks
- Fuzzy Set Theory
- Fuzzy Rules, Fuzzy Reasoning and Fuzzy Inference System
- Neuro-Fuzzy Models
- Optimization

Textbook(s):

1. Neuro-Fuzzy and Soft Computing, Jang, Sun, Mizutani, PHI/Pearson Education

Reference Book(s) :

1. Introduction to Soft Computing, Roy and Chakraborty, Pearson Education
2. Fuzzy Logic with Engineering Applications, Timothy J. Ross, McGraw-Hill, 1997.
3. Genetic Algorithms: Search, Optimization and Machine Learning, Davis E. Goldberg, Addison Wesley, N.Y., 1989.
4. Neural Networks: A Comprehensive Foundation, Simon Haykin, Prentice Hall
5. Neural Network Design, M. T. Hagan, H. B. Demuth, Mark Beale, Thomson Learning, Vikash Publishing House
6. Neural Networks, Fuzzy Logic and Genetic Algorithms, S. Rajasekaran and G.A.V. Pai, PHI, 2003

CS 3035 Machine Learning

Credit: 3
Category: PEC
Prerequisite(s): Probability & Statistics (MA 2011)

Course Description:

This subject aims to introduce undergraduate students to the world of Machine Learning. This course serves as a first course and expect the learners pile their fundamentals in this field. . The course introduces the motivation for machine learning and other cognitive techniques by different learning methods. It emphasizes on different categories of machine learning like supervised, unsupervised learning. Each of these categories is further described in detail through several problems in each class.

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

CO1: analyze fundamental issues and challenges of machine learning
CO2: develop an appreciation for what is involved in learning from data
CO3: evaluate the strengths and weaknesses of many popular machine learning approaches
CO4: appreciate the underlying mathematical relationships within and across Machine Learning algorithms and the paradigms of supervised and un-supervised learning
CO5: apply the concept of regression methods, classification methods and clustering methods
CO6: design and implement various machine learning algorithms in a range of real-world applications

Topics:

- Machine Learning, AI, Motivations for Studying ML
- Linear models
- Unsupervised learning
- Theoretical ML
- Assorted Topics

Textbook(s):

1. M. Gopalan, Applied Machine Learning , McGraw-Hill Education, 2019

Reference Book(s):

1. Christopher M. Bishop, Pattern Recognition and Machine Learning,Springer, 2006
2. Kevin Murphy, Machine Learning: A Probabilistic Perspective, MIT Press, 2012
3. Duda, Hart and Stork, Pattern Classification (2nd ed.), Wiley Interscience, 2000
4. Tom Mitchell, Machine Learning, McGraw Hill, 1997 (new chapters on line, 2006)

CS 3040 Data Structures Using C

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

Course Description:

This course explores several fundamental algorithms and data structures of computer science, and learns to implement them in C. 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.

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: implement different linear data structures such as Stack and Queue to solve various problems
CO4: implement different non-linear data structures such as Tree and Graph on various computing problems
CO5: implement standard algorithms for searching, sorting and hashing
CO6: effectively choose the data structure that efficiently models the information in a problem

Topics:

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

Textbook(s):

1. Data Structures: A Pseudocode Approach with C, 2nd edition, Richard F. Gilberg, Behrouz A. Forouzan.

Reference Book(s):

1. Data Structures, Schaum's OutLines, Seymour Lipschutz, Tata Mcgraw Hill
2. Data Structures using C by Aaron M. Tenenbaum, Yedidyah Langsam, Moshe J. Augenstein. Pearson, 1st Edition
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 3042 Computer Organization

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

Course Description:

This course teaches the fundamentals of computer architecture and organization, including CPU, registers, arithmetic unit, control unit and input output components.

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

CO1: understand how computer hardware has evolved to meet the needs of multiprocessing systems
CO2: study instruction Set Architecture: Instruction format, types, various addressing modes
CO3: understand the basic components and design of the CPU: the ALU and control unit
CO4: understand the memory organization: SRAM, DRAM, concepts on cache memory, Memory interleaving, Associative memory, Virtual memory organization
CO5: coprehend the parallelism both in terms of a single processor and multiple processors
CO6: understand the I/O Organization: Basics of I/O, Memory-mapped I/O & I/O mapped I/O, Types of I/O transfer: Program controlled I/O, Interrupt-driven I/O, DMA

Topics:

- Introduction:
- Basic Processing Unit
- Pipelining
- Memory System
- I/O Organization

Textbook(s):

1. Carl Hamacher, Zvonko Vranesic and Safwat Zaky, “Computer Organization”, Fifth Edition, Tata McGraw Hill, 2002.

Reference Book(s):

1. William Stallings, “Computer Organization and Architecture – Designing for Performance”, Sixth Edition, Pearson Education, 2003.
2. John P. Hayes, “Computer Architecture and Organization”, Third Edition, Tata McGraw Hill, 1998.
3. V.P. Heuring, H.F. Jordan, “Computer Systems Design and Architecture”, Second Edition, Pearson Education, 2004.

CS 3044 Relational Database Management System

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

Course Description:

This course focuses on concepts and structures required to design and implement a database management system. Various data models, integrity constraints, concurrency, step-by-step normalization process is also covered in this course.

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

CO1: understand the basic concepts & applications of database systems
CO2: construct an Entity-Relationship (E-R) model from specifications and to perform the transformation of the conceptual model into corresponding logical data structures
CO3: construct queries using relational algebra
CO4: construct queries and maintain a simple database using SQL
CO5: distinguish between good and bad database design, as well as apply data normalization principles
CO6: apply database transaction management and database recovery

Topics:

- Introduction
- Relational Data Model
- Relational Query Language
- Relational Database Design
- Transaction Processing

Textbook(s):

1. Fundamentals of Database System By R. Elmasari & S.B. Navathe, 7th Edn,2018, Pearson Education

Reference Book(s):

1. Database Management Systems by R. RamaKrishna & J. Gehrke ,3rd Edn, 2018, McGraw-Hill Education
2. Fundamentals of Relational Database management Systems by S. Sumathi & S. Esakkirajan, 2007 Springer.
3. Database System Concepts by A. Silberschatz, H.F. Korth & S. Sudarshan, 6th Edn, 2019, McGraw- Hill Education

CC 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

CS 3096 Tools and Techniques Laboratory

Credit: 2
Category: PCLC
Prerequisite(s): Data Structures and Algorithms (CS 2001), Object Oriented Programming (IT 2005), and Probability & Statistics (MA 2011)

Course Description:

The course aims to provide exposure to problem-solving through python programming. It aims to train the student to implement different machine learning techniques using python library.

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

CO1: acquire a fundamental understanding of the basics of Python Programming
CO2: understand and implement the Data Structures in Python: List, Tuple, Set and Dictionary
CO3: explore the understanding of Object Oriented Programming using Python
CO4: comprehend and apply the concept of Regular Expressions using large data-set(csv files)
CO5: implement various Python tools and Libraries like Panda,Numpy, SciKit, matplotlib etc.
CO6: develop a Mini project in Python in any of the domain like Machine Learning,Natural Language Processing,Sentiment Analysis,Data Analytics,Web Scrapping and Web development, chatbots etc.

Topics:

- Python Installation, Data types,User Input/Output,Code commenting
- Control Flow and Looping
- Data Structure like Lists, Tuples, Dictionaries and Sets
- Functions, Lambda, Filter, Map, Reduce
- Generators , Iterators, Decorators
- File Handling, Exception Handling
- Basics of Object Oriented Programming in Python
- Regular Expression(Regex)
- JSON and Database Handling in Python
- Data Analytics using Libraries:Pandas,Numpy,Matplotlib
- Web Scrapping using Beautiful soup and Selenium
- Overview of Machine Learning(Supervised & Unsupervised ML)
- Mini Project on Web Development,Data Analytics,Natural Language Processing
- Mini Project on Android Development

CS 4001 Distributed Algorithms

Credit: 3
Category: PEC
Prerequisite(s): Design and Analysis of Algorithms (CS 2012)

Course Description:

Distributed algorithms are algorithms designed to run on multiple processors, without tight centralized control. In general, they are harder to design and harder to understand than single-processor sequential algorithms. Distributed algorithms are used in many practical systems, ranging from large computer networks to multiprocessor shared-memory systems.

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

CO1: understand different models of distributed systems and understand the basic techniques for designing algorithms in these models
CO2: learn and apply knowledge of distributed techniques and methodologies
CO3: explain the design, testing, and performance analysis of distributed algorithms
CO4: identify faults and failures in distributed systems
CO5: design and develop stabilized distributed algorithms for specific problems
CO6: design and develop distributed algorithms for real world problems

Topics:

- Introduction
- Synchronous Network Model
- Asynchronous system model
- Asynchronous network model
- Shared memory
- Fault Tolerance in distributed systems

Textbook(s):

1. Nancy A Lynch, "Distributed Algorithms", Morgan Kaufman Publishers 1996

Reference Book(s):

1. Gerard Tel, "Introduction to Distributed Algorithms", Cambridge University Press, 2nd Edition, 2000

CS 4002 High Speed Networks

Credit: 3
Category: PEC
Prerequisite(s): Computer Networks (IT 3005)

Course Description:

This course builds on topics introduced in the undergraduate computer networks course and investigates more advanced concepts to highlight the features of different technologies involved in high speed networking and their performance. Topics to be addressed include high speed LANS, ATM protocol architecture details, IP QoS, and MPLS switching.

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

CO1: understand the basics of high speed networking technologies
CO2: understand traffic and congestion Management
CO3: understand resource allocation and service management approach
CO4: demonstrate the knowledge of network planning and optimization
CO5: apply the concepts learnt in this course to optimize performance of high-speed networks
CO6: design and configure networks to support a specified set of applications

Topics:

- Frame Relay Networks
- Queuing Analysis
- Retransmission Timer Management
- Integrated Services Architecture
- RSVP

Textbook(s):

1. William Stallings, High-speed networks and Internets – Performance and Quality of Service, PHI

Reference Book(s):

1. Mahoob Hassan, Raj and Jain, High Performance TCP/IP Networking: Concepts, issues and solutions,PHI
2. William Stallings, High-speed networks: TCP/IP and ATM design principles, PHI
3. Marc Boisseau, Michel Demange, Jean-Marie Munier, High speed networks, Wiley
4. Abhijit S. Pandya, Ercan Sea, "ATM Technology for Broad BandTelecommunication Networks", CRC Press, New York, 2004.

CS 4003 Software Defined Network

Credit: 3
Category: PEC
Prerequisite(s): Computer Networks (IT 3005)

Course Description:

This course introduces about software defined networking, an emerging paradigm in computer networking that allows a logically centralized software program to control the behavior of an entire network. In this course, the perspective from different players is highlighted, including a discussion of Network Function Virtualisation (NFV). The deployment of software defined networks is discussed in detail with a focus on OpenFlow.

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

CO1: differentiate between traditional networks and software defined networks
CO2: understand advanced and emerging networking technologies
CO3: apply the SDN abstractions over the networks
CO4: obtain skills to do advanced networking research and programming
CO5: apply techniques that enable applications to control the underlying network using SDN
CO6: describe Network Functions Virtualization components and their roles in SDN

Topics:

- Introducing SDN
- SDN Abstractions
- Programming SDN'S
- SDN Applications and Use Cases
- SDN'S Future and Perspectives

Textbook(s):

1. Cosma Rohilla Shalizi, Advanced Data Analysis from an Elementary Point of View, 2015.

Reference Book(s):

1. Deng & Yu, Deep Learning: Methods and Applications, Now Publishers, 2013.
2. Ian Goodfellow, Yoshua Bengio, Aaron Courville, Deep Learning, MIT Press, 2016.
3. Michael Nielsen, Neural Networks and Deep Learning, Determination Press, 2015.

CS 4004 Transaction Processing Systems

Credit: 3
Category: PEC
Prerequisite(s): Database Management System (CS 2004)

Course Description:

This course describes the fundamental of information processing system involving the collection, modifications and retrieval of all transaction data. It includes in-depth knowledge of consistency, scheduling, performance, reliability, authentication and authorization of transactions.

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

CO1: describe Transaction Processing System and understand ACID (atomicity, consitency, isolation, durability) properties of transactions and their implications on system correctness and performance
CO2: understand various transaction processing models and how these models influence the design of applications involving transactional access to a database
CO3: identify and discuss the procedures to safeguard Transaction Processing System
CO4: implementation and support of ACID properties in modern relational and non-relational database transaction processing systems
CO5: comprehend modern architectures of distributed transaction processing systems and their influence on ecurity, Replication and ACID properties
CO6: determine the practices that can be applied to test Transaction Processing System

Topics:
- Introduction
- Schedules, Concurrency and locking Model
- Recovery Process
- Transaction Processing
- Security Issues

Textbook(s):
1. Michael Kifer, Arthur Bernstein and Philip M. Lewis, "Database Systems: An Application Oriented Approach", 2nd Edition, Addison-Wesley, 2006.

Reference Book(s):
1. Philip A. Bernstein and Eric Newcomer, "Principles of Transaction Processing", 2nd Edition,Morgan Kaufmann, Elsevier, 2009.

CS 4005 Pervasive Computing

Credit: 3
Category: PEC
Prerequisite(s): Cloud Computing (IT 3022)

Course Description:

The course discusses on the omnipresence of information devices. These devices can be embedded into cars, airplanes, ships, bikes, posters, signboards, walls and even clothes. This course focuses on the understanding elements involved in designing and building Internet of Things / Ambient Intelligence based Environments. It, thus covers independent information devices including but not limited to wearable computers, mobile phones, smart phones, smart-cards, wireless sensor-compute nodes etc. and the services made available by them in typical Ubiquitous/ Pervasive / Everywhere Computing environment. It includes select aspects of human-computer interaction using several types of elements including sensing, text, speech, handwriting and vision.

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

CO1: understand the fundamentals of pervasive computing
CO2: familiarize with architectural elements of pervasive computing system
CO3: distinguish several wireless and web-based protocols for device connectivity and security
CO4: integrate pervasive computing in voice technology on WAP architecture
CO5: implement pervasive web application on PDA
CO6: develop applications of pervasive computing

Topics:
- Introduction
- Device connectivity and web applications
- Wireless Application Protocol and voice technology
- Personal digital assistant and pervasive web application
- Interface issues in pervasive computing

Textbook(s):
1. JochenBurkhardt, Horst Henn, Stefan Hepper, Thomas Schaech & Klaus Rindtorff, "Pervasive Computing, Technology and Architecture of Mobile Internet Applications", Pearson Education, 2012. ISBN-13: 978-0201722154

Reference Book(s):
1. Stefen Poslad: Ubiquitous Computing: Smart Devices, Environments and Interactions, Wiley, London, 2009, Indian reprint, 2014.
2. UweHansmann, L. Merk, M. Nicklous, T. Stober, U. Hansmann, "PervasiveComputing (Springer Professional Computing) ", 2003, Springer Verlag,ISBN:3540002189
3. Frank Adelstein, Sandeep KS Gupta, Golden Richard III, Loren Schwiebert, "Fundamentals of Mobile and Pervasive Computing", McGraw Hill edition, 2006. ISBN-13: 978-0071412377

CS 4006 Programming for Multi Core Systems

Credit: 3
Category: PEC
Prerequisite(s): High Performance Computing (CS 3010)

Course Description:

The course briefly covers the history of the microprocessor evolution and discusses the reasons for the recent shift in architecture design toward multicores. Students will also learn about the various programming models currently used for programming parallel architectures. The course will explore broader implications of the stream programming model to various kinds of traditional parallelization technology. This course teaches how to organize the computations of the threads so that they work together and perform the required computations efficiently, making good use of the available hardware resources.

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

CO1: understand the fundamentals of multi-core architecture
CO2: know the basic concepts of multi core programming using threads
CO3: understand various programming constructs in multi-core architecture
CO4: analyze the handling of threads in multi-core systems
CO5: exploit the benefit of parallel programming
CO6: design and develop APIs for Multi threaded Applications

Topics:

- Fundamentals of Multi core
- Introduction to Threads
- Thread Programming Types and APIs
- Thread Handling and Debugging
- Implementation of Different Programming Constructs

Textbook(s):

1. Shameem Akhter and Jason Roberts, "Multi-Core Programming: Increasing Performance through Software Multi Threading", Intel Press, 2006
2. Maurice Herlihy and NirShavit, "The Art of Multiprocessor Programming",Revised First Edition, Elsevier Publication, 2012

Reference Book(s):

1. John L. Hennesy, and David E. Patterson, "Computer Architecture: A Quantitative Approach", 5th Edition, Elsevier Publication, 2012
2. Thomas Rauber and GudulaRünger, "Parallel Programming: for Multi-core and Cluster Systems" , 2nd Edition, Springer Publication, 2010

CS 4007 Soft Computing

Credit: 3
Category: PEC
Prerequisite(s): Probability & Statistics (MA 2011)

Course Description:

Soft computing is a concept which has a direct bearing in machine intelligence. Now, intelligent systems have become a reality. The guiding principle of soft computing is to exploit the tolerance for imprecision, uncertainty, and partial truth to achieve tractability, robustness, low solution cost, and better rapport with reality. The course emphasizes on principle and applications of some representative soft computing methodologies such as fuzzy logic (Fuzzy Inference Systems), neurocomputing (Artificial Neural Network) and probabilistic reasoning (Genetic Algorithms). It also introduces the significance of a hybrid model known as ANFIS (Adaptive Neuro-Fuzzy Inference System).

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

CO1: understand the concepts soft computing and its associated methodologies
CO2: understand and analyze fuzzy rules, fuzzy reasoning and various fuzzy inference systems
CO3: comprehend the significance of derivative free optimization and learn to apply genetic algorithms to optimization problems
CO4: gain knowledge on the concepts of artificial neural networks and apply neural networks to various classification problems
CO5: analyze some hybrid models such as adaptive neuro-fuzzy inference systems
CO6: design and develop applications of soft computing techniques to solve various inferencing, classification and optimization problems

Topics:

- Introduction of soft computing
- Fuzzy sets
- Neural network architecture
- Artificial Neural Network
- Derivative-free Optimization
- Genetic algorithm

Textbook(s):

1. Neuro-Fuzzy and Soft Computing, Jang, Sun, Mizutani, PHI/Pearson Education .

Reference Book(s):

1. Timothy J. Ross, “Fuzzy Logic with Engineering Applications”, Wiley India, 3rd edition, 2012
2. Zimmermann H. J. "Fuzzy set theory and its Applications" Springer international edition, 2011
3. David E. Goldberg, “Genetic Algorithms in Search, Optimization, and Machine Learning”, Pearson Education, 2009
4. Laurene V. Fausett, “Fundamentals of Neural Networks: Architectures, Algorithms, And
5. Applications”, Pearson Education, 1st edition, 1993
6. W. T. Miller, R. S. Sutton and P. J. Webros, “Neural Networks for Control”, MIT Press, 1996

CS 4008 Advanced Cryptography

Credit: 3
Category: PEC
Prerequisite(s): Discrete Mathematics (MA 2013)

Course description:

The course covers the concepts of relevance of number theory, group, ring, finite fields and modular arithmetic in various contexts of cryptography, formal notions of attacks, public key cryptosystems, various digital signature schemes, Zero Knowledge Proofs and Protocols for authentication and lattice based cryptography which is a candidate for post-quantum cryptography

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

CO1: understand the relevance of number theory, group, ring, finite fields and modular arithmetic in various contexts of Cryptography
CO2: understand the basic concepts of cryptography and various attack models
CO3: understand the ideas of asymmetric key cryptosystems, entity authentication, message digest algorithms and digital signature schemes
CO4: break cryptosystems that are not provably secure
CO5: derive simple provable security proofs for cryptographic schemes
CO6: design and implement cryptographic protocols

Topics:

- Review of number theory, group, ring and finite fields, quadratic residues, Legendre symbol, Jacobi symbol
- Formal Notions of Attacks
- Public key cryptography
- Digital signatures
- Zero Knowledge Proofs and Protocols, lattice based cryptography

Textbook(s):

1. W. Mao, “Modern Cryptography: Theory & Practice”, Pearson Education, 2010
2. Jeffrey Hoffstein, Jill Pipher, and Joseph H. Silverman, “An Introduction to Mathematical Cryptography”, Springer publication.

Reference Book(s):

1. Koblitz, N., “Course on Number Theory and Cryptography”, Springer Verlag, 1986
2. Menezes, A, et.al., “Handbook of Applied Cryptography”, CRC Press, 1996
3. Thomas Koshy, “Elementary Number Theory with applications”, Elsevier India, 2005

CS 4009 Middleware Technologies

Credit: 3
Category: PEC
Prerequisite(s): Web Technology (IT 2004)

Course Description:

This course aims to discuss on Middleware Technologies, so that they can pick out the real issues and start building complex distributed systems.

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

CO1: have fundamental knowledge on client server programming
CO2: understand middleware architecture and distributed applications
CO3: design applications using JSP with database connectivity through JDBC drivers
CO4: design and create the distributed applications using Remote Method Invocation (RMI)
CO5: design and develop middleware components using EJB framework
CO6: design IT applications and business processes using middleware architecture

Topics:

- Introduction to client server computing
- Middleware
- JSP
- Database connectivity using JDBC
- Introduction to RMI and RPC
- Introduction to EJB Component Architecture

Textbook(s):

1. Chris Britton, "IT Architectures and Middleware: Strategies for Building Large, Integrated Systems", Pearson Education, 2 nd Edition , 2004

Reference Book(s):

1. Professional Java Server Programming: J2EE 1.3ed Paperback – 2007 by Cedric Buest Subrahmanyam Allamaraju

CS 4010 Game Theory

Credit: 3
Category: PEC
Prerequisite(s): Probability & Statistics (MA 2011)

Course Description:

Game theory is the mathematical modeling of strategic interaction among rational agents. The course will provide basic representing games and strategies. The course will discuss on various application of game theory.

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

CO1: identify strategic situations and represent them as games
CO2: solve simple games using various techniques
CO3: analyze economic situations using game theoretic techniques
CO4: recommend and prescribe which strategies to implement.
CO5: apply the awareness of life-long learning of Game Strategy
CO6: understand the perfect and imperfect information in competitive world

Topics:

- Introduction
- Game in strategic form
- Perfect Information Games
- Bayesian Games
- Static games
- Signaling Games Bargaining

Textbook(s):

1. Martin Osborne, An Introduction to Game Theory, Oxford University Press, 2004

Reference Book(s):

1. Giacono Bonaanno, Game Theory, 2nd edition, 2018, ISBN: 978-19833604638.

CC 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

CC 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

COURSES OF OTHER PROGRAMMES

CC 3021 Principles of Cryptography

Credit: 3
Category: PEC
Prerequisite(s): Probability & Statistics (MA 2011)

Course Description:

The course covers the concepts of relevance of number theory, group, ring, finite fields and modular arithmetic in various contexts of cryptography, Security goals and principles, formal notions of attacks, working principles of various symmetric key cryptographic algorithms, working principles of various asymmetric key cryptographic algorithms, message integrity, entity authentication mechanisms and key management techniques.

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

CO1: understand the Mathematics of Symmetric and Asymmetric Key Cryptography
CO2: understand the basic concepts and goals of the security
CO3: analyze symmetric key cryptosystems and their applications
CO4: analyze public key cryptosystems and their applications
CO5: study the requirement of Key management
CO6: evaluate a range of access control and authentication mechanisms

Topics:

- Mathematical Foundations for Cryptography
- Introduction to Computer Security
- Symmetric Key Cryptography
- Asymmetric Key Cryptography
- Integrity, Authentications, and Key Management

Textbook(s):

1. Cryptography and Network Security: Behrouz A Forouzan and Debdeep Mukhopadhyay, McGraw Hill Education, 3rd edition 2018.

Reference Book(s):

1. Cryptography and Network security: Principles and Practice, William Stallings, Pearson Education, 5th edition, 2011.
2. Introduction to Cryptography with Coding Theory: W. Trappe and L. C. Washington, Pearson Education, 2nd edition 2011.
3. Elementary Number Theory with applications: Thomas Koshy, Elsevier India, 2008.
4. Cryptography and Network Security: Atul Kahate, Tata McGraw Hill Education, 3rd edition, 2013.

CC 3024 Network Security

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

Course Description:

The course covers the principles and architecture of network security, detection of common threats and vulnerabilities, symmetric and asymmetric crypto systems, various hash functions, access control, key distribution, user authentication, IP security, transport-Level Security, application-level security and wireless network security.

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

CO1: understand fundamentals of networks security, principles and its architecture
CO2: detect common threats and vulnerabilities
CO3: understand various cryptographic operations used for both symmetric and asymmetric cryptographic algorithms
CO4: analyze different ways to distribute keys over the network along with satisfying user authentication
CO5: finding secure protocols that provide security at different layers of OSI model over the Internet
CO6: understand the importance of secure communication in wireless medium and security mechanisms used in Wireless LAN

Topics:

- Introduction to security issues, various attacks, security services
- Cryptography techniques
- Key Distribution and User Authentication approaches
- IP Security
- Transport-Level Security
- Application-Level Security
- Wireless Network Security

Textbook(s):

1. Network Security Essentials: Applications and Standards, William Stallings, 4th Edition, Pearson, 2011

Reference Book(s):

1. Cryptography and Network Security: Behrouz A Forouzan and Debdeep Mukhopadhyay, McGraw Hill Education, 3rd edition, 2018.
2. William Stallings, Cryptography and Network Security: Principles and Practice, Pearson, 7th Edition, 2017.

CC 3028 Information Security

Credit: 3
Category: PEC
Prerequisite(s): Computer Networks (IT 3005)

Course Description:

The course covers the principles of security, taxonomy of cryptography, symmetric cryptosystems, asymmetric crypto systems, various hash functions, access control and authorization mechanisms, software flaws, malwares and their solutions, network security issues and challenges.

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

CO1: understand the common threats faced in day to day life
CO2: analyze the foundational theory behind information security, the basic principles and techniques in designing a secure system
CO3: distinguish between symmetric and asymmetric crypto systems
CO4: analyze the access control and authorization mechanisms
CO5: find the software flaws and malwares and provide the solutions
CO6: solve the security issues over the network

Topics:

- Introduction to principles of Security
- Symmetric- and Asymmetric- Key Cryptography
- Hash Functions & Cryptanalysis
- Access Control & Authorization
- Software Flaws & Malwares
- Network Security:

Textbook(s):

1. Information Security, Principles and Practices –Mark Stamp – 2nd Edition, 2018, Wiley.

Reference Book(s):

1. Cryptography and Network Security – Behrouz A. Forouzan, Debdeep Mukhopadhyay, 3rd Edition, 2018, McGraw Hill Education .
2. Cryptography and Network Security, Principles and Practice – William Stallings – 5th Edition, 2011, Pearson.

EC 2011 Digital Electronics

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

Course Description:

This course covers all basicl concepts in digital design. The course starts with fundamentals of Boolean Algebra-different number systems and interconversions, 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 analyse 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 analyse 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 2016 Communication Engineering

Credit : 4
Category: PCC
Prerequisite(s): Principles of Signals and Systems (EC 2023)

Course Description:

This course is offered to 5th semester Electronics and Electrical, Electronics and Instrumentation, Electronics and Computer Science Engineering students. Students will be able to understand the essence and applications of communication engineering in today's world. The main objective of this course is to understand and implement the basic Analog and Digital communication techniques/ circuits with the help of theoretical concept and problem solving. Moreover this course help the students to perform communication Engineering laboratory in current semester along with provides a basic idea to understand higher communication based subjects

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

CO1: understand the basic of signal and systems, Fourier transform and their properties, random process, random variable, PSD & ESD of a signal
CO2: explain the need of communication, its definition & understand the block diagram of different types of communication system
CO3: classify amplitude modulation, angle modulation, Pulse modulation, Types of digital modulation
CO4: applying Fourier transform for analysis of radio spectrum, sketch the waveform and interpret the information present
CO5: design simple systems for generating and demodulating amplitude modulated signals, frequency modulated signal, pulse modulated signal and digital modulation
CO6: design a communication system and select an appropriate modulation technique for a particular application

Topics:

- Introduction
- Signals
- Amplitude Modulation
- AM Radio Receiver
- Angle Modulation
- FM Radio Receiver
- Pulse Modulation and Demodulation
- Digital Modulation
- Modern Communication Systems

Textbook(s):

1. Modern Digital and Analog Communications Systems - B.P. Lathi - Hardcover, Oxford University Press, 4th Edition.

Reference Book(s):

1. Principles of Communication System – H. Taub & D.L.Schilling – TMH, 3rd Edition
2. Introduction To Analog &Digital Communication System- Simon Haykins,Wiley Student Edition 2011, John Wiley

EC 2023 Principle of Signals and Systems

Credit: 2
Category: PCC
Prerequisite(s): Mathematics - II (MA 1004)

Course Description:

Principle of Signals and Systems is an introduction to analog and digital signal processing, a topic that forms an integral part of engineering systems in many diverse areas, including seismic data processing, communications, speech processing, image processing, defense electronics, consumer electronics, and consumer products.
The course presents and integrates the basic concepts for both continuous-time and discrete-time signals and systems. Signal and system representations are developed for both time and frequency domains. These representations are related through the Fourier transform and its generalizations, which are explored in detail. The Laplace transform exposition and demonstration of the basic concepts of analog signals and systems, are discussed and illustrated.

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

CO1: comprehend and plot continuous and discrete signals and determine respective characteristics
CO2: explain the relation between signals and vectors and analyze the concept of vector space and orthogonality
CO3: classify various types of systems and analyze system characteristics in time domain
CO4: determine the frequency domain representations of periodic and aperiodic signals using Fourier analysis and its properties
CO5: analyze LTI systems in frequency domain using Fourier analysis for periodic as well as aperiodic signals
CO6: determine the Laplace Transform of various signals and analyze analog systems characteristics using Laplace transform and its properties

Topics:

- Introduction to signals and Classification of signals
- Introduction to continuous and discrete time signals and sampling theorem
- Decomposition of signals, Representation of signals in terms of impulses
- Introduction&classification to systems with examples
- Characteristics of LTI systems and derivation of system response
- Causality and stability criteria of discrete and analog LTI IIR, FIR
- Introduction to Fourier Analysis and their need in LTI
- Properties of CTFS with examples&Approximation of Fourier Series to Transform for aperiodic signals
- Properties of Fourier transform with examples
- Analysis of LTI Systems using FT, Establishment of Laplace transformas modification of FT
- Laplace transform. Convergence of Laplace Transform, Properties of Laplace Transform
- Transfer function, Pole-Zero plot and ROC properties

Textbook(s):

1.Signals & Systems by Oppenheim and Willsky, PHI publlication , 2nd edition.

Reference Book(s):

1.Signals and Systems, Tarun Kumar Rawat, Oxford Publication, 1stedition, 2015.
2.Signals and Systems, Nagoor Kani, MGH, 6thedition.
3.Signals and systems, Narayana Iyer, Cengage Publication, 1stedition, 2012.
4.Signals and systems, Simon Haykin, John Wiley and Sons, 2nd edition.

5.Signals and systems, Ramesh Babu, Scitech Publication, 4thedition.

EC 2093 Digital Electronics Laboratory

Credit: 2
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 withVerilog 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

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 MTECH and PhD 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 technoque
- Data formating, different Digital Modulation and Demodulation Techniques such as BASK,BPSK,BFSK,QPSK
- Open ended experiments

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 demonstrate 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 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 learntestbench 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 Book(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 Digital Communication Techniques (EC 2012), Communication Techniques (EC 3005), Communication Engineering (EC 2016)

Course Description:

The significant learning and design experiences of the course EC3036 Cellular communication include the basics of cellular communication, 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, handoff are described. 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 communication and to understand basic Cellular Architecture and practical mobile communication strategies
CO2: describe basic propagation models and to understand signal degradation in wireless channels
CO3: design channel equalization and to implement diversity techniques used for practical cellular systems
CO4: distinguish between the 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 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 Ed., 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, 1 st Ed., 2005.

EC 3064 Information Theory and Coding

Credit: 3
Category: PEC
Prerequisite(s): Digital Communication Techniques (EC 3005)

Course Description:

This course is intended for undergraduate students of the electronics engineering and the computer science programs.

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.
Information theory and coding are the two load-bearing pillars of any digital communication system. In this introductory course, we will start with the basics of information theory and source coding. Subsequently, we will discuss the theory of linear block codes (including cyclic codes, BCH codes, RS codes), convolutional codes.
Finally, we will introduce the basics of secure communications by focusing on cryptography and physical layer security. Wherever possible, applications of the theory in real world scenarios have been provided.

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.
2. Principle of Digital Communication- J. Das, P. K. Chatterjee & S. K. Mullick.

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.

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 and 8086. Interfacing chips 8255 PPI, 8259 PIC and 8251 USART. Basics of 8051 Microcontroller. In this course, the students learn about assembly language to program the Microprocessors, Microcontrollers and develop programs to solve simple applications. This course will also help the students to perform simple experiments in MPMC lab using Microprocessor, Microcontroller based trainer kits in real time.

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:

- Introduction : Review of Semiconductor Memory Chips, Tristate Concept & Bus Structure, A Basic Microprocessor based system
- 8 bit Processor Overview : Concept of Bus Structure, Brief outline of a 8085 Microprocessor based system, Architecture, Concept of stack, Overview of Instructions & Addressing Modes etc.
- 8086 (16 bit Microprocessor) : Introduction, 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 : Introduction, Overview of MCS-51 Family of Microcontrollers Memory Organization - Program Memory, Data Memory, Register Banks & SFRs, Bit Addressable RAM, Pins & Signals, Addressing Modes, 8051 Instruction Set & Sample problems, 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 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. Furthermore, wireless communication-related experiments are performed on the Virtual Labs platform of IIT Kharagpur.
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 pathloss fundamentals are performed on the Virtual Labs platform.

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 networkconfigurations using CISCO® Packet Tracer
CO4: analyze and comprehend the frequency reuse concepts and effects of handover (Mobility Management) in mobile cellular networks (MCN) using Virtual Lab
CO5: analyze and comprehend effect of shadowing on path-loss formula using Virtual Lab
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 using virtual lab
- To understand the effect of shadowing on pathloss formula
- Two open ended experimentsbased on application and scenario-specific network requirements based on case-study/client requirement

Textbook(s):

1. Wireless Communication by Theodre S Rappaport, Pearson Education India
2. Computer Networks by Behrouz A Forouzan

Reference Book(s):

1. NS by Example byJae Chungand Mark Claypool [http://nile.wpi.edu/NS/]

EC 6122 Satellite Communication Systems

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

Course Description:

The course offers the students to the basic concept regarding satellite communication. Satellite communication systems carry much of the world's communication traffic, especially over oceans, and are extensively used for television distribution and navigation. Satellites are also being involved for data relay and personal communication systems. This course will help the students to know how to place a satellite in orbit and about the earth & space segment. The satellite services like broadcasting are also studied.

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: analyzelogical 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. 2. Wireless Sensor Network, C. Raghavendram, K Sivalingam and T. Znati, KLUWER ACADEMIC PUBLISHERS, 2004.

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.

IT 2004 Web Technology

Credit: 3
Category: PCC / OEC
Prerequisite(s): Object Oriented Programming (IT 2005)

Course Description:
This course provides a basic overview and understanding of many key web technologies internet fundamentals, such as HTML & Cascading Style Sheets (CSS). This course of study also builds on the skills gained by students in Java Fundamentals or Java Foundations to help advance Java programming skills. Students will design object-oriented applications with Java and will create Java programs using hands-on, engaging activities

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

CO1: understand and design interactive web page(s) using HTM & CSS
CO2: identify classes, objects, members of a class and relationships among them needed for a specific problem
CO3: design Java application programs using basic concepts of OOP principles and proper program structuring
CO4: demonstrate the concepts of polymorphism, inheritance, packages & interfaces
CO5: analyze Java programs to implement error handling techniques using exception handling
CO6: apply I/O streams and design of an applet

Topics:
- Web Development
- Introduction to Java
- Classes, Inheritance
- Interface, Package
- Exception Handling
- String Handling
- Java I/O Stream
- Applet

Textbook(s):
1. Java Programming for Core and Advanced Learners, Sagayaraj, Denis, Karthik and Gajalakshmi, 1st Edition, Universities Press 2018

Reference Book(s) :
1. Java-The Complete Reference,Herbert Schildt, 9th Edition, McGraw Hill Education 2014
2. HTML- Complete Reference,Powell, 3rd Edition, TMH 2007
   Introduction to JAVA Programming, Y.Daniel Liang, 6th Edition, Pearson Education 2007

IT 2005 Object Oriented Programming

Credit: 3
Category: PCC / OEC
Prerequisite(s): Computer Programming (CS 1093)

Course description:

This course is a comprehensive hands-on introduction to object oriented programming in C++ for C programmers. Emphasis is placed on the features of C++ that support effective modeling of the problem domain and reuse of code. Topics include Introduction to Object Oriented Programming, Class and Object, Constructor and Destructors, Static members, Friend functions, Inheritance, Polymorphism: Operator Overloading, Virtual Functions, Exception Handling, Templates, Files and Streams. Besides the theoretical foundations, students acquire Hands -on experience by implementing all the OOPs concepts.

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

CO1: understand the difference between structure-oriented programming and object-oriented programming
CO2: apply object-oriented programming language like C++ and associated libraries to develop object- oriented programs
CO3: apply various object-oriented features like class, object, inheritance, data abstraction, encapsulation polymorphism to solve various computing problems using C++ language
CO4: apply and Analyzing concepts of operator-overloading, constructor and destructor
CO5: apply and evaluate exception handling and use built-in classes from STL
CO6: implement, test and debug solutions in C++

Topics:

- Introduction to Object Oriented Programming
- Class and Object
- Inheritance
- Polymorphism
- Exception Handling, Templates, Files and Streams

Textbooks(s):

1. Object Oriented Programming with C++, Reema Thareja, OXFORD University Press, Revised First Edition, 2018.
2. Object Oriented Programming with C++, E.Balaguruswamy, McGraw Hill Education; Seventh edition 2017.

Reference Book(s):

1. C++ completes reference, Herbert Schildt, TMG Hill, 4th Edition, 2002.
2. C++ How to Program, Deitel and Deitel, Pearson Education Asia, 8th Edition, 2011.
   Object Oriented Programming with Ansi and Turbo C++, Ashok N Kamthane, Pearson Education, 1st Edition,2003

IT 2094 Web Technology Laboratory

Credit: 1
Category: PCLC
Prerequisite(s): Data Structures and Algorithms (CS 2001) and Object Oriented Programming (IT 2005)

Course Description:

This course provides the adequate knowledge to the students related to ways of designing various web pages for different applications. It also imparts the idea how to develop the front end applications using HTML and java languages.

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

CO1: understand the concept of HTML & create a web page using html and style sheet etc.
CO2: understand and implement the object oriented programming features using java
CO3: apply the concepts of class, package and interface in different use cases using java
CO4: implement the features of inheritance, string, exception and event handling in java
CO5: apply the predefined data structure using collection classes and life cycle model of applet for different applications using java

Topics:

- Design web pages using basic text formatting tags in HTML along with List, Table, Frame and form
- Design web pages using HTML with CSS
- Java program using control statements
- Java Program using array, command line arguments, static and final modifier
- Java program using class and objects, method overloading and constructor overloading
- Java program using different types of inheritance, method overriding and dynamic method dispatch
- Java program using abstract class and interface
- Java Program using package

IT 2095 Object Oriented Programming Laboratory

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

Course Description:

Object oriented programming lab uses C++ language for program implementation. This course is helpful for the students as they get to learn the basics of object-oriented programming and to use them along with the traditional programming concepts of C.

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

CO1: apply an object oriented approach to programming and identify potential benefits of object-oriented programming over other approaches
CO2: reuse the code and write the classes which work like built-in types
CO3: design applications which are easier to debug, maintain and extend
CO4: apply object-oriented concepts in real world applications

Topics:

- Execution of basic Input / Output statements in C++
- Execution of programs using Class & Objects
- Execution of programs using Constructors
- Execution of programs using Friend Function & Friend Class
- Execution of programs using concepts of Inheritance
- Execution of programs using concepts of Polymorphism (Function overloading, Operator overloading, Virtual Functions)
- Execution of programs using Pointers
- Execution of programs using Templates
- Execution of programs using File Handling in C++

IT 3003 Software Engineering

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

Course Description:

This course will explore several concepts and principles in parallel with software development. The course will begin with an introduction to software engineering as well as discussion of the main methodologies of software engineering. It covers all the phases of SDLC. The quality and reliability attributes of the software also discussed. Recent trends like Client-Server Software engineering, Service Oriented Architecture (SOA), Software as a Service (SaaS) are also discussed.

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

CO1: differentiate different software process models and understand their applicability in real life projects
CO2: gather and specify requirements of the software projects
CO3: apply the basic project management practices in real life projects
CO4: translate the baseline requirement specifications into design & development process
CO5: distinguish and apply different testing methodologies
CO6: evaluate different software matrix

Topics:

- Software Process Models
- Software Requirement Engineering
- Software Project Management
- Structural Analysis & Design
- Testing Strategies
- Software Reliability Software Maintenance
- Emerging Topics

Textbook (s):

1. Fundamentals of Software Engineering, Rajib Mall, PHI, Fifth edition.

Reference Book(s):

1. Software Engineering, A Practitioner's Approach, Roger S. Pressman, TMG Hill, Eighth edition.
2. Software Engineering, I. Sommerville, Pearson Education, Asia, Tenth Edition.

IT 3005 Computer Networks

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

Course Description:

This course provides an introduction to computer networks, with a special focus on the Internet architecture and protocols. Topics include layered network architectures, addressing, naming, forwarding, routing, communication reliability, the client-server model, web and email protocols. Besides the theoretical foundations, students acquire practical experience by implementing the basic features of real Internet protocols.

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

CO1: understand different models used for communication in a computer network
CO2: analyze how information transforms while moving through various layers of a computer network
CO3: apply the working of various application layer protocols to design a new protocol
CO4: evaluate the performance and reliability of data transmission
CO5: evaluate how to check and preserve the integrity of data during communication in a network
CO6: analyze the techniques of interconnection of nodes

Topics:

- Introduction
- Application Layer
- Transport Layer
- Network Layer
- Link-layer

Textbook(s):

1. Computer Networks: A top-down approach by Forouzan, McgrawHill .

Reference Book(s):

1. Computer Networking: A top-down approach", by Kurose and Ross, *5th Edition, Pearson*
2. Computer Networks", by A.S. Tannenbaum, 5th Edition, Pearson
3. Computer Networks: A systems approach", by Peterson and Daive, 5th Edition, Morgan Kaufmann

IT 3006 Data Analytics

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

Course Description:

This course provides an introduction to the concepts of big data, with focus on data analytics techniques and models. Topics include data analysis techniques such as regression modeling, support vector machines, time series analysis, rule Induction, sequential cover algorithm, data stream management systems, filtering streams for mining data streams. It further covers key topics such as hadoop, mapreduce, pig, hive, NoSQL and visualization concepts for handling the complexity of semi-structured and unstructured data. Besides the theoretical foundations, students formulate the concepts, principles, and techniques focusing on the applications to industry and real world experience.

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

CO1: understand and classify the characteristics, concepts and principles of big data
CO2: apply the data analytics techniques and models
CO3: implement and analyze the data analysis techniques for mining data streams
CO4: examine the techniques of clustering and frequent item sets
CO5: analyze and evaluate the framework and vizualization for big data analytics
CO6: formulate the concepts, principles and techniques focusing on the applications to industry and real world experience

Topics:

- Introduction to Big Data
- Data Analysis
- Mining Data Streams
- Frequent item sets and Clustering
- Frameworks and Visualization

Textbook(s):

1. Data Analytics, Radha Shankarmani,M. Vijayalaxmi, Wiley India Private Limited, ISBN: 9788126560639.

Reference Book(s):

1. Data Science and Big Data Analytics: Discovering, Analyzing, Visualizing and Presenting Data by EMC Education Services (Editor), Wiley, 2014
2. Bill Franks, Taming the Big Data Tidal Wave: Finding Opportunities in Huge Data Streams with advanced analystics, John Wiley & sons, 2012.
3. Glenn J. Myatt, Making Sense of Data, John Wiley & Sons, 2007 Pete Warden, Big Data Glossary,O'Reilly, 2011.
4. Jiawei Han, MichelineKamber "Data Mining Concepts and Techniques", Second Edition, Elsevier, Reprinted 2008.
5. Stephan Kudyba, Thomas H. Davenport, Big Data, Mining, and Analytics, Components of Strategic Decision Making, CRC Press, Taylor & Francis Group. 2014
6. Big Data, Black Book, DT Editorial Services, Dreamtech Press, 2015

IT 3007 Internet Of Things

Credit: 3
Category: PCC
Prerequisite(s): Computer Networks (IT 3005)

Course Description:

The Internet of Things (IoT) is everywhere. It provides advanced data collection, connectivity, and analysis of information collected by computers everywhere—taking the concepts of Machine-to-Machine communication farther than ever before. This course gives a foundation in the Internet of Things, including the components, tools, and analysis by teaching the concepts behind the IoT and a look at real-world solutions.

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

CO1: understand basics of IoT
CO2: apply knowledge of IoT in the application areas of IoT
CO3: design IoT systems using IoT design methodology
CO4: analyze the working of different IoT physical devices
CO5: judge the applications of IoT in BigData and cloud
CO6: develop different IoT based application related to different domain area of IoT

Topics:

- Introduction to Internet of Things
- Application of Domain Specific IoTs: Home Automation, Environment, Energy, Retail, Logistics, Agriculture, Industry, Health& Lifestyle
- IoT and M2M
- IoT Platform Design Methodology
- IoT Physical Devices & Endpoint
- IoT Physical Server and Cloud Offering
- Case Studies Illustrating IoT Design
- Advanced Topics

Textbook(s):

1. Arshadeep Bahga,Vijay Madisetti, "Internet of Things -A Hands-on Approach", Universities Press, 1st Edition, ISBN:9788173719547.

Reference Book(s):

1. Adrian McEwen, Hakim Cassimally, "Designing the Internet of Things", Wiley Publication, 1st Edition, November 2013,ISBN:9781118430620.
2. Harry Fairhead ,"Raspberry Pi IOT in C", IO Press Publication, 1st Edition, ISBN:9781871962468.

IT 3022 Cloud Computing

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

Course Description:

The course presents a top-down view of cloud computing, from applications and administration to programming and infrastructure. Its main focus is on parallel programming techniques for cloud computing and large scale distributed systems which form the cloud infrastructure. The topics include: overview of cloud computing, cloud systems, parallel processing in the cloud, distributed storage systems, virtualization and security in the cloud.

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

CO1: understand the basic concepts of Distributed System and Cloud Computing
CO2: analyze the different cloud models
CO3: compare the various cloud services and cloud platforms
CO4: analyze various scheduling techniques applied in cloud platform
CO5: appraise VM provisioning and migration techniques used in cloud environment
CO6: examine various cloud applications and issues

Topics:

- Introduction to various computing environment
- Cloud Models
- Cloud Services
- Virtualization
- Cloud Application and challenges

Textbook(s):

1. Cloud Computing by Shailendra Singh, Oxford University Press, 2018

Reference Book(s):

1. Cloud Computing Principles and Paradigms, edited by Rajkumar Buyya, James Broberg and Andrzej Goscinski, Wiley Publication, 2013
2. Cloud Computing for Dummies, Judith Hurwitz, Robin Bloor, Marcia Kaufman and Fern Halper, Wiley Publication, 2009

IT 3024 Mobile Applications Development

Credit: 3
Category: PEC
Prerequisite: Web Technology (IT 2004)

Course Description:

This course gives the necessary skill to design and develop mobile applications which fulfill the extensive demand of fastest growing mobile market. In this course, student will learn to develop mobile app for Google Android devices. This course mostly cover the mobile operating system, programming language and related tools to develop mobile application, network technology, data handling and topics related to sensing and GPS information. At the end of the course, student should able to develop mobile apps on various areas such as health care, gaming, Internet of Things, Social network, etc.

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

CO1: learn technology and business trends impacting mobile applications
CO2: understand the characterization and architecture of mobile applications
CO3: understand the enterprise scale requirements of mobile applications
CO4: apply the data base connectivity for mobile application
CO5. design and develop mobile applications using one application development framework
CO6. gain knowledge about connectivity of multimedia & wireless application using mobile

Topics:

- Introduction
- Android Architecture
- User Interface and Application Components
- Files and Database Handling
- User Experience Enhancement
- Messaging and Location-Based Services
- Multimedia, Wireless Connectivity and Telephony

Textbook(s):

1. Reto Meier, “Professional Android 4 Application Development”, Wrox, 2012

Reference Book(s):

1. Matt Gifford, “Phone Gap Mobile Application Development Cookbook”, PACKT, 2012
2. Adrian Kosmaczewski, “Mobile JavaScript Application Development”, O’RELLY, 2012

IT 3031 Data Mining And Data Warehousing

Credit: 3
Category: PEC
Prerequisite(s): Database Management System (CS 2004)

Course Description:

This course introduces the basic knowledge of appropriate data mining algorithms to solve real world problems and data warehouse with dimensional modeling and apply OLAP operations. It will cover step-by-step exploratory reviews of different techniques for classification, clustering, and pattern discovery. Finally, it will help the user experiences towards research and innovation.

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

CO1: understand the basic principles, concepts & applications of data mining and familiar with mathematical foundations of data mining tools
CO2: analyze the fundamental concepts, benefits, problem areas associated with data warehousing along with various architectures and main components of a data warehousing
CO3: evaluate the kinds of patterns that can be discovered by association rule mining algorithms
CO4: analyze various classification and prediction algorithms to solve the real problems
CO5: apply various clustering algorithms to solve the real problems
CO6: develop ability to design various algorithms based on data mining tools to solve web, spatial, temporal, text and multimedia data

Topics:

- Introduction
- Data Warehousing and Preprocessing
- Association Rules
- Classification
- Clustering
- Advanced Techniques

Textbook(s):

1. J. Han and M. Kamber, "Data Mining: Concepts and Techniques", 4th Edition, Morgan Kaufman,2015.

Reference Book(s):

1. M. H. Dunham, "Data Mining: Introductory and Advanced Topics", Pearson Education, 2006.
2. I H. Witten and E. Frank, "Data Mining: Practical Machine Learning Tools and Techniques," Morgan Kaufmann, 2000.
3. D. Hand, H. Mannila and P. Smyth. Principles of Data Mining. Prentice-Hall. 2001.

IT 3034 Multimedia Systems And Architecture

Credit: 3
Category: PEC
Prerequisite(s): Computer Networks (IT 3005)

Course Description:

Course covers both theoretical and practical issues in designing multimedia systems. Topics to be covered include introduction to multimedia systems, digital video compression techniques, operating system support for digital audio and video, as well as network and transport protocols for multimedia.

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

CO1: demonstrate knowledge on the concepts of multimedia systems
CO2: understand the audio and Video concepts used
CO3: analyzing different compression techniques and formulate new compression technique
CO4: analyzing and understand the transmission and distribution of Multimedia content
CO5: gain knowledge on Multimedia Database and Content-based storage and retrieval
CO6: understand the hypermedia and virtual reality concept and Design using VRML

Topics:

- Introduction to multimedia, audio, image, graphics, video and animation
- Audio and Video signals
- Compression techniques (Image Compression, Audio Compression and Video Compression)
- Multimedia Communication and Retrieval
- Hypermedia, Digital Copyrights, Virtual Reality, VRML.

Textbook(s):

1. Principles of Multimedia by Ranjan Parekh, 2nd Edition, 2018, McGraw-Hill Education

Reference Book(s):

1. Multimedia: Computing Communications & Applications by Ralf Steinmetz & Klara Nahrstedt, 1st Edition, 2002 , Pearson
2. Multimedia Systems by John F. Koegel Buford, 1st Edition, 2002, Pearson

IT 3039 Human Computer Interaction

Credit: 3
Category: PEC
Prerequisite(s): Web Technology (IT 2004), Software Engineering (IT 3003)

Course Description:

In this course, students are introduced to the fundamental theories and concepts of human-computer interaction (HCI). HCI is an interdisciplinary field that integrates theories and methodologies across many domains including cognitive psychology, neurocognitive engineering, computer science, human factors, and engineering design. Students will gain theoretical knowledge of and practical experience in the fundamental aspects of human perception, cognition, and learning as relates to the design, implementation, and evaluation of interfaces. Topics covered include interface design, usability evaluation, universal design, interaction styles, multimodal interfaces, devices and screen-based controls, and communicating mechanisms.

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

CO1: understand the importance of Human Computer Interaction and its fundamentals
CO2: analyze various design methods for HCI
CO3: evaluate the implemented interaction styles used in HCI
CO4: apply the HCI fundamentals for interface communications
CO5: experiment for developement of new and efficient human computer interfaces
CO6: build the application oriented human computer interface for solving real life problems

Topics:

- Goal directed design
- Designing
- Interaction Styles
- Communication
- Service design

Textbook(s):

1. Galitz's Human Machine Interaction, Dhananjay R. Kalbande, Prashant Kanade, Sridari Iyer Wiley India 2015, ISBN: 9788126558681.

Reference Book(s):

1. The Essential Guide to user Interface Design, Third Edition by Wilbert O. Galitz, Wiley.
2. Interaction Design: Beyond Human-Computer Interaction, Second Edition by Jenny Preece et al., John Wiley & Sons Ltd.
3. Designing the User Interface: Strategies for Effective Human Computer Interaction, Second Edition by B. Sheiderman et al., Addison Wesley.

IT 3040 Mobile Computing

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

Course Description:

The course is an introduction to the fundamentals of mobile computing which covers cellular communication network and Ad-Hoc network. In this course, students are able to get the knowledge about the functionality of different communication layers involve in wireless communication. In addition, this course gives detail description of different protocols involved in different layers of wireless commutation.

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

CO1: understand the necessary knowledge of cellular communication, infrastructure-less networks
CO2: analyze TCP, MAC protocols and their technical feasibility
CO3: analyze device independent applications
CO4: acquire knowledge about the basic concepts and principles in mobile computing
CO5: understand techniques involved, in networks
CO6: analyze systems issues for the design and implementation of mobile computing systems

Topics:

- Basics Of Communication Technologies
- MAC Protocols for Mobile Communication
- Mobile internet protocol and transport layer
- Mobile telecommunication system (GSM, GPRS, and UMTS)
- Mobile ad-hoc networks (MANET and VANET)

Textbook(s):

1. Mobile Communications, Jochen Schiller, PHI/Pearson Education, Second Edition, 2003.
2. Fundamentals of Mobile Computing, Rajib Mall, PHI, Second Edition, 2015.
3. Wireless Communications and Networks, William Stallings, PHI/Pearson Education, 2002.

Reference Book(s):

1. Principles of Wireless Networks, KavehPahlavan, PrasanthKrishnamoorthy, PHI/Pearson Education, 2003.
2. Principles of Mobile Computing, Uwe Hansmann, LotharMerk, Martin S. Nicklons and Thomas Stober, Springer,New York, 2003.
3. Mobile Communication Systems, HazysztofWesolowshi, John Wiley and Sons Ltd, 2002.

IT 3044 Fundamentals of Software Engineering

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

Course Description:

This course will explore several concepts and principles in parallel with software development. The course will begin with an introduction to software engineering as well as discussion of the main methodologies of software engineering.

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

CO1: differentiate different software process models and understand their applicability in real life projects
CO2: gather and specify requirements of the software projects
CO3: apply the basic project management practices in real life projects
CO4: translate the baseline requirement specifications into design & development process
CO5: distinguish and apply different testing methodologies
CO6: evaluate different cost matrix

Topics:

- Software Process Models
- Software Requirement Engineering
- Software Project Management
- Structural Analysis & Design
- Testing Strategies

Textbook(s):

1. Fundamentals of Software Engineering, Rajib Mall, PHI, 4th edition.

Reference Book(s):

1. Software Engineering, A Practitioner's Approach, Roger S. Pressman ,TMG Hill, Eighth edition.
2. Software Engineering, I. Sommerville, Pearson Education, Ninth edition.

IT 3095 Networks Laboratory

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

Course Description:

This course enables students to develop skills required to design, develop and troubleshoot network based applications.

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

CO1: understand how network protocols will work
CO2: design network protocols for communication
CO3: implement network protocols
CO4: troubleshoot implementation of Network protocols
CO5: understand the working of network routing

Topics:

- The concept of networking and it's significance in computer network, its components (i.e. h/w and s/w) required for data communication in a Computer Network. (Showing the h/w components like Network Interface Card (NIC), Network Cable, RG-45 Connector,Hub, Switch, Router etc.)
- Highlight the importance of socket programming as a s/w for data communication and the basic fundamentals required for doing socket programming using C
- Review of function, pointer, structure, structure with in a structure, pointer to structure, and command line argument concept using C programming Language
- The concept of s little endian and big endian & its significance of endianness in computer network
- Basics of Socket Programming. Details of Connection less Socket programming APIs for TCP/IP stack using C Programming
- Details of Connection Oriented Socket programming APIs for TCP/IP stack using C Programming
- Demonstration of the packet Analyzer tool (wireshark) to analyze the details of a packet which is captured during packet transmission in the network
- Overview of file transfer over a computer network. Discussion of how to design a stop-and-wait protocol on top of connectionless sockets. Discussion of how to fragment and reassemble packets at the source and destination host respectively

IT 3096 Data Analytics Laboratory

Credit: 2
Category: PCLC
Prerequisite(s): Computer Programming (CS 1093), Object Oriented Programming (IT 2005)

Course Description:

The course aims to provide exposure to R programming. This course trains the student to implement different way of data retrieval along with classification and analysis of data with the help of the functionality available in R programming language.

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

CO1: understand the basics of R programming
CO2: understand the R objects and perform various computational operations on it
CO3: implement regression techniques, time series analysis, classification, and clustering techniques using R
CO4: import and export files using R and to reshape data to support different analyses
CO5: explore and implement various visualization techniques using R
CO6: debug R program with the application of error handling and error recovery

Topics:

- R-Overview, Environment Setup, Data Types, Variables, Operators, Basic Syntax
- Decision making-simple if, if…else, if…else if…else, switch etc and Loops- while, for, repeat loop
- Functions- Built-in Functions, User-defined Functions,Strings with built-in string functions)
- Vectors- Single element vector, multiple element vector, Lists, Matrices, Array, Factors, packages, Data frames
- Data Interfaces- CSV Files, Excel Files,various plots,charts
- Implementation of linear regression, multiple linear regression, nonlinear regression, logistic regression, time series analysis
- Implementation of classification techniques: Naive bayes and SVM
- Implementation of clustering: K-Means, K-Medoids

IT 4005 Software Testing

Credit: 3
Category: PEC
Prerequisite(s): Fundamentals of Software Engineering (IT 3044)

Course Description:

This course will examine fundamental of software testing and program analysis techniques. In particular, the important phases of testing will be reviewed, emphasizing the significance of each phase when testing different types of software. Students will learn the state of the art in testing technology for object-oriented, component-based, graphical-user interface, and web software. In addition, closely related concepts such as dynamic testing, static testing, test process, mutation testing and program analysis (e.g., program-flow and data-flow analysis) will also be studied. Emerging concepts such as regression testing and test automation along with their impact on testing will be examined.

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

CO1: understand the basic terminologies and need for software testing and generate test cases for a given software application
CO2: analyze the different dynamic and static testing techniques and apply the same for testing software applications
CO3: understand the importance of regression testing and apply the appropriate regression testing strategies to test the software under modification and understand different factors of prioritization and prioritize the test cases
CO4: analyze different test plans and understand the test process management
CO5: understand the benefits of test automation and its challenges
CO6: apply the software testing techniques to different specialized environments

Topics:
- Testing Methodology
- Software Testing Terminology and Methodology
- Testing Techniques Dynamic Testing
- White Box Testing
- Static Testing
- Regression Testing
- Managing the Test Process
- Test Automation
- Testing for Specialized Environment

Textbook(s):
1. Software Testing Principles : Practices, Naresh Chauhan, Oxford University Press, New Delhi, 2010.

Reference Book(s):
1. Foundation of Software Testing, Aditya P Mathur, Pearson Education, 2008.
2. Software Testing and Analysis Process Principles and Techniques, Mauro Pezze, Michal Young, WiIley India, 2008.
3. Software Testing Principles and Practices, Srinivasan Desikan, Gopalaswamy Ramesh, 2nd Edition, Pearson, 2007.

MA 2011 Probability and Statistics

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

Course Description:

The course includes fundamentals of Probability and further enter to the concept of random variables with its use in different probability single distributions, joint distributions etc. In Statistic part estimations of parameters, confidence interval , regression and hypothesis testing are included to be more familiar in the field of Statistics.

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

CO1: understand the concept of probability and related terms, conditional probability and independent events
CO2: get the idea of random variable and different discrete probability distribution
CO3: use continuous probability distribution, joint probability distribution of random variables and expected values
CO4: solve problems related to co-variance and co-relation and know the methods of point estimation
CO5: know sampling, statistical intervals , confidence interval for population mean and normal population distribution
CO6: analyse hypothesis based on single sample and deduce inferences based on two samples

Topics:

- Basics on Probability
- Random variables and some specific probability distributions
- Joint distributions
- Estimation of parameters, confidence interval
- Testing of hypothesis

Textbook(s):

1. Probability and Statistics for Engineers and Sciences by J. L. Devore, CENGAGE Learning.
2. Advanced Engineering Mathematics by Erwin Kreyszig, Wiley, INC, 10th Edition.

Reference Book(s):

1. Introduction to Probability and Statistics by William Mendenhall, Robert J, Beaver and Barbara M. Beaver, CENGAGE Learning.

MA 2013 Discrete Mathematics

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

Course Description:

Discrete mathematics includes different mathematical logics, idea of set, relation and function. Emphasis is given on the recurrence relation and their Algebraic structure

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

CO1: convert sentences in natural language into mathematical statements and understand predicate and quantifiers, rules of inference and prove results by principle of mathematical induction
CO2: use the principles of inclusion and exclusion of sets, relations and functions and solve related problems
CO3: use the idea of partition of sets, partial ordering relation, Hasse diagram and Lattice
CO4: work out problems on recurrence relations by substitution and method of generating functions
CO5: analyse algebraic structures, groups, semi group, subgroups and proof of Lagrange's theorem
CO6: identify homomorphism and isomorphism of groups, ring, integral domain and field

Topics:

- Propositional logic, predicate logic, mathematical induction
- Set, Relation & Function
- Recurrence Relation and their solutions Algebraic structure

Textbook(s):

1. Discrete Mathematics and its Applications by Kenneth H Rosen (Mc Graw Hill 7th Edition)

Reference Book(s):

1. Elements of Discrete Mathematics. A Computer oriented approach by C.L Liu, D.P. Mohapatra (Tata Mc Graw Hill 4th Edition-2013)

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KIIT Deemed to be University

At / P.O.:-KIIT, Bhubaneswar-751024, Odisha, India

Ph: + 91 2725113, 2741998, Fax: +91 2740326, E.mail: kiit@kiit.ac.in, Website:www.kiit.ac.in