

BACHELOR'S DEGREE PROGRAMME

B. Tech in Computer Science & System 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

2021 - 2025

B. Tech in Computer Science & System Engineering

**Course Structure and Detailed Syllabi
for students admitted in
2021 - 25
Academic Session**



Kalinga Institute of Industrial Technology (KIIT)
Deemed to be University U/S 3 of UGC Act, 1956
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B. TECH IN COMPUTER SCIENCE AND SYSTEM ENGINEERING

Programme Educational Objectives (PEOs):

The B. Tech programme in Computer Science and System 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 & System 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 by using the concepts on Network Processors Design and Performance Evaluation of Computer Systems.
- 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 Embedded Systems.
- o) Ability to utilize the knowledge in solving practical real life technological problems in the field of Computer Science & System 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

FIRST SEMESTER

Theory							
Sl. No	Course Code	Course Title	L	T	P	Total	Credit
1.	MA 1003	Mathematics – I	3	1	0	4	4
2.	PH 1007	Physics	3	1	0	4	4
3.	EE 1003	Basic Electrical Engineering	3	0	0	3	3
4.	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
3.	YG 1081	Yoga and Human Consciousness	0	0	2	2	1
Total of Practical & Sessional						14	7.5
Semester Total						28	21.5

SECOND SEMESTER

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

COURSE STRUCTURE FOR B. TECH IN COMPUTER SCIENCE AND SYSTEM ENGINEERING

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 2005	Semi Conductor Devices	3	0	0	3	3
5	IT 2005	Object Oriented Programming	3	0	0	3	3
6	MA 2013	Discrete Mathematics	3	0	0	3	3
Total of Theory						19	19
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						25	22

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 2012	Design and Analysis of Algorithms	3	0	0	3	3
3	EC 2020	Microprocessors, Microcontrollers, and Interfacing	3	1	0	4	4
4	CS 2004	Database Management System	3	1	0	4	4
5	CS 2006	Computer Organization and Architecture	3	1	0	4	4
6	MA 2011	Probability and Statistics	3	0	0	3	3
Total of Theory						21	21
Practical							
1	CS 2094	Database Management System Laboratory	0	0	2	2	1
2	CS 2092	Operating Systems Laboratory	0	0	2	2	1
3	CS 2098	Algorithms Laboratory	0	0	2	2	1
Sessional							
1	HS 2081	Business Communication	0	0	2	2	1
Total of Practical & Sessional						8	4
Semester Total						29	25

SEMESTER - V

Sl. No	Course Code	Course Title	L	T	P	Total	Credit
Theory							
1	IT 3007	Internet of Things	3	0	0	3	3
2	IT 3009	Computer Networks	3	0	0	3	3
3	CS 3011	Artificial Intelligence	3	0	0	3	3
4	IT 3003	Software Engineering	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						19	19
Practical							
1	IT 3095	Networks Laboratory	0	0	2	2	1
2	CS 3097	Advanced Programming Laboratory	0	0	2	2	1
Total of Practical						4	2
Semester Total						23	21

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 3033	Embedded Systems Design and Application	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	IT 3098	Cloud Computing Laboratory	0	0	2	2	1
2	CS 3096	Tools and Techniques Laboratory	0	1	2	3	2
Sessional							
1	CM 3082	Minor Project	0	0	4	4	2
Total of Practical Sessional						10	5
Semester Total						28	23

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	CM 4081	Project – I / Internship					3
2	CM 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	CM 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.	CM 3021	Systems Simulations and Modeling	3
2.	CM 3023	Network Processors Design	3
3.	IT 3035	Natural Language Processing	3
4.	CS 3031	Computational Intelligence	3
5.	CS 3037	Principles of Automata	3

Dept. Elective – II

1.	CS 3027	Real Time Systems	3
2.	IT 2004	Web Technology	3
3.	CS 3035	Machine Learning	3
4.	CS 3008	Compiler Design	3
5.	CS 3012	Parallel and Distributed Computing	3

Dept. Elective - III

1.	IT 3024	Mobile Applications Development	3
2.	CM 3022	Principles of Processor Design	3
3.	CM 3024	Performance Evaluation of Computer Systems	3
4.	IT 3039	Human Computer Interaction	3
5.	CS 3032	Big Data	3

Dept. Elective – IV

1.	CS 3029	Advanced Database Management Systems	3
2.	CS 3033	Computer Graphics	3
3.	CC 3026	Cyber Security	3
4.	IT 3006	Data Analytics	3

Dept. Elective – V

1.	IT 3031	Data Mining and Data Warehousing	3
2.	EC 3013	Principles of Digital Signal Processing	3
3.	IT 3040	Mobile Computing	3
4.	CM 3026	Programming for Embedded Systems	3

HONORS COURSES OFFERED BY COMPUTER 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 3009)
3	CS 4003	Software Defined Network	Computer Networks (IT 3009)
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 3009	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 3009	Computer Networks	NIL
5	IT 2004	Web Technology	Object Oriented Programming (IT 2005)
6	CC 3028	Information Security	Computer Networks (IT 3009)
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 2nd 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) 10th 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, 11th 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 compounds, 7th Edition -Robert M. Silverstein, Francis, Webster, David J. Kiemle; John 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, Frederick C, Ross and David B. Bailey. TMH Publications.
3. Biology. Neil A. Campbell and Jane B. Reece, 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, 10th 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, 11th 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-Phase 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, microscope, 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 \AA (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 Kirchhoff'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

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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 Organization and 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 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", Galgotia 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 Representation, 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 call and analyzing its parent 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 be 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 analyzers through 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. Loudon, 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
- Adversarial 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, 3rd Edition, Tata McGraw Hill.,2008
2. Principles of Artificial Intelligence – Nils J. Nilsson,1st Edition, Elsevier, 1982.

CS 3012 Parallel and Distributed Computing

Credit: 3

Category: PEC

Pre-requisite(s): Data Structures and Algorithms (CS 2001), Design and Analysis of Algorithms (CS 2012)

Course Description:

This course focuses on various parallel programming platforms, principle of parallel algorithm design, cost analysis, and implementation of parallel algorithms. The design of parallel algorithms uses a class of basic communication operations as building blocks. The scope of this course covers metrics for quantifying the performance of parallel algorithms including basic concepts of the message-passing programming paradigm. The design of different sorting & searching & graph algorithms on parallel platforms and its challenges are part of this course.

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

- CO1: analyze different models of parallel and distributed computing and understand the basic techniques for designing algorithms in these models
- CO2: learn and apply knowledge of parallel and distributed computing techniques and methodologies
- CO3: design, develop, and analyzing performance of parallel and distributed applications.
- CO4: implement fundamental Computer Science methods and algorithms in the development of parallel applications
- CO5: explain the design, testing, and performance analysis of a software system
- CO6: evaluate design, development, and performance analysis of parallel and distributed applications

Topics:

- Introduction to Parallel Computing
- Parallel Programming Platforms
- Principles of Parallel Algorithm Design
- Basic Communication Operations
- Analytical Modeling of Parallel Programs
- Programming Using the Message Passing Paradigm
- Sorting & Searching Algorithms
- Graph Algorithms

Textbook(s):

1. Introduction to Parallel Computing, Second Edition, Ananth Gram, Anshul Gupta, George Karypis, Vipin Kumar, Person Education.
2. Parallel programming in c with MPI and Open MP, M.J. Quinn, TMH.

Reference Book(s):

1. Parallel Computer Architecture and Programming, D.E.Culler,J.P Singh & A Gupta, Morgan Kaufman
2. Designing and Building Parallel Programs, I.Foster. Addison-Wesley.

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, 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 3029 Advanced Database Management System

Credit: 3

Category: PEC

Prerequisite(s): Database Management System (CS 2004)

Course Description:

This course provides a systematic approach of advanced database areas as well as the basics of database systems. It covers the query processing and optimization techniques. The concepts of parallel and distributed database, distributed query processing, distributed concurrency control have been covered. It also covers different data warehousing technologies, multidimensional modeling, data mining techniques.

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

- CO1: analyze Database Management Systems and construct simple and moderately advanced database queries using Structured Query Language (SQL)
- CO2: apply the detail query processing and techniques involved in query optimization
- CO3: evaluate the database storage structures and access techniques such as file organizations, indexing methods
- CO4: analyze the details of distributed database design process, concept of a distributed database transaction and related facilities, including concurrency control, backup and recovery
- CO5: evaluate the concept of parallel database design process
- CO6: study contemporary issues and emerging technologies such as On-Line Analytical Processing (OLAP), Data Warehouse and Data mining

Topics:

- DBMS & SQL
- Query Evaluation
- Physical Database Design & Tuning
- Parallel & Distributed Databases
- Data Warehousing & Data Mining

Textbook(s):

1. Database Management Systems by RamaKrishna & Gehrke, 3rd Edition, 2018, McGraw-Hill Education

Reference Book(s):

1. Fundamentals of Database System By Elmasari & Navathe, 7th Edition, 2018, Pearson Education
2. Database System Concepts by Silberschatz, Korth & Sudarshan, 6th Edition, 2019, McGraw-Hill Education

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 3032 Big Data

Credit: 3

Category: PEC

Prerequisite(s): Database Management System (CS 2004)

Course Description:

The course provides an introduction to big data with a special focus on the big data tools. Besides the theoretical foundations, students acquire practical experience by programming in R. This course provides exposure to theory as well as practical and software used in data analytics such as R.

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

CO1: understand the concept of data management and evolution of Big Data

CO2: understand and implement various big data technology foundations

CO3: apply the fundamentals of Hadoop ecosystem and its components for data analysis

CO4: analyze the optimization techniques in data bases

CO5: analyze the storage techniques in data bases

CO6: explore the understanding of text, sentiment analytics

Topics:

- overview of big data
- big data technology foundations
- Hadoop ecosystem
- storing data in databases and data warehouses
- text analytics, sentiment analysis, opinion mining

Textbook(s):

1. Big Data, Black Book, DT Editorial Services, Dreamtech Press, 2015
2. Big Data and Analytics, Seema Acharya, Subhashini Chellappan, Infosys Limited, Publication: Wiley India Private Limited, 1st Edition 2015

Reference Book(s):

1. Bill Franks, Taming the Big Data Tidal Wave: Finding Opportunities in Huge Data Streams with advanced analytics, John Wiley & sons, 2012.
2. Glenn J. Myatt, Making Sense of Data, John Wiley & Sons, 2007 Pete Warden, Big Data Glossary, O'Reilly, 2011.
3. Big Data For Dummies, Judith Hurwitz, Alan Nugent, Fern Halper, Marcia Kaufman, Wiley 2013

CS 3033 Computer Graphics

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

Course Description:

This course aims at providing the students the knowledge in a broad sense to describe "almost everything on computers that is not text or sound". This subject refers to the learning of several different things like representation and manipulation of image data by a computer, usage of various technologies used to create and manipulate images. Using the knowledge of Graphics one can do the Graphics programming which will be exposed to the creation of 2D and 3D graphical scenes using open graphics library suits. By learning this subject students will be familiar with image manipulation, enhancement. Students will learn to create animations and can incorporate this in multimedia presentation/ Game/ Project. Students can create 3D graphical scenes using open graphics library suits.

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

- CO1: understand basics of the components of a graphics system and to become familiar with its components, hardware and applications of computer graphics
- CO2: analyze and implement various algorithms to scan, convert the basic geometrical primitives, transformations, Area filling
- CO3: evaluate the mapping of world coordinates to device coordinates and clipping
- CO4: understand basics of three dimensional graphics, 3D geometric transformations, projections and how detect the visible surfaces
- CO5: analyze the concept of curve fitting
- CO6: design and develop of modeling, rendering, shading and animation

Topics:

- Introduction
- Two Dimensional Graphics
- Two Dimensional Geometric Transformations
- Two Dimensional Viewing
- 3D Geometric Transformations
- Visible surface detection
- Three Dimensional Graphics
- Illumination model and surface rendering

Textbook(s):

1. Computer Graphics with openGL, Donald D. Hearn and M. Pauline Baker, Prentice Hall, 3rd Ed, 2003.

Reference Book(s):

1. Computer Graphics - Principles and Practice, J. D. Foley, A. Van Dam, S. K. Feiner and J. F. Hughes, Second Edition in C, Addison Wesley, 2nd Ed, 2003.
2. Mathematical Elements for Computer Graphics, D. F. Rogers, J. A. Adams, McGraw Hill, 2nd Ed, 2001

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 3037 Principles of Automata

Credit: 3

Category: PEC

Prerequisite(s): Discrete Mathematics (MA 2013)

Course Description:

The course discusses the concept of automata as acceptors and their associated behaviour. This course focuses on design of different mathematical models such as Finite automata, Push-down automata and Turing machines. Further, the limitation of these automata and their corresponding language is discussed. Along with above, the course also highlights the design of grammar for each language class and discusses the properties of each language class as well. Finally, the course provides an overview of Chomsky hierarchy of language classes in-order to co-relate the language classes.

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

- CO1: understand the concepts formal languages and finite automata
- CO2: develop an understanding of equivalence in finite automata and its minimization
- CO3: analyze the knowledge of regular languages and their properties
- CO4: implement the concepts of context-free grammars and their properties
- CO5: analyze context-free languages and pushdown automata
- CO6: evaluate Turing machines and Chomsky hierarchy of formal languages

Topics:

- Formal Languages and Finite Automata
- Regular Languages and their Properties
- Context-Free Grammars and their Properties
- Context-free Languages and Pushdown Automata
- Turing Machines and Relevant Topics

Textbook(s):

1. Introduction to Automata Theory, Languages, and Computation, 3e, John E. Hopcroft, Rajeev Motwani, Jeffrey D. Ullman, Pearson Education India, 2008.

Reference Book(s):

1. An Introduction to Formal Languages and Automata, 6e. Peter Linz. Jones & Bartlett, 2016.
2. Introduction to Languages and the Theory of Computation, 3e, John C. Martin. McGraw-Hill Education, 2009.
3. Languages and Machines, 3e, Thomas A Sudkamp, Pearson Education India, 2007.

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: comprehend 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

CM 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 3097 Advanced Programming Laboratory

Credit: 1

Category: PCLC

Prerequisite(s): Data Structures and Algorithms (CS 2001)

Course Description:

This course is to teach students advanced problem solving through computer programming. This course enables the student to look at a real-world problem and decide right data structures and algorithms which are appropriate for solving the problem. It aims at train the students to implement computer algorithms with efficient java programs.

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

CO 1: understand & implement the Object Oriented Programming concepts

CO 2: determine the right algorithmic paradigm for solution to different types of problems

CO 3: understand the debugging technique while compiling and running program

CO 4: understand different integrated development environment tools like eclipse used in computer programming

CO 5: implement the solution using in-build packages in java programming language

Topics:

- R-Overview, Environment Setup, Data Types, Variables, Operators
- Decision making statements, looping
- Built-in and user defined functions
- Strings with built-in functions
- Vectors, matrices, arrays
- Factors, packages
- Data frames, Data interfaces

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 Outcomes: 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 Band Telecommunication 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, consistency, 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 security, 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. Hennessy, 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.

CM 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

CM 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 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 3026 Cyber Security

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

Course Description:

The course covers the technology, practices, processes and challenges of cyber security, cyber security metrics, security management goals , security frameworks , analysis of the performance of decision making for a secured cyber world, cyber security policies and its taxonomy.

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

CO1: understand cyber security and various technical aspects related with cyber security
CO2: understand the evolution of cyber security and its challenges
CO3: identify and realize the objectives of cyber security
CO4: analyze the performance of decision making for a secured cyber world
CO5: detecting the cyber security policy taxonomy
CO6: acquire knowledge on cyber security policies

Topics:

- Introduction
- Cyber Security Evolution
- Cyber Security Objectives
- Guidance for Decision Makers
- The Catalog Approach
- Cyber Security Policy Catalog

Textbook(s):

1. Cyber Security (Policy Guidebook): Bayuk, Healey, Rohmeyer, Sachs, Schmidt, Weiss , Wiley (Student Edition), 2017

Reference Book(s):

1. Computer Security Fundamentals: Chuck Easttom ,3rd Edition, 2016 ,Pearson
2. Cyber Security and Threats: Concepts, Methodologies, Tools, and Applications 1st Edition by Information Resources Management Association (Author, Editor), 2018, USA

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 crypto systems, 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.

CM 3021 Systems Simulation And Modeling

Credit: 3

Category: PEC

Prerequisite(s): Probability & Statistics (MA 2011)

Course Description:

This course covers modeling and simulation principles as applied to engineering systems. Students learn to use simulation to model complex engineering systems. Models will be developed for both continuous and discrete systems. Students will understand the techniques of modeling in the context of hierarchy of knowledge about a system and develop the capability to apply the same to study systems through available software.

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

CO1: understand Modeling & simulation

CO2: analyze important terminologies

CO3: evaluation and classification of systems/models

CO4: learn GPSS

CO5: apply probability concepts in simulation

CO6: evaluate simulation languages, analysis and testing of simulation outputs

Topics:

- Introduction
- Mathematical and Statistical Models
- Languages
- Experiments
- Case study

Textbook(s):

1. Geoffrey Gordon, "System Simulation", Second edition, Prentice Hall, India, 2002.
2. Jerry Banks and John S.Carson, Barry L.Nelson, David M.Nicol, "Discrete Event System Simulation", Third edition, Prentice Hall, India, 2002.

Reference Book(s):

1. Robert E. Shannon, "System Simulation The art and science", , Prentice Hall, New Jersey, 1995.
2. D.S. Hira, "System Simulation", S.Chand and company Ltd, New Delhi, 2001.

CM 3022 Principles of Processor Design

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

Course Description: In this course students will learn the basic principles of processor design while implementing FPGA. A process will be designed step by step on a real FPGA board using HDL. Students will study the principles of hardware design and synthesis while implementing the processor. Hardware and Software interface through ISA will also be learnt.

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

- CO1: understand the different components of digital design flow, design validations, simulations and their timing analysis using Verilog HDL
- CO2: understand different digital design perspectives using hardware definition language (HDL) in Verilog
- CO3: differentiating the functional and behavioral aspects of combinational and sequential circuits.
- CO4: analyzing the bus structure, timers, primary memory, digital filters and pipeline architectures using different case studies
- CO5: get dipper into register transfer logic which is necessary for computations, and test them during design of CPU data paths
- CO6: understand the intricacies in processor design and develop processor circuits using Verilog

Topics:

- Digital Design Flow in Verilog
- Verilog Language Concepts
- Combinational and Sequential Circuits
- Designing aspects of bus structure, Simple processor, Timer, SRAM, Cache
- Register Transfer Level Design and Test

Textbook(s) :

1. ZainalabedinNavabi, “Verilog Digital System Design”, 2nd Edition, McGraw Hill, 2008

Reference Book(s):

1. Michael D. Ciletti, “Advanced Digital Design with the Verilog HDL” 2nd edition, Pearson Edition, 2009

CM 3023 Network Processors Design

Credit: 3

Category: PEC

Prerequisite(s): Computer Networks (IT 3005)

Course Description:

This course introduces basic design issues in network systems and gives detail about the performance improvement using advanced hardware called network processor. Through this course, students can understand the detail about network processor architecture, communication mechanism, and different programming aspects for implementation on network processor.

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

CO1: understand the basics of network processor architecture

CO2: understand basic concepts of processor scheduling and other parameters used for measuring performance of network processor

CO3: comprehend the network processor and its communication mechanisms

CO4: implement various programming aspects of network processors

CO5: design and develop optimal Network Processor

CO6: analyze the various memory interfaces and its components

Topics:

- Introduction
- Network Processor Technology
- Commercial Network Processors
- Network Processor Architecture

Textbook(s):

1. Douglas E.Comer “Networks Systems Design using Network Processors” Prentice Hall, 2003

Reference Book(s):

1. Patric Crowley, Mark A. Franklin , Haldun Hadimioglu, and Peter Z. Onufryk, “Network Processors Design: Issues and Practices (Volume-2)”, 2004
2. Hill Carlson, “Intel Internet Exchange Architecture & Applications a Practical Guide to Intel’s network Processors” Intel press.
3. Ran Giladi, “Network Processors Architecture, Programming, and Implementation”, Morgan Kaufmann Publishers, 2008

CM 3024 Performance Evaluation of Computer Systems

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

Course Description:

This course will study the methods and techniques of performance analysis methods for computer system. It covers fundamental techniques for measurement such as stochastic processes, statistical analysis, simulation models, etc. In addition, it also focuses on the theoretical aspects of analytical modeling using queuing theory principles.

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

- CO1: understand the concept of evaluating the performance of machine, models, parameters for evaluating the performance
- CO2: understand the basic concepts of different types of evaluating models with case study of different server based on Queuing model
- CO3: analyze different business model using stochastic process
- CO4: implement simulation modeling and different techniques for measurement

Topics:

- Introduction
- Random variable
- Multiclass Open Queuing Network Models
- Stochastic processes Markov Models
- Queuing Network Model

Textbook(s):

1. D. A. Menascé, V. Almeida, and Larry W. Dowdy, Performance by Design: Computer Capacity Planning by Example, Prentice Hall, 2004.

Reference Book(s):

1. Raj Jain, "The Art of Computer Systems Performance Analysis: Techniques for Experimental Design, Measurement, Simulation, and Modeling", Wiley Interscience, 1991.
2. K.S. Trivedi, "Probability and Statistics with Reliability, Queueing and Computer Science Applications", John Wiley and Sons, 2001.

CM 3026 Programming for Embedded Systems

Credit: 3

Category: PEC

Prerequisite(s): Computer Architecture (CS 2006), Microprocessors, Microcontrollers, and Interfacing (EC 2020)

Course Description:

The course introduces the design and working of the embedded systems that covers system requirements specifications, architectural, detailed design, and implementation, focusing on real-time applications. The emphasis is given on the micro controller -based embedded systems design, development and implementation. Topics include embedded system types, the 8051 architecture, basic assembly language programming concepts: data transfer and logical instructions, arithmetic operations, decimal arithmetic, jump and call Instructions, I/O interfacing, task scheduling, interrupt management, compilers for embedded systems and other related topics.

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

CO1: understand the embedded system design process

CO2: understand the working of 8051 Micro controller

CO3: write assembly language programs using 8051

CO4: interface with keyboard, display, A/D and D/A converters

CO5: understand the scheduling in real-time systems

CO6: design and analyze the embedded system to address real time issues

Topics:

- Embedded Computing
- The 8051 Architecture
- Assembly Language Programming for 8051 Micro controller
- Interfacing with Keyboards, Displays, D/A and A/D Conversions, Multiple Interrupts, Serial Data Communication
- Architecture and Performance Analysis
- Implementation

Textbook(s):

1. Computers as Components-Principles of Embedded Computer system Design, Wayne Wolf, Elsevier.
2. The 8051 Microcontroller, Third Edition, Kenneth J. Ayala, Thomson.

Reference Book(s):

1. P. Marwedel, Embedded System Design. Springer Verlag, 2006.
2. Embedded Systems - Architecture, Programming and Design, Raj Kamal, TMH.

EC 2005 Semiconductor Device

Credit: 3

Category: PCC

Prerequisite(s): Analog Electronics Circuit (EC 1004)

Course Description:

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

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

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

Topics:

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

Textbook(s):

1. SOLID STATE ELECTRONIC DEVICES: Streetman & Banerjee, 7th Edition, Pearson.

Reference Book(s):

1. SEMICONDUCTOR DEVICES: BASIC PRINCIPLES, Jasprit Singh John Wiley & Sons, 2000
2. INTEGRATED ELECTRONICS: ANALOG AND DIGITAL CIRCUIT SYSTEMS, Jacob Millman, Christos Halkias, Chetan D Parikh, 2nd Edition, TMH 2010.
3. SEMICONDUCTOR PHYSICS AND DEVICES: Donald Neaman and Drubesh Biswas, 2012, 4th Edition, TMH 2012.

EC 2011 Digital Electronics

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

Course Description:

This course covers all basic 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 2020 Microprocessors, Microcontrollers & Interfacing

Credit: 4

Category: PCC

Prerequisite(s): Digital Electronics (EC 2011)

Course Description:

The objective of this course is to teach the fundamentals of Microprocessor (like 8085, 8086) and Microcontroller (like 8051) systems to the students. In this course, the students learn about assembly language to program the Microprocessors, Microcontrollers and develop programs to solve simple applications. This course will also help the students to perform simple experiments in MPMC lab using Microprocessor, Microcontroller based trainer kits in real time. The students can incorporate the concepts learned in this course into their electronics designs for the other courses (like IOT) and final year projects using Microprocessors, Microcontrollers.

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

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

Topics:

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

Textbook(s):

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

Reference Book(s):

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

EC 2093 Digital Electronics Laboratory

Credit: 1

Category: PCLC

Prerequisite(s): Nil

Course Description:

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

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

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

Topics:

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

EC 3033 Embedded System Design and Application

Credit : 3

Category PEC

Prerequisite(s): Microprocessor, Microcontrollers and Interfacing (EC 2020)

Course Description:

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

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

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

Topics:

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

Textbook(s):

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

Reference Book(s):

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

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, Siddhartha K. Rastogi, 8th Edition, Pub. Oxford University Press. ISBN: 9780199467068.
2. Engineering Economics – James L. Riggs, David D. Bedworth and Sabah U. Randhawa, 4th Edition, McGraw Hill Education (India) Private Limited, New Delhi, 2016.

Reference Book(s):

1. Principles of economics, Deviga Vengedasalam and Karunakaran Madhavan, Oxford University Press, New York, 3rd Edition, 2013.
2. Managerial Economics-Principles and Worldwide Applications-Dominick Salvatore, Adapted by Ravikesh Srivastava, 7th Edition, 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 University Press, New Delhi.
3. Bhagwati Jagdish and Arvind Panagariya (2012): 'India's Tryst with Destiny'. Collins Business, Noida, India.
4. Jean Derezé and Amartya Sen (1996): 'Indian Development: Selected Regional Perspectives'. Oxford University Press, New Delhi.
5. Aijava 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. In addition, 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 (12th 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. Judge, 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 be 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
- Industrial 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 technology

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 “Environmental Law and policy in india”. Oxford University Press, 2001.
2. Howard b rockman “Intellectual Property Law for engineers and scientists”. 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.
3. 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 3009 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 Madiseti, "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(s): 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 Books(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 3035 Natural Language Processing

Credit: 3

Category: PEC

Prerequisite(s): Probability & Statistics (MA 2011)

Course Description:

NLP is an area of machine learning which deals with natural – human – languages. This is a broad field, dealing with problems ranging from speech recognition and transcription to text, to translation between different languages, to extracting entities such as people and locations from text, to providing natural language answers to natural language questions. In short, NLP gives machines the ability to read and understand human language – not to the extent humans can, but well enough to enable machines to perform simple tasks.

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

CO1: understand the concept of NLP and its algorithms

CO2: evaluate different computing architectures for natural language processing for various parameters

CO3: apply the different modeling and tagging concepts for language processing

CO4: analyze the various grammars & parsing algorithms

CO5: explore the role of statistical parsing & machine translation

CO6: analyze the role of natural language processing in real life application

Topics:

- Introduction
- Words & Lexicon
- Hidden Markov Models & Tagging
- Grammars & Parsing Algorithms
- Statistical Parsing & Machine Translation

Textbook(s):

1. Foundations of Statistical Natural Language Processing, Manning, C. D. and H. Schutze, The MIT Press.

Reference Book(s):

1. Speech and Language Processing, Jurafsky, D. and J. H. Martin, Prentice-Hall.
2. Natural Language Understanding, Allen, J., The Benajmins/Cummings Publishing Company Inc.
3. Elements of Information Theory, Cover, T. M. and J. A. Thomas, Wiley.
4. Statistical Language Learning, Charniak, E., The MIT Press.
5. Statistical Methods for Speech Recognition, Jelinek, F., The MIT Press.

IT 3038 Object-Oriented System Design

Credit: 3

Category: PEC

Prerequisite(s): Software Engineering (IT 3003)

Course Description:

This course will analyze the different system modeling techniques and examine the need for unified modeling. Further, this course will discuss about user's view, behavioral view, structural view, implementation view, and environmental view of Unified Modeling Language (UML). Different design axioms and the mapping with the object-oriented systems are also discussed in detail for real world problems.

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

CO1: analyze and compare the advantages and disadvantages of traditional software development with object-oriented software development

CO2: analyze the different system modeling techniques and understand the need for unified modeling.

CO3: implement the users' view and behavioral view of object-oriented systems using UML

CO4: implement the structural view, implementation view and environmental view of object-oriented systems using UML

CO5: design axioms with applications of object-oriented analysis and design for solving real world problems using O-O design process

CO6: understand the access layer and apply the mapping with object relational systems

Topics:

- Overview of Object-Oriented Development
- Object Basics
- Object-Oriented Systems
- Object-Oriented Methodologies
- Unified Modeling Language (UML)
- Object-Oriented Analysis Process
- Object Classification
- Identifying Object Relationships, Attributes and Methods
- The Object-Oriented Design Process and Design Axioms
- Designing Classes
- Object Relational Systems
- View Layer

Textbook(s):

1. Ali Bahrami, "Object Oriented Systems Development", Tata McGraw-Hill Publisher, Tata McGraw-Hill Edition 2008.

Reference Book(s):

1. Applying UML and Patterns: An Introduction to Object-Oriented Analysis and Design and Iterative Development, Craig Larman, Third Edition, Addison Wesley, 2004.
2. Introduction to Object Oriented Analysis and Design, Stephen R Schach, Tata McGraw-Hill, 2003.
3. Unified Modeling Language Reference Manual, James Rumbaugh, Grady Booch, Addison Wesley, 1999.
4. Practical Object-Oriented Design with UML, Mark Priestley, 2nd Edition, Tata McGraw-Hill, 2003.
5. Object-Oriented Design with UML and JAVA, K Barclay, Elsevier, 2004.

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 development 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 3098 Cloud Computing Laboratory

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

Course Description:

This cloud computing laboratory course aims to provide a hands-on training on study of cloud concepts and capabilities across the various cloud service models including Infrastructure as a Service (IaaS), Platform as a Service (PaaS), Software as a Service (SaaS). Students will work with Amazon Web Services and use them to rent and provision compute resources and then program and deploy applications that run on these resources.

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

CO1: Configure various virtualization tools such as Virtual Box, VMware workstation
CO2: Design and deploy a web application in a PaaS environment
CO3: Learn how to simulate a cloud environment to implement new schedulers
CO4: Install and use a generic cloud environment that can be used as a private cloud
CO5: Understand the Identity management and User management in cloud

Topics:

- Understand and implement various scheduling algorithms (FCFS, Maxmin, Roundrobin, SJF) using C programming
- Setup and Install Cloud Analyst simulator to simulate the cloud environment
- Study and present a comparative report by running various cloud scheduling algorithms
- Amazon Elastic Compute Cloud (Amazon EC2) is a web service that provides secure, resizable compute capacity in the cloud. Create an Amazon Elastic Compute Cloud EC2 instance with basic system configuration
- Associate a Static Public IP Address With Your EC2 Instance
- Study and implement the various Database As a Service provided by AWS (Amazon RDS, Amazon Dynamo DB etc)
- Find a procedure to transfer the files from one virtual machine to another virtual machine
- Understanding the security management, authentication and Identity Access Management in cloud

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, Willey 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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