

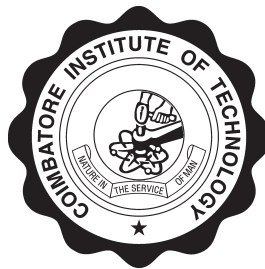
# **COIMBATORE INSTITUTE OF TECHNOLOGY**

(Government Aided Autonomous Institution Affiliated to Anna University, Chennai)

**COIMBATORE - 641 014, TAMILNADU, INDIA**

**DIAMOND JUBILEE**

(1956 - 2016)



**Department of Computer Science and Engineering &  
Information Technology**

**B.Tech. INFORMATION TECHNOLOGY**

**Curriculum and Syllabi**

**THIRD TO EIGHTH SEMESTER**

**Under Choice Based Credit System**

( For the students admitted during the academic year 2015 - 2016 and onwards )

## INDEX

S.No	Contents	Page No.
1	Vision and Mission of the Institute	1
2	Vision and Mission of the Department of Computer Science and Engineering & Information Technology	2
3	Programme Educational Objectives (PEOs)	3
4	Programme Outcomes (POs) and Program Specific Outcomes (PSOs)	4
5	Subjects of Study	5
6	Professional Electives (PE)	7
7	Humanities and Social Sciences (HS) & Basic Sciences (BS)	8
8	Engineering Sciences (ES)	9
9	Professional Core (PC)	10
10	Employability Enhancement Courses (EEC)	11
11	Summary of Total Credit Percentage	11
12	Open Electives (OE)	12
13	Syllabus for Semester - III	17
14	Syllabus for Semester - IV	28
15	Syllabus for Semester - V	37
16	Syllabus for Semester - VI	47
17	Syllabus for Semester - VII	56
18	Syllabus for Semester - VIII	61
19	Syllabus for Professional Electives	65
20	Syllabus for Open Electives	89

# **COIMBATORE INSTITUTE OF TECHNOLOGY**

(Government Aided Autonomous Institution Affiliated to Anna University, Chennai)

## **VISION AND MISSION OF THE INSTITUTE**

### **VISION**

The Institute strives to inculcate a sound knowledge in Engineering along with realized social responsibilities to enable its students to combat the current and impending challenges faced by our country and to extend their expertise to the global arena.

### **MISSION**

The Mission of the institute is to impart high quality education and training to its students to make them world-class Engineers with a foresight to the changes and problems and pioneers to offer innovative solutions to benefit the nation and the world at large.

# **DEPARTMENT OF COMPUTER SCIENCE AND ENGINEERING & INFORMATION TECHNOLOGY**

## **COIMBATORE INSTITUTE OF TECHNOLOGY**

### **VISION AND MISSION OF THE DEPARTMENT**

#### **VISION**

To evolve as a Centre of Excellence in research, learning and consultancy, integrating Computer and Information Sciences with Natural Sciences and Engineering concepts to develop products and services for the benefit of the Industry and Society at large.

#### **MISSION**

- To impart value based technical education and entrepreneurial skills to the graduates through state of art infrastructure and innovative faculty.
- To educate students towards the design and development of intelligent products and services meeting global demands and standards
- To promote collaborative learning and research with industry, government and International organizations for continuous knowledge transfer and enhancement.
- To develop globally competent engineers, capable of providing secure and "Out-of-the Box" computing and information technology solutions
- To enable the graduates to adapt to the rapidly changing technology with strong fundamentals.

**DEPARTMENT OF COMPUTER SCIENCE AND ENGINEERING &  
INFORMATION TECHNOLOGY**

**COIMBATORE INSTITUTE OF TECHNOLOGY**

**PROGRAMME EDUCATIONAL OBJECTIVES (PEOs)**

- PEO 1** : Students will acquire sound knowledge in mathematical, scientific and engineering fundamentals and knowledge in Information and Communication Technology to analyze, formulate and solve the real life problems.
- PEO 2** : Graduates will encompass entrepreneurship skills and ability to develop, implement innovative, integrated and secure information technology solutions for meeting the global challenges and changing requirements.
- PEO 3** : Graduates will possess professional and ethical attitude, leadership qualities, desire for lifelong learning, and ability to work in multidisciplinary teams in meeting the broader societal needs.

# DEPARTMENT OF COMPUTER SCIENCE AND ENGINEERING & INFORMATION TECHNOLOGY

## B.Tech. INFORMATION TECHNOLOGY

### PROGRAM OUTCOMES AND PROGRAM SPECIFIC OUTCOMES (POs & PSOs)

- PO1** : Ability to apply fundamental knowledge in mathematics, general engineering, electrical sciences and information technology to solve real world problems.
- PO2** : Ability to identify, interpret, analyze and design solutions using appropriate algorithms of varying complexities in the field of information and communication technology.
- PO3** : Ability to design, develop, evaluate and implement secure optimized software processes, components, solutions and embedded systems, with consideration to public health, safety, cultural and environmental issues.
- PO4** : Ability to investigate, analyze complex problems by the application of suitable mathematical and research tools, to design Information Technology products and solutions.
- PO5** : Ability to identify and utilize the state-of-the-art tools and techniques in the design and development of software products and solutions.
- PO6** : Ability to understand the broader needs of the society and industry and be involved in the development of products and solutions.
- PO7** : Ability to understand the impact of engineering solutions in the societal and environmental context and formulate effective measures for sustainable development.
- PO8** : Ability to demonstrate the understanding of professional ethics, legal issues and social responsibilities.
- PO9** : Ability to function and perform as an individual and in multidisciplinary teams through group discussions and written skills.
- PO10** : Ability to lead and communicate effectively in understanding the requirements, designing and documenting the solutions for diverse application segments.
- PO11** : Ability to apply the principles of economics, finance and project management skills in solving real life problems and enable them to become future entrepreneurs.
- PO12** : Ability to understand the ever changing societal needs and engage in life-long learning.
- PSO1** : Ability to design and develop cost effective, secure, reliable IT and network products and solutions using emerging tools and techniques for meeting the global needs.
- PSO2** : Ability to identify and analyze voluminous and heterogeneous data by applying suitable evolutionary algorithms, statistical techniques and analytical tools to facilitate information retrieval, pattern discovery, predictive modeling and decision making in scientific and business applications.

# COIMBATORE INSTITUTE OF TECHNOLOGY

(Government Aided Autonomous Institution Affiliated to Anna University, Chennai)

## B.Tech. INFORMATION TECHNOLOGY

### CHOICE BASED CREDIT SYSTEM

Curriculum from the academic year 2015 - 2016 onwards

### SUBJECTS OF STUDY

#### Semester III

Course Code	Course Name	L	T	P	C	CAT
15CIM31	Linear Algebra, Fourier Transforms and Partial Differential Equations	3	2	0	4	BS
15CIM32	Automata Theory and Discrete Mathematics	3	2	0	4	PC
15CI01	Data Structures and Algorithms - I	3	2	0	4	PC
15CI02	Computer Architecture	3	0	0	3	PC
15CI03	Object Oriented Programming and Java	3	0	0	3	PC
15IT01	Electron Devices and Circuits	3	0	0	3	ES
15HSS01	Science of Creativity and Professional Ethics	1	1	0	1	HS
15CI04	Object Oriented Programming Laboratory	0	0	2	1	PC
15IT02	Electron Devices and Circuits Laboratory	0	0	2	1	ES
	<b>TOTAL CREDITS</b>				<b>24</b>	

#### Semester IV

Course Code	Course Name	L	T	P	C	CAT
15CIM41	Numerical Methods, Statistics and Random Processes	3	2	0	4	BS
15CI05	Data Structures and Algorithms - II	3	2	0	4	PC
15CI06	Operating Systems	3	0	0	3	PC
15CI07	Database Management Systems	3	0	0	3	PC
15CI08	Data Communications	3	0	0	3	ES
15IT03	Microprocessors and Microcontrollers	3	0	0	3	PC
15CI09	Data Structures and Algorithms Laboratory	0	0	2	1	PC
15CI10	Database Management Systems Laboratory	0	0	2	1	PC
15IT04	Microprocessors and Microcontrollers Laboratory	0	0	2	1	PC
	<b>TOTAL CREDITS</b>				<b>23</b>	

**Semester V**

Course Code	Course Name	L	T	P	C	CAT
15CI11	Computer Networks	3	0	0	3	PC
15CI12	UNIX Internals	3	0	0	3	PC
15CI13	Software Engineering	3	0	0	3	PC
15CI14	Resource Management Techniques	3	2	0	4	BS
15IT05	Distributed Systems	3	0	0	3	PC
	Elective - I	3	0	0	3	PE/OE
15CI15	Networks Laboratory	0	0	2	1	PC
15CI16	Operating Systems Laboratory	0	0	2	1	PC
15CI17	Soft Skills Development	0	0	2	1	EEC
15IT07	Mini Project	0	0	3	0	EEC
	<b>TOTAL CREDITS</b>				<b>22</b>	

**Semester VI**

Course Code	Course Name	L	T	P	C	CAT
15CI18	Data Warehousing and Data Mining	3	0	0	3	PC
15CI19	Cryptography and Network Security	3	0	0	3	PC
15CI20	Web Technology	3	0	0	3	PC
15IT06	Software Testing and Quality Assurance	3	0	0	3	PC
	Elective - II	3	0	0	3	PE /OE
	Elective - III	3	0	0	3	PE /OE
15CI21	Software Engineering Laboratory	0	0	2	1	PC
15CI22	Web Programming Laboratory	0	0	2	1	PC
15IT07	Mini Project	0	0	3	3	EEC
	<b>TOTAL CREDITS</b>				<b>23</b>	

**Semester VII**

Course Code	Course Name	L	T	P	C	CAT
15IT08	Information Coding Techniques	3	2	0	4	PC
15IT09	Cloud and Virtualization	3	0	0	3	PC
	Elective - IV	3	0	0	3	PE /OE
	Elective - V	3	0	0	3	PE /OE
	Elective - VI	3	0	0	3	PE /OE
15IT10	Cryptography Laboratory	0	0	2	1	PC
15IT11	Cloud and Virtualization Laboratory	0	0	2	1	PC
15IT13	Project and Viva - Voce	0	0	8	0	EEC
	<b>TOTAL CREDITS</b>				<b>18</b>	



**Semester VIII**

Course Code	Course Name	L	T	P	C	CAT
15HSS02	Industrial Economics and Corporate Management	3	0	0	3	HS
15IT12	Software Project Management	3	0	0	3	PC
	Elective - VII	3	0	0	3	PE /OE
	Elective - VIII	3	0	0	3	PE /OE
	Elective - IX	3	0	0	3	PE /OE
15IT13	Project and Viva - Voce	0	0	8	8	EEC
	<b>TOTAL CREDITS</b>				<b>23</b>	

**PROFESSIONAL ELECTIVES (PE)**

Course Code	Course Name	L	T	P	C
15CIE01	Graphics and Multimedia Systems	3	0	0	3
15CIE02	Open Source Systems	3	0	0	3
15CIE03	Digital Image Processing	3	0	0	3
15CIE04	Mobile computing	3	0	0	3
15CIE05	Digital Forensics	3	0	0	3
15CIE06	Object Oriented Analysis and Design	3	0	0	3
15CIE07	Big data Analytics	3	0	0	3
15CIE08	Ad-hoc Networks	3	0	0	3
15CIE09	Information Security	3	0	0	3
15CIE10	Machine Learning	3	0	0	3
15CIE11	Internet of Things	3	0	0	3
15CIE12	Information Storage Management	3	0	0	3
15CIE13	Software Metrics and Measurement	3	0	0	3
15CIE14	Wireless Sensor Networks	3	0	0	3
15CIE15	Soft Computing	3	0	0	3
15CIE16	Service Oriented Architecture and Web Services	3	0	0	3
15ITE01	Enterprise Resource Planning	3	0	0	3
15ITE02	Business Intelligence	3	0	0	3
15ITE03	Human Computer Interaction	3	0	0	3
15CS12	Artificial Intelligence	3	0	0	3
15CS13	Embedded and Real-time Systems	3	0	0	3
15CS16	Principles of Compiler Design	3	0	0	3

**HUMANITIES AND SOCIAL SCIENCES (HS)**

Course Code	Course Name	L	T	P	C	Semester
15FY12	Technical English	2	0	2	3	I
15FY18	English Language Laboratory	0	0	2	1	I
15FY22	Language Elective	2	2	0	3	II
15FY24	Principles of Environmental Science and Engineering	3	0	0	3	II
15HSS01	Science of Creativity and Professional Ethics	1	0	0	1	III
15HSS02	Industrial Economics and Corporate Management	3	0	0	3	VIII
	<b>TOTAL CREDITS</b>				<b>14</b>	

**BASIC SCIENCES (BS)**

Course Code	Course Name	L	T	P	C	Semester
15FY11	Mathematics-I	3	2	0	4	I
15FY13	Engineering Physics	3	0	0	3	I
15FY14	Engineering Chemistry	3	0	0	3	I
15FY16	Physics Laboratory -I	0	0	2	1	I
15FY17	Chemistry Laboratory-I	0	0	2	1	I
15FY21	Mathematics-II	3	2	0	4	II
15FY23	Materials Science	3	0	0	3	II
15FY26	Physics Laboratory -II	0	0	2	1	II
15FY27	Chemistry Laboratory-II	0	0	2	1	II
15CIM31	Linear Algebra, Fourier Transforms and Partial Differential Equations	3	2	0	4	III
15CIM41	Numerical Methods, Statistics and Random Processes	3	2	0	4	IV
15CI14	Resource Management Techniques	3	2	0	4	V
	<b>TOTAL CREDITS</b>				<b>33</b>	

**ENGINEERING SCIENCES (ES)**

Course Code	Course Name	L	T	P	C	Semester
15CM01	Basic Civil and Mechanical Engineering	4	0	0	4	I
15CS03	Fundamentals of Digital Computers	3	0	0	3	I
15FY15	Engineering Graphics-I	1	0	4	3	I
15CS04	Digital Laboratory	0	0	2	1	I
15ME02	Sheet Metal, Plumbing, Electrical Wiring And Home Appliances Laboratory	0	0	2	1	I
15CS01	C-Programming	3	0	0	3	II
15EE04	Fundamentals of Electrical Engineering	3	0	0	3	II
15FY25	Engineering Graphics-II	1	0	4	3	II
15CS02	C-Programming Laboratory	0	0	2	1	II
15ME01	Carpentry and Fitting Laboratory	0	0	2	1	II
15IT01	Electron Devices and Circuits	3	0	0	3	III
15IT02	Electron Devices and Circuits Laboratory	0	0	2	1	III
15CI08	Data Communications	3	0	0	3	IV
	<b>TOTAL CREDITS</b>				<b>30</b>	

**PROFESSIONAL CORE (PC)**

Course Code	Course Name	L	T	P	C	Semester
15CIM32	Automata Theory and Discrete mathematics	3	2	0	4	III
15CI01	Data Structures and Algorithms - I	3	2	0	4	III
15CI02	Computer Architecture	3	0	0	3	III
15CI03	Object Oriented Programming and Java	3	0	0	3	III
15 CI04	Object Oriented Programming Laboratory	0	0	2	1	III
15 CI05	Data Structures and Algorithms - II	3	2	0	4	IV
15 CI06	Operating Systems	3	0	0	3	IV
15 CI07	Database Management Systems	3	0	0	3	IV
15IT03	Microprocessors and Microcontrollers	3	0	0	3	IV
15CI09	Data Structures and Algorithms Laboratory	0	0	2	1	IV
15CI10	Database Management Systems Laboratory	0	0	2	1	IV
15IT04	Microprocessors and Microcontrollers Laboratory	0	0	2	1	IV
15CI11	Computer Networks	3	0	0	3	V
15CI12	Unix Internals	3	0	0	3	V
15CI13	Software Engineering	3	0	0	3	V
15IT05	Distributed Systems	3	0	0	3	V
15CI15	Networks Laboratory	0	0	2	1	V
15CI16	Operating Systems Laboratory	0	0	2	1	V
15CI18	Data Warehousing and Data Mining	3	0	0	3	VI
15CI19	Cryptography and Network Security	3	0	0	3	VI
15CI20	Web Technology	3	0	0	3	VI
15IT06	Software Testing and Quality Assurance	3	0	0	3	VI
15CI21	Software Engineering Laboratory	0	0	2	1	VI
15CI22	Web programming Laboratory	0	0	2	1	VI
15IT08	Information Coding Techniques	3	2	0	4	VII
15IT09	Cloud and Virtualization	3	0	0	3	VII
15IT10	Cryptography Laboratory	0	0	2	1	VII
15IT11	Cloud and Virtualization Laboratory	0	0	2	1	VII
15IT12	Software Project Management	3	0	0	3	VIII
	<b>TOTAL CREDITS</b>				<b>71</b>	

### EMPLOYABILITY ENHANCEMENT COURSES (EEC)

Course Code	Course Name	L	T	P	C	Semester
15CI17	Soft Skill Development	0	0	2	1	V
15IT07	Mini Project	0	0	6	3	VI
15IT13	Project and Viva-Voce	0	0	16	8	VII & VIII
	<b>TOTAL CREDITS</b>				<b>12</b>	

### SUMMARY OF TOTAL CREDIT PERCENTAGE

Sl. No.	Subject Area	Credits as per Semester								Credits Total
		I	II	III	IV	V	VI	VII	VIII	
1.	HS	4	6	1					3	14
2.	BS	12	9	4	4	4				33
3.	ES	12	11	4	3					30
4.	PC			15	16	14	14	9	3	71
5.	PE					3	3	6	6	18
6.	OE						3	3	3	9
7.	EEC					1	3		8	12
	Total	28	26	24	23	22	23	18	23	187
8.	Non Credit / Mandatory			*	*	*	*	*	*	

\* In-plant training (minimum of 4 weeks) during course of study

Sl. No.	Course work Subject Area	Range of Total Credits		
		In%	Total Credits = 187	Number of 3 Credit Subjects
1	HS	7.48(5-10)	14 (9-18)	4
2	BS	17.64(15-20)	33(27-36)	3
3	ES	16.04(15-20)	30 (27-36)	7
4	PC	37.96(30-40)	71 (54-72)	15
5	PE	9.62(10-15)	18 (18-27)	6
6	OE	4.81(5-10)	9 (9-18)	3
7	EEC	6.41(10-15)	12(18-27)	1

# COIMBATORE INSTITUTE OF TECHNOLOGY

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## OPEN ELECTIVES (OE)

### DEPARTMENT OF CIVIL ENGINEERING

Course Code	Course Name	L	T	P	C	Eligible Branches
15CEE35	Disaster Management	3	0	0	3	All Branches
15CEE36	Renewable Energy Resources	3	0	0	3	All Branches
15CEE38	Environmental Impact Assessment	3	0	0	3	All Branches
15CEE39	Solid and Hazardous Waste Management	3	0	0	3	All Branches
15CEE40	Principles of Sustainable Development	3	0	0	3	All Branches
15CEE41	Safety Engineering in Buildings	3	0	0	3	All Branches

### DEPARTMENT OF MECHANICAL ENGINEERING

Course Code	Course Name	L	T	P	C	Eligible Branches
15MEOE01	Robotics	3	0	0	3	All Branches
15MEOE02	Low Cost Automation	3	0	0	3	All Branches
15MEOE03	Adaptive Control and Process Dynamics	3	0	0	3	All Branches
15MEOE04	Project Planning and Management	3	0	0	3	All Branches
15MEOE05	Supply Chain Management	3	0	0	3	All Branches
15MEOE06	Resource Management Techniques	2	2	0	3	All Branches
15MEOE07	Sustainable Development	3	0	0	3	All Branches
15MEOE08	Processing and Applications of Biomaterials	3	0	0	3	All except CSE & IT
15MEOE09	Numerical Simulation of Fluid Flow	3	0	0	3	All Circuit Branches
15MEOE10	Solar Energy Utilisation	3	0	0	3	Civil & Chemical

### DEPARTMENT OF ELECTRICAL AND ELECTRONICS ENGINEERING

Course Code	Course Name	L	T	P	C	Eligible Branches
15EEOE01	Energy Auditing	3	0	0	3	ECE, Mech, Chemical, Civil
15EEOE02	Solar and Wind Energy Systems	3	0	0	3	ECE, Mech, Chemical
15EEOE03	Hybrid Smart Vehicles	3	0	0	3	All Branches except Civil, Chemical
15EEE07	Electrical Safety	3	0	0	3	All Branches
15EEE14	Energy Efficient Lighting System	3	0	0	3	All Branches

**DEPARTMENT OF ELECTRONICS AND COMMUNICATION ENGINEERING**

Course Code	Course Name	L	T	P	C	Eligible Branches
15ECOE01	Consumer Electronics	3	0	0	3	Civil & Mech
15ECOE02	ARM System Architecture	3	0	0	3	CSE & IT
15ECOE03	Broadband Communication	3	0	0	3	Mech, EEE, CSE & IT
15ECOE04	Robotics for Industrial Applications	3	0	0	3	Mech, CSE & IT
15ECOE05	Signal Processing and its Applications	3	0	0	3	Chemical, Mech & CSE

**DEPARTMENT OF CSE**

Course Code	Course Name	L	T	P	C	Eligible Branches
15CSOE01	Fundamentals of Software Engineering	3	0	0	3	EEE, ECE, Mech, Chemical & Civil
15CSOE02	Introduction to Data Warehousing and Data Mining	3	0	0	3	EEE, ECE, Mech, Chemical & Civil
15CSOE03	Introduction to Embedded Systems	3	0	0	3	Mech, Chemical & Civil
15CSOE04	Internet Programming	3	0	0	3	EEE, ECE, Mech, Chemical & Civil
15CSOE05	Customer Relationship Management Essentials	3	0	0	3	IT, EEE, ECE, Mech, Chemical & Civil
15CSOE06	E-commerce	3	0	0	3	IT, EEE, ECE, Mech, Chemical & Civil

**DEPARTMENT OF IT**

Course Code	Course Name	L	T	P	C	Eligible Branches
15ITOE01	Digital Computer Basics	3	0	0	3	Mech, Civil & Chem
15ITOE02	Programming in Java	3	0	0	3	EEE, ECE, Mech, Civil & Chemical
15ITOE03	Fundamentals of Database Systems	3	0	0	3	EEE, ECE, Mech, Civil & Chemical
15ITOE04	Cloud Computing Fundamentals	3	0	0	3	EEE, ECE, Mech, Civil & Chemical
15ITOE05	Information Security Fundamentals	3	0	0	3	EEE, ECE, Mech, Civil & Chemical
15ITOE06	Introduction to Human Computer Interaction	3	0	0	3	CSE, EEE, ECE, Mech, Civil & Chemical
15ITOE07	Enterprise Resource Planning Concepts	3	0	0	3	CSE, EEE, ECE, Mech, Civil & Chemical

**DEPARTMENT OF CHEMICAL ENGINEERING**

Course Code	Course Name	L	T	P	C	Eligible Branches
15CHOE01	Industrial Safety Engineering	3	0	0	3	All Branches
15CHOE02	Risk Analysis and Hazop	3	0	0	3	All Branches
15CHOE03	Green Technology	3	0	0	3	All Branches
15CHOE04	Corrosion Science and Engineering	3	0	0	3	All Branches
15CHOE05	Introduction to Chemical Engineering	3	0	0	3	All Branches

**DEPARTMENT OF MATHEMATICS**

Course Code	Course Name	L	T	P	C	Eligible Branches
15MOE01	Graph Theory and Its Applications	3	0	0	3	All Branches
15MOE02	Methods of Applied Mathematics	3	0	0	3	All Branches
15MOE03	Linear and Non-Linear Programming	3	0	0	3	All Branches
15MOE04	Probability and Random Processes	3	0	0	3	All Branches

**DEPARTMENT OF PHYSICS**

Course Code	Course Name	L	T	P	C	Eligible Branches
15POE01	Introduction to Nanoscience and Nanotechnology	3	0	0	3	All Branches except IT
15POE02	Physics and Technology of Thin Films	3	0	0	3	Mech, EEE, ECE & Chemical
15POE03	Solar Cell Fundamentals and Materials	3	0	0	3	EEE, ECE & Chemical
15POE04	Advanced Material Processing Technologies	3	0	0	3	Mech & Chemical

**DEPARTMENT OF CHEMISTRY**

Course Code	Course Name	L	T	P	C	Eligible Branches
15COE01	Medical Nano Technology	3	0	0	3	Chemical
15COE02	Advanced Drug Delivery Systems	3	0	0	3	Chemical
15COE03	Biosensors	3	0	0	3	Chemical, ECE & EEE
15COE04	Nanocomposites	3	0	0	3	Mech, Chemical & Civil
15COE05	Biorefinery	3	0	0	3	Mech & Chemical



**DEPARTMENT OF HUMANITIES**

Course Code	Course Name	L	T	P	C	Eligible Branches
15HOE01	Principles of Management	3	0	0	3	All Branches
15HOE02	Current Trends in Indian Economy	3	0	0	3	All Branches
15HOE03	Monetary Economics	3	0	0	3	All Branches
15HOE04	Accounting for Managerial Decisions	3	0	0	3	All Branches
15HOE05	Entrepreneurship Development	3	0	0	3	All Branches
15HOE06	Employability Skills	3	0	0	3	All Branches
15HOE07	English for Academic Purposes	3	0	0	3	All Branches
15HOE08	English for Competitive Exams	3	0	0	3	All Branches
15HOE09	Life and Literature	3	0	0	3	All Branches



# 15CIM31 - LINEAR ALGEBRA, FOURIER TRANSFORMS AND PARTIAL DIFFERENTIAL EQUATIONS

L	T	P	C
3	2	0	4

## ASSESSMENT : THEORY

### COURSE OUTCOME

- CO1** : To discuss linear transformations, matrix operations for solving linear systems and to find rank and dimensions.
- CO2** : To discuss vector spaces and their properties and use Gram Schmidt process for orthogonalisation
- CO3** : To find infinite and finite Fourier transforms of standard functions and study the properties
- CO4** : To formulate and solve the partial differential equations of linear and non-linear with standard techniques of higher order.
- CO5** : To solve the one dimensional wave equation, one dimensional and two dimensional heat equations using Fourier series solution

### LINEAR ALGEBRA-I

System of Linear equations - Solution of linear system -Linear transformations - Matrix of linear transformation - Matrix operations - Inverse of a matrix - Matrix factorizations - Subspaces of  $R_n$  - Dimension and Rank - Determinants - Cramer's rule - Matrix factorization - Cholesky decomposition - QR factorization - Singular value decomposition - Toeplitz matrices and some applications. (9)

### LINEAR ALGEBRA-II

Vector spaces and subspaces - Null spaces and column spaces - Linearly independent sets - Basis - Coordinate systems - Dimension of a vector space - Rank - Eigenvector and Eigen values-Characteristic equation- Diagonalization - Eigenvectors and linear transformations - Orthogonal sets - Gram-Schmidt process - Least square problems - Inner products space. (9)

### PARTIAL DIFFERENTIAL EQUATIONS

Formation by elimination of arbitrary constants and functions - solution by direct method-solution of first order non-linear PDE-standard types - Lagrange's linear equation-Linear higher order homogeneous PDE with constant coefficients. (9)

### FOURIER TRANSFORMS

Fourier integral theorem (without proof) - Infinite Fourier transform - infinite Fourier sine and cosine transforms - properties and problems - Convolution theorem - Parseval's identity - Finite Fourier sine and cosine Transforms - properties and problems. (9)

### BOUNDARY VALUE PROBLEMS

Vibration of strings-one dimensional wave equations, one dimensional heat flow- unsteady state and steady state -Two dimensional heat flow steady state in Cartesian coordinates-Separation of variables-Fourier series solution. (9)

**TOTAL : 75**

### TEXT BOOKS

1. Kandasamy, P.et al., "Engineering Mathematics", Volume - III S.Chand & Co.Revised Edition, 2013.
2. Veeraranjan.T, "Transforms and Partial Differential Equations First edition McGraw Hill Education India Pvt Ltd, New Delhi, 2011.
3. Venkataraman.M.K., "Engineering Mathematics III", for B.E., Third Semester, The National Publishing Company, Revised and Enlarged Fourteenth Edition 2008.
4. Venkataraman.M.K., "Engineering Mathematics III-A", The National Publishing Company, Eleventh Edition, 2008.
5. David C Lay, "Linear Algebra and Its Applications", Pearson Education Asia, New Delhi, 2003.
6. Gilbert Strang, "Linear Algebra and Its Applications," Brooke/Cole Ltd., New Delhi, Fourth Revised Edition, 2012.

## REFERENCE BOOKS

1. Erwin Kreyszig, "Advanced Engineering Mathematics", John Wiley & Sons (Asia) Private Limited., Tenth Edition, 2011.
2. Grewal, B.S., "Higher Engineering Mathematics", Khanna Publishers, 42nd Edition, 2013
3. Grewal, B.S., "Numerical Methods in Science and Engineering", Reprint Khanna Publishers, Ninth Edition, 2013
4. Jain M.K. Iyengar, S.R.K. & Jain R.K., "Numerical Methods for Scientific and Engineering Computation", New Age International (P) Ltd, Sixth edition, 2012.

# 15CIM32 - AUTOMATA THEORY AND DISCRETE MATHEMATICS

L	T	P	C
3	2	0	4

## ASSESSMENT : THEORY

### COURSE OUTCOME

- CO1** : Apply logical reasoning in verifying the correctness and validity of simple instances of valid logical arguments.
- CO2** : Design encoding and decoding procedures for error detection and correction.
- CO3** : knowledge in constructing system models which are the natural extension of Automata that are used to devise design procedures.
- CO4** : Discuss and deploy specification of languages using grammars.

### MATHEMATICAL LOGIC

Connectives - Conditional and Biconditional statements -Statement formulae and Truth tables -Tautologies and Tautological Implications -Normal forms -Disjunctive and Conjunctive Normal Forms - The Theory of Inference for the Statement Calculus - Consistency of Premises - The Predicate Calculus - Variables and Quantifiers - Special variable formulae involving Quantifiers - Theory of Inference for the Predicate Calculus. (8)

### ALGEBRAIC STRUCTURES I

Rings, Integral domains and Fields - Properties - Polynomial Rings - Construction of Finite Fields - Irreducible Polynomials - Primitive element of a Finite Field - Primitive Irreducible Polynomials. (7)

### ALGEBRAIC STRUCTURES II

Residue arithmetic for Computers - Coding theory - Error Detection - Correction - Distance between Code Words - Minimum distance and weight - Group Code, Linear Code and Cyclic Code - Problems under Encoding and Decoding Techniques. (8)

### FINITE AUTOMATA

Chomsky Classification of Grammars - Finite State Systems - Basic definitions - Transition diagrams - Deterministic & Nondeterministic Finite Automata - Finite Automata with  $\epsilon$ -moves - Finite Automata with Output - Moore & Mealy Machine.(9)

### GRAMMARS AND PUSH DOWN AUTOMATA

Context-Free Grammars - Simplification of Context -Free Grammars - Chomsky Normal Form. Pushdown Automata: Definitions - Pushdown Automata and Context-Free Languages - Solving problems like  $0^n, 1^n$  etc. (5)

### TURING MACHINES

Introduction - The Turing Machine Model - Simulating Computers using Turing Machines -Well-formedness of parentheses - Addition of unary numbers - Multiplication of unary numbers - Recognition of binary palindromes - Recognition of words of the form  $0^n, 1^n$ . (8)

**TOTAL : 75**

### TEXT BOOKS

1. J.P.Tremblay, R.Manohar, "Discrete Mathematical structures with applications to computer science", Tata McGraw Hill, 38th Edition reprint 2010.
2. John E.Hopcroft, Rajeev Motwani, Jeffery D. Ullman, "Introduction to Automata Theory, Languages and Computation", Addison Wesley, Pearson Education, Third Edition, Second Impression, 2009.
3. Ralph P. Grimaldi, "Discrete and Combinatorial Mathematics: An Applied Introduction", Addison Wesley Publishing Company, Fifth Edition, Pearson Education, Second Impression, 2008.

### REFERENCE BOOKS

1. Kenneth H. Rosen, "Discrete Mathematics and its Applications", Tata McGraw-Hill, Seventh Edition, 2012.
2. John.C.Martin, "Introduction to Languages and the Theory of Computation", Third Edition, Tata McGraw Hill, Seventh reprint, 2010.
3. Mishra K.L.P, Chandrasekaran. N. "Theory of Computer Science: Automata, Languages and Computation", Prentice Hall of India, Third Edition, 2008.

# 15CI01 - DATA STRUCTURES AND ALGORITHMS - I

L	T	P	C
3	2	0	4

## ASSESSMENT : THEORY

### COURSE OUTCOME

**CO1** : Learn the fundamental data structures such as lists, stacks, queues, trees, graphs and associated algorithms

**CO2** : Choose the Data Structures and Algorithms that are appropriate for different applications

**CO3** : Analyze the computational complexity of computer algorithms

### DATA, INFORMATION AND ALGORITHM ANALYSIS

**Data Vs Information - Representation of Numbers** : Integer, Real, Representation of Characters - Definition of an Algorithm - Basic Steps in Development of an Algorithm - Algorithm Notations - Sparks - Algorithm Complexity - Space and Time Complexity - Order Notations - Definition of NP Hard - NP Complete. (6)

### LINEAR LIST

**Definition - Arrays** : Representation and Characteristics - Array of Structures - Polynomial Representation- Multidimensional Arrays. (3)

### STACKS AND QUEUES

Fundamentals of Stacks, Queues and Dequeues - Application of Stacks: Recursion - Conversion of Infix to Postfix and Prefix Expressions - Evaluation of Postfix Expressions - Application of Queues: Wire Routing-Priority Queue-Multiple Stacks and Queues. (7)

### LINKED LISTS

Singly and Doubly Linked Lists: Basic Operations - Linked Stacks and Queues - Polynomial Manipulation-Multiprecision Arithmetic-Equivalence Relations. (6)

### SPARSE MATRICES

Representation - Transpose and Multiplication of Sparse Matrices in Three Tuple Form - Sparse Matrices using Linked Lists. (5)

### CHARACTER STRINGS

Representation: Fixed Length, Workspace Index, Linked List - Operations: Concatenation, Insertion, Deletion, Sub-String, Pattern Matching. (4)

### TREES

Definition - Binary Trees: Representations, Traversal, Properties - Threaded Binary Trees - Copying and Equivalence of Binary Trees - Binary Tree Representation of General Trees - Application of Trees : Binary Search Trees: Principle, Addition and Deletion of Nodes, Decision Trees, Game Trees. (7)

### GRAPHS

Terminology and Representations - Warshall Algorithm - Traversals - Biconnectivity - Connected Components - Spanning Trees - Shortest Path - Transitive Closure- Activity Networks - Topological Sort - Critical Paths-Enumerating all Paths-Euler and Hamiltonian Paths. (7)

\* **Note** : Algorithms will be taught in Sparks like notation.

**TOTAL : 75**

### TEXT BOOK

1. Ellis Horowitz, Sartaj Sahani, "Fundamentals of Data Structures in C", Galgotia Publications, Second Edition, 2008.

### REFERENCE BOOKS

1. Satraj Sahani, "Data structures, Algorithms and applications in C++", McGraw Hill, Second Edition, 2005.

2. Jean-Paul Tremblay and Paul G. Sorenson, "An Introduction to Data Structures with Applications", McGraw Hill, Second edition, 2008.

# 15CI02 - COMPUTER ARCHITECTURE

L	T	P	C
3	0	0	3

## ASSESSMENT : THEORY

### COURSE OUTCOME

- CO1** : Demonstrate the working of the algorithm for performing arithmetic operations, using the registers and ALU within the processor.
- CO2** : Illustrate the control sequences and draw data flow path during the instruction execution.
- CO3** : Discuss the concept of pipelining and examine hazards and techniques to enhance the performance of the system.
- CO4** : Given a memory module specifications, choose the appropriate memory mapping procedure to enhance the performance of the system.
- CO5** : Discuss the communication of I/O interface and ports with the processor.

### MACHINE INSTRUCTIONS AND ARITHMETIC OPERATIONS

Instruction and Instruction sequencing: Register Transfer Notation - Assembly Language Notation - RISC and CISC Instruction Sets - Instruction Execution and Straight Line Sequencing - Branching - Addressing modes - Stacks- Subroutines - CISC Instruction sets - RISC and CISC styles. Arithmetic algorithms for Additions, Subtraction, Multiplication and Division on Signed magnitude, 2's compliment numbers and Floating point Numbers (10)

### BASIC PROCESSING UNIT

Fundamental Concepts - Instruction Execution: Load - Store - Arithmetic and Logical Instructions. Hardware components: Register File - ALU - Data path - Instruction Fetch Section. Instruction Fetch and Execution Steps: Branching - Waiting for Memory. Control signals - Hardwired Control: Data path Control Signals - Dealing with Memory Delay. CISC Style Processor: Interconnect using Buses - Micro programmed Control. (9)

### PIPELINING

Basic Concepts - Pipeline Organization - Pipelining Issues - Data Dependencies: Operand Forwarding - Handling Data Dependencies in Software. Memory Delays - Branch Delays: Unconditional Branches - Conditional Branches - Branch Delay Slot - Branch Prediction. Resource limitations - Performance Evaluation: Effects of stalls and penalties - Number of pipeline stages. Superscalar Operation: Branches and Data Dependencies - Out-of-Order Execution - Execution Completion - Dispatch Operation. (9)

### MEMORY SYSTEM

Memory Hierarchy-Memory Address Map-Memory Connection to CPU-Associative Memory: Hardware Organization - Match Logic - Read and Write Operation. Cache Memory: Associative mapping - Direct Mapping - Set Associative Mapping - Writing into Cache - Cache Initialization. Virtual Memory: Address mapping using Pages-Associative Memory Page Table - Page Replacement. (8)

### I/O ORGANIZATION

Accessing I/O Devices: I/O Device Interface - Program-Controlled I/O. Interrupts: Enabling and Disabling Interrupts - Handling Multiple Devices - Controlling I/O Device Behavior - Processor Control Register. Direct Memory Access - Bus Structures - Bus Operation: Synchronous Bus - Asynchronous Bus. Arbitration - Interface circuits: Parallel Interface - Serial Interface. (9)

**TOTAL : 45**

### TEXT BOOKS

1. Carl Hamacher, Zvonko Vranesic, Safwat Zaky and Naraj Manjikian, "Computer Organization and Embedded Systems", McGraw-Hill, Sixth Edition, 2012. (Machine Instructions, Processing Unit, Pipelining and I/O Organization)
2. Morris Mano, "Computer System Architecture ", Prentice Hall of India, Third Edition, 2008. (Arithmetic Operations and Memory System)

## REFERENCE BOOKS

1. *William Stallings, "Computer Organization and Architecture - Designing for Performance", Pearson Education, Ninth Edition, 2012.*
2. *David A. Patterson and John L. Hennessy, "Computer Organization and Design: The Hardware/ Software Interface", Morgan Kaufmann, Fifth Edition, 2013.*
3. *John P. Hayes, "Computer Architecture and Organization", McGraw Hill, Sixth Edition, 2007.*



# 15CI03 - OBJECT ORIENTED PROGRAMMING AND JAVA

L	T	P	C
3	0	0	3

## ASSESSMENT : THEORY

### COURSE OUTCOME

**C01** : Identify classes and objects in software applications.

**C02** : Design objects for specific applications in java.

**C03** : Demonstrate the concepts of multithreading, java networking, applet and its use.

### OBJECT ORIENTED PROGRAMMING

Introduction to object oriented languages - Evolution of object oriented languages - Object oriented programming paradigm - Basic concepts of object oriented programming - Procedural vs Object oriented programming. (6)

### INTRODUCTION TO JAVA

Java and Internet - Byte Code - Features of Java - Java Development Environment- Java Programming: Methods and Classes - Constructor - Garbage Collection - Overloading - Inheritance - Overriding - Packages and Interfaces - Java I/O systems - String Handling : String and String Buffer. (12)

### EXCEPTION HANDLING

Exception Handling: Fundamentals of Exception handling and types - Built in Exceptions - User defined Exceptions. (5)

### THREADS AND NETWORKING

Multithreaded Programming : Thread Model - The Main Thread - Creating a Thread - Creating Multiple Threads - Thread priorities - Synchronization - Inter thread communication - Networking : Networking Basics - Inet address - TCP/IP Sockets - URL - Datagrams. (11)

### APPLET AND DATABASE CONNECTIVITY

Introduction to Abstract Window Tool kit - Applet class : Applet Basics - Applet Architecture - HTML applet tags - Parameter passing - Audio clip interface - Event Handling: The Delegation Event Model - Event class: Keyboard and Mouse events handling. Data Base Connectivity: basic structure of JDBC API. (11)

**TOTAL : 45**

### TEXT BOOK

1. Herbert Schilt : " Java 2 - Complete Reference ", Tata McGraw Hill, McGraw Hill Education, Ninth Edition, 2014.

### REFERENCE BOOK

1. Deitel H.M and Deitel P.J, " Java - How to Program", Prentice Hall of India, Ninth Edition, 2012.

# 15IT01 - ELECTRON DEVICES AND CIRCUITS

L	T	P	C
3	0	0	3

## ASSESSMENT : THEORY

### COURSE OUTCOME

- CO1** : Infer the characteristics of diode and discuss its application and to analyse the Characteristics of Bipolar Junction transistors and Field effect transistors.
- CO2** : Assess the biasing technique for stability and analyse BJT and FET amplifier circuits and to classify, analyse the feedback amplifiers.
- CO3** : Design of Oscillators and analysing Multi vibrators circuits.

## SEMICONDUCTOR DIODES AND APPLICATIONS

PN junction diode- Characteristics and parameters- Half wave and full wave rectifiers-Series and shunt clipping circuits- clamping circuits- Voltage doublers- Zener diodes-Characteristics and parameters- Zener diode regulators. (9)

## JUNCTION TRANSISTORS

Bipolar Junction transistor operation- Voltages and currents- Amplification and switching- CE characteristics- Bias point- Voltage-divider bias circuit design-JFET operation and characteristics- JFET amplification and switching- Voltage divider bias of FET - Enhancement and Depletion MOSFET. (9)

## TRANSISTOR BIASING & STABILISATION

Operation point - Stability factor - Collector to base bias - Self bias - Need for bias stabilisation - Stability against variation in  $I_{co}$ ,  $V_{be}$  and  $V_{ce}$  - Stability factor S - Comparison biasing circuits - Bias compensation - Biasing FET & MOSFET-Common emitter amplifier circuit analysis- Common source amplifier circuit analysis. (10)

## FEEDBACK AMPLIFIERS

Classification of amplifiers- Feedback concept- General characteristics of negative feedback amplifiers- Effect of negative feedback -Voltage series feedback- Current series feedback- Current shunt - Voltage shunt feedback -Feedback and stability- Gain and phase margin. (9)

## OSCILLATORS AND MULTIVIBRATORS

Analysis and Design of Hartley, Colpitts, RC phase shift, Wein Bridge and Crystal Oscillators-Analysis of collector coupled, Monostable, bistable and as table multi vibrators- Schmitt trigger. (8)

**TOTAL : 45**

## TEXT BOOKS

1. David A. Bell, "Electronic Devices and Circuits", Oxford University Press, Fifth Edition, 2008. (Semiconductor Diodes And Applications, Junction Transistors, Transistor Biasing & Stabilisation)
2. Jacob Millman, Christos C Halkais, Satyabrata Jit, " Electronic Devices and Circuits", Tata McGraw Hill, Third Edition, 2011. (Feedback Amplifiers, Oscillators and Multi vibrators)

## REFERENCES

1. Milman & Taub, "Pulse digital and switching waveforms", Tata McGraw Hill, Twenty Seventh Reprint, 2007.
2. Allen Mottershed, "Electronic Devices and Circuits - An Introduction", PHI Learning, 2011.
3. Robert L. Boylstead and Louis Nashelsky, "Electronic Devices and Circuit Theory", Ninth Edition, Prentice Hall of India, New Delhi, 2005.
4. Salivahanan, "Electronic Devices and Circuits", Tata McGraw-Hill, New Delhi, Reprint 2006.
5. Dharmaraj Cheruku and Battula Tirumal Krishan, "Electronic circuits and Devices Theory and Practice", PHI, 2009.
6. Balbir Kumar and Shail B. Jian, "Electronic Devices and Circuits", Second edition, PHI Learning, 2014.

# 15HSS01 - SCIENCE OF CREATIVITY AND PROFESSIONAL ETHICS

L	T	P	C
1	1	0	1

## ASSESSMENT : THEORY

### COURSE OUTCOME

Students will be able to,

- CO1** : Describe the principles of karma yoga and functioning of mind and consciousness.
- CO2** : Hypothesize the evolution of Universe and living beings in a global and societal context
- CO3** : Infer the principles of Yoga to practice it and know the value of health.
- CO4** : Interpret the philosophy of introspection procedures for better living
- CO5** : Assess, take personal responsibility and follow professional ethics for sustained growth in career and life.

### LIFE FORCE, MIND AND CONCIUSNESS

Science of Creativity and Personality Development - Objectives - Principles of Karma Yoga - Duty Consciousness - Communism and Capitalism - Law of Nature - Life Force - Origin - Potentiality of the Life Force - Premordial State - Wave Theory - Consciousness - Pancha Thanmatras - Secret of Revelations - Mind - Biomagnetism - Physical Transformation of Biomagnetism. (7)

### EVOLUTION OF THE UNIVERSE AND LIVING BEINGS

Evolution of the Universe: Creation Theory - Evolution Theory - Theory of Permanence - Theory of Mithya - Evolution of Living Beings: Absolute Space and Force - Plants Experience Pain - Two Eyes and Two Ears - Seven Constituent Layers in the Body. (5)

### YOGA AND ITS BENEFITS

Simple and Safe Yoga - Upa Yoga Practices: Yoga for Peace - Yoga for Health - Yoga for Joy - Yoga for Love - Yoga for Well-being - Yoga for Success. Physical Exercise - Meditation - Seven Centers of Meditation - Benefits - Effect of Good Vibrations - Cause and Effect System - Food and Health. (6)

### INTROSPECTION

Attachment, Detachment and Moderation in Enjoyment - Imaginary Expectations - Harmony in Life: Self, Family, Society and Nature - Introspection: Analysis of Thought, Moralization of Desire, Neutralization of Anger, Eradication of Worries and Self Realization. (6)

### HUMAN VALUES

Morals, Values and Ethics - Integrity - Work Ethics - Service Learning - Virtues - Respect for Others - Living Peacefully - Caring - Sharing - Honesty - Courage - Valuing Time - Co-operation - Commitment - Empathy - Self Confidence - Challenges in Work Place - Impact of cyberspace on individuals. (6)

**TOTAL : 30**

### TEXT BOOKS

1. Yogiraj Vethathri Maharishi, "Karma Yoga - The Holistic Unity", Vethathri Publications, IV Edition, 2009. (Chapters 1-7, 10-12)
2. R.S.Naagarazan, "A Textbook on Professional Ethics and Human Values", New Age International Publishers, New Delhi, 2011.

### REFERENCE BOOKS

1. Sadhguru, "Body the Greatest Gadget and Mind is your Business", Diamond Pocket Books Pvt. Ltd, Isha Foundations, 2013.
2. Swami Vivekananda and Swami Nikhilananda, "Karma Yoga and Bhakti Yoga", II Edition, Ramakrishna Vivekananda Publications, 2008.
3. Henry Dreyfuss, "The Measure of Man and Woman: Human Factors in Design", John Wiley and Sons Publications, 2012.
4. Mike W. Martin and Roland Schinzinger, "Ethics in Engineering", IV Edition, McGraw Hill, New York, 2005.
5. M. Govindarajan, S. Natarajan, V.S. Senthilkumar, "Engineering Ethics", I Edition, Prentice Hall of India, 2009.

## 15CI04 - OBJECT ORIENTED PROGRAMMING LABORATORY

L	T	P	C
0	0	2	1

**ASSESSMENT : PRACTICAL**

### ***COURSE OUTCOME***

***CO1*** : Create effective java applications using fundamental object oriented programming Concepts.

***CO2*** : Demonstrate advanced java concepts like Exception handling, Multithreading and Applets.

***CO3*** : Design and develop java applications for real world problems.

### **EXPERIMENTS USING THE FOLLOWING CONCEPTS**

1. Control statements in Java.
2. Classes.
3. Inheritance.
4. Exception Handling.
5. Packages & Interface.
6. Multithreading.
7. Applet and AWT Tools.
8. Socket programming using TCP and UDP.
9. Case study Database Connectivity.

## 15IT02 - ELECTRON DEVICES AND CIRCUITS LABORATORY

L	T	P	C
0	0	2	1

### ASSESSMENT : PRACTICAL

#### COURSE OUTCOME

- C01** : Knowledge and ability to explain the characteristics of diodes and transistors and ability to design circuits using transistors for the given specification.
- C02** : Practical knowledge on the designing and testing biasing circuits
- C03** : Ability to design an amplifiers, oscillators and multivibrators.

#### EXPERIMENTS

1. Characteristics of Silicon and Germanium diodes.
2. Characteristics of Zener diode.
3. Design and testing of Clippers and Clampers.
4. Common Emitter characteristics of BJT.
5. Common Source characteristics of FET.
6. Design and testing of voltage divider bias using BJT
7. Design and testing of feedback amplifiers circuits(Voltage series and Voltage shunt)
8. Design and testing of feedback amplifiers circuits(Current series and Current shunt)
9. Design and testing of RC Phase Shift Oscillator.
10. Design and testing of LC Oscillator.
11. Design and testing of as table Multi vibrator.
12. Design and testing of Bi stable Multi vibrator.

# 15CIM41 - NUMERICAL METHODS, STATISTICS AND RANDOM PROCESSES

L	T	P	C
3	2	0	4

## ASSESSMENT : THEORY

### COURSE OUTCOME

- CO1 : To Summarize the concepts of numerical methods in solving linear system of equations using Gaussian methods. Also to discuss standard methods to solve ordinary differential equations.
- CO2 : To analyze and study various methods to solve partial differential equations numerically.
- CO3 : To discuss two-dimensional random variables and their properties. Also to discuss curve fitting with least square technique.
- CO4 : To demonstrate the concepts of sampling theory with various hypothetical testing.
- CO5 : To analyze the classification of random processes with standard measures.

### NUMERICAL METHODS - I

Linear simultaneous equations : Gauss elimination method - Gauss Jordan method - Crout's method - Gauss seidal method -- Relaxation method. Ordinary differential equations : Taylor's series - Modified Euler's - Runge - kutta fourth order methods - Milne s predictor - corrector method. (9)

### NUMERICAL METHODS - II

Finite difference approximations - solution of PDE - Laplace equation - Liebmanns iteration process - Poisson equation - Parabolic equation - Bender Schmidt and Crank - Nicholson methods - Hyperbolic equation. (9)

### TWO DIMENSIONAL RANDOM VARIABLES

Probability mass function - Probability distribution function - Cumulative distribution function - Marginal probability functions - Conditional distribution - Expectation of two dimensional random variables - Covariance - Correlation - regression - curve fitting - least square technique - only curve of the form or reducible to the form. (9)

### SAMPLING THEORY

Elements of sampling theory - Large sample tests - Test for mean, variance and proportions - small sample tests-t, F, chi-square tests - contingency table - test for independence. (9)

### RANDOM PROCESSES

Classification of random processes - Special classes of Random processes - Average values of Random processes - Stationarity - Analytical representation of random processes - Auto correlation function and its properties - Cross-Correlation function and its properties - Ergodicity - Mean Ergodic theorem - Correlation Ergodic process - Distribution Ergodic process - Power spectral Ergodic density function and its properties. (9)

**TOTAL : 75**

### TEXT BOOKS

1. Kandasamy. P., et al., "Numerical methods.", S.Chand and Company, 2013.
2. Veerarajan T, "Probability Statistics and Random Process," Tata McGraw Hill publishing company Ltd, Third edition, 2009.
3. Venkataraman M.K, "Higher mathematics for Engineering and Science" National Publishing Company,2000.
4. Kandasamy P., et al, "Probability Statistics and Random Process", S Chand and Company 2013.

### REFERENCE BOOKS

1. Erwin Kreyszig., "Advanced Engineering Mathematics", John Wiley and Sons (Asia) Private Limited, Tenth Edition, 2011.
2. Grewal, B.S., "Higher Engineering Mathematics", Khanna Publishers, 42nd Edition, 2013.
3. Kapoor. J.N and Saxena, H.C., "Mathematical Statistics", S Chand and Company, Twelfth Edition Reprint, 2013.
4. Grewal, B.S., "Numerical Methods in Science and Engineering", Khanna Publishers, Ninth Edition Reprint, 2013.
5. Trivedi, K.S., "Probability and Statistics with Reliability, Queueing and Computer Science Applications", Prentice-Hall, Inc., Englewood Cliffs, New Jersey, 2003.

# 15CI05 - DATA STRUCTURES AND ALGORITHMS - II

L	T	P	C
3	2	0	4

## ASSESSMENT : THEORY

### COURSE OUTCOME

- CO1** : Explain the various file organization and access methods.
- CO2** : Analyze sorting, searching algorithms with their complexities and their application to real world problems
- CO3** : Describe various memory management algorithms as used in different operating Systems.
- CO4** : Choose the appropriate data structure and algorithm design method to implement real world problems.

### FILES

External Storage Devices - Definitions and Concepts - Record Organization - Sequential Files - Indexed Sequential Files: Structure and Processing - Other Method of File Organizations: VSAM - Multiple Key Access: Multi list, Inverted List, Cellular Partitions. (7)

### SORTING

Introductory Considerations - Internal Sorts: Selection Sort, Bubble Sort, Insertion Sort, Merge Sort, Shell Sort, Heap Sort, Quick Sort, Radix Sort, Address Calculation Sort - External Sorts : Poly phase Sort, Oscillating Sort, Sorting on Discs-Extended Run List-time Complexity for Sorting Algorithms. (9)

### SEARCH STRATEGIES

Sequential Search - Binary Search -Extended Binary Tree - Huffman Coding- Search Trees: Height Balanced Trees, 2-3 Trees, Weight Balanced Trees, B-Tree, B+ Trees, Tries, Red Black Trees, Tournament Trees. (9)

### HASH TABLE METHODS

Introduction- Hashing Functions - Hashing Methods - Collision Resolution Techniques - Time Complexity for Searching Algorithms. (5)

### DYNAMIC STORAGE MANAGEMENT

First Fit - Best Fit - Storage Release - Boundary Tag Method - Buddy System - Garbage Collection -Compaction. (7)

### ALGORITHMS DESIGN

Basic Steps in Complete Development of an Algorithm - Algorithms and Design Methods: Sub Goals, Hill Climbing and Working Backward, Heuristics, Back Track Programming, Branch and Bound, Simulated Annealing - Knapsack Problem (Back Tracking)- Traveling Salesmen Problem(Branch and Bound). (8)

\* Note : Algorithms will be taught in Sparks like notation.

**TOTAL : 75**

### TEXT BOOKS

1. Jean Paul Tremblay, Paul G. Sorenson, "An Introduction to Data Structures with Applications", McGraw Hill, Second Edition, 2008. (Files, Sorting, Hash Table Methods, Search Strategies, Dynamic Storage Management)
2. Horowitz E., Sahani S., and Rajasekaran Sanguthevar, "Fundamental of Computer Algorithms", Universities Press (Computer Science), Second Edition, 2008. (Algorithms Design)

### REFERENCE BOOKS

1. Alfred V. Aho, John. E. Hopcroft, Jeffrey D, Ullman, "Data Structures and Algorithms", Pearson Education, 2002.
2. AnanyLevitin, "Introduction to the design and analysis of Algorithms", Pearson, Third edition, 2011

# 15CI06 - OPERATING SYSTEMS

L	T	P	C
3	0	0	3

## ASSESSMENT : THEORY

### COURSE OUTCOME

- CO1** : Outline the basic functionalities of operating systems, operating system components, various types of operating system and system software.
- CO2** : Apply process scheduling, processes synchronization, deadlock algorithms to demonstrate process execution.
- CO3** : Examine various memory management schemes and find suitable technique to design the system.
- CO4** : Describe disk scheduling algorithms, Secondary storage management techniques for better utilization of external memory and identify the file organization and access methods.

### OPERATING SYSTEM OVERVIEW

Introduction to system software - Objectives and functions of OS - Evolution of OS - Distributed System - Real-Time systems - Operating system components - Interrupts -System call -Virtual Machines - Symmetric Multiprocessing - Microkernel. (3)

### PROCESS DESCRIPTION AND CONTROL

Process - Process states - Process description - Process control -Processes and Threads - Uniprocessor Scheduling: Types of Processor Scheduling - Scheduling Algorithms - Overview of Multiprocessor Scheduling and Real time scheduling. (10)

### MUTUAL EXCLUSION AND SYNCHRONIZATION

Principles of concurrency - Mutual exclusion: Software and hardware approaches - Semaphores - Monitors - Message Passing - Readers/ Writers problem. Deadlock and Starvation: Principles of deadlock - Deadlock Prevention - Deadlock Detection - Deadlock Avoidance. (10)

### MEMORY MANAGEMENT

Memory management requirements - Memory partitioning - Loading and Linking - Paging - Segmentation. Virtual Memory: Hardware and control structures - Operating Systems software: Fetch Policy, Placement policy, Replacement policy, Resident set management, Cleaning policy, Load control. (10)

### I/O MANAGEMENT AND FILE MANAGEMENT

I/O devices - Organization of I/O function - OS design issues - I/O buffering - Disk scheduling. File management: Overview - File organization and access - File directories - File sharing - Record blocking-Secondary storage management. (8)

### OTHER SYSTEM SOFTWARE

Macro processor - Features, Design - Linkers - Loaders: Loader schemes. (4)

**TOTAL : 45**

### TEXT BOOKS

1. William Stallings, "Operating Systems Internals and Design Principles", Pearson Education, Eighth Edition, 2015. (Operating System Overview, Process Description and Control, Mutual Exclusion and Synchronization, Memory Management, I/O Management And File Management)
2. John J Donovan, "System Programming", McGraw Hill Publication, Reprint, 2014. (Other System Software)

### REFERENCE BOOKS

1. Leland L.Beck, D.Manjula, "System Software", Pearson Education, Third Edition, 2007.
2. Silberchatz, Galvin, Gagne, "Operating System Concepts", John Wiley, Nineth Edition,2013.
3. Harvey M. Deitel, Paul J. Deitel, David R. Choffnes, "Operating Systems", Prentice Hall, Third Edition, 2004.



# 15CI07 - DATABASE MANAGEMENT SYSTEMS

L	T	P	C
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## ASSESSMENT : THEORY

### COURSE OUTCOME

- CO1** : Describe database architecture and explain concepts of different data models
- CO2** : Describe the features of Entity Relationship diagram and draw Entity Relationship diagram for the given real world application
- CO3** : Formulate database solution for given real world application using SQL and relational algebra expressions
- CO4** : Given a database design with set of Functional dependency, analyze the design using functional dependency theory and reconstruct the design using normalization.
- CO5** : Demonstrate various storage techniques, transaction concepts and various concurrency control mechanisms

### INTRODUCTION

Purpose of DBMS - Applications - Views of data - Data Abstraction - Instances and Schemas - Data Models - Database Languages - Relational Databases - Database Architecture - Database users and administrators - History of Database systems. Entity- Relationship (E-R) Model: Basic concepts - Constraints - E-R Diagram - Weak Entity Sets - Reduction of Relational schemas. BigData - Introduction. (9)

### RELATIONAL MODEL

Structure of Relational Databases - Relational Algebra Fundamentals - Codd's Rule- Additional and extended relational algebra operations - Null values - Modification of Database. SQL: Basic Structure - Set operations - Aggregate functions - Nested Sub queries - Complex queries - Views - Modification of the database - Integrity constraints - Referential Integrity - Triggers - Assertions - Embedded SQL. (10)

### DATABASE DESIGN

Features of good relational design - Atomic domains and First Normal Form - Decomposition using Functional Dependencies - Functional Dependency theory - Normalization using Functional Dependencies - Decomposition using Multi-valued Dependencies. (7)

### STORAGE

Data Capturing Technique: Bar code - QR code. RAID, Indexing and Hashing: Basic concepts, Ordered Indices: Dense and Sparse Indices - Multi Level Indices - Index Update. B+-Tree Index Files: Structure of a B+-Tree - Queries in B+-Trees. Static Hashing, Dynamic Hashing. (8)

### TRANSACTION MANAGEMENT

Transaction Concepts and States - Concurrent Executions - Serializability. Concurrency control: Lock Based Protocols: Locks, Granting of Locks, 2-phase locking protocol - Timestamp Based Protocols - Validation based protocols - Deadlock Handling. Recovery Systems: Failure classification - Log based Recovery - Recovery with concurrent Transactions. (11)

**TOTAL : 45**

### TEXT BOOK

1. Abraham Silberschatz, Henry F.Korth,S.Sudharshan,"Database System Concepts", McGraw-Hill, Sixth Edition, 2013.

### REFERENCE BOOKS

1. Ramez Elmasri, Shamkant B. Navathe, "Fundamentals of Database Systems", Pearson Education, Sixth Edition, 2013.
2. Raghuram Ramakrishnan, Johannes Gehrke, "Database Management Systems", McGraw Hill Education, Third Edition, 2014.
3. Peter Rob, Corlos M. Coronel, "Database Systems: Design, Implementation and Management," Thompson Learning Course Technology, Tenth edition, 2012.
4. Thomas M. Connolly and Carolyn E. Begg, "A Practical Approach to Design, Implementation and Management", Pearson, 6th Edition, 2014.

# 15CI08 - DATA COMMUNICATIONS

L	T	P	C
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## ASSESSMENT : THEORY

### COURSE OUTCOME

- CO1 : Summarize different analog and digital transmission techniques.*
- CO2 : Discuss the types of Multiplexing and switching techniques for Data Communication.*
- CO3 : Apply various error detection and correction mechanisms to maintain data accuracy.*
- CO4 : Describe the various technologies used in wired networks with their applications.*
- CO5 : Explain the different generations of cellular networks and various Satellite Communications.*

### ANALOG AND DIGITAL TRANSMISSION

Overview of analog and digital signals - Transmission impairments - Data Rate Limits - Performance - Digital coding Schemes: Line Coding, Block Coding. Modulation Schemes: Pulse-code modulation, Delta modulation, Amplitude-shift keying modulation, Frequency-shift keying, Phase-shift keying modulation, Quadrature amplitude modulation, Amplitude modulation, frequency modulation, Phase modulation. (12)

### BANDWIDTH UTILIZATION AND SWITCHING

Multiplexing: Frequency-Division, Wavelength-Division, Time-Division Multiplexing - Spread Spectrum: Frequency Hopping Spread spectrum, direct sequence Spread spectrum. Transmission Media: Guided, Unguided Media - Switching: Circuit Switching, Packet Switching - Space division switches, Time division switches. (8)

### ERROR DETECTION AND CORRECTION

Types of Errors - Block Coding: Hamming distance, Parity Check code - Cyclic Codes: Cyclic Redundancy Check - Checksum: One's Complement addition - Forward Error Correction. (9)

### WIRED COMMUNICATION

Telephone Networks: Components, LATAs, Signaling, SS7, Dial-up Service, Digital Subscriber Line - Cable TV Networks - SONET: Architecture, STS-1 Frame Format - ATM: Architecture, Cell format. (9)

### WIRELESS COMMUNICATION

Cellular Telephony: Operations, First generation (1G): AMPS-Second generation (2G): GSM, IS-95-Third generation (3G): IMT-2000-Introduction to 4G - Satellite Communications: Operations, GEO, MEO, LEO Satellite Systems. (7)

**TOTAL : 45**

### TEXT BOOK

1. Behrouz A Forouzan, "Data Communication & Networks", McGraw Hill, 5th Edition, 2013.

### REFERENCE BOOKS

1. William Stallings, "Data & Computer Communications", Pearson Education, 8th edition, 2013.
2. Wayne Tomasi, "Introduction to Data Communications and Networking", Pearson, 1st edition, 2009.

# 15IT03 - MICROPROCESSORS AND MICROCONTROLLERS

L	T	P	C
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## ASSESSMENT : THEORY

### COURSE OUTCOME

- C01** : Describe the internal architecture of a processor  
**C02** : Write assembly language programs and analyze their performance  
**C03** : Describe the interface for peripheral devices to microprocessor  
**C04** : Describe the process involved in developing microprocessor based systems

### 8085 MICROPROCESSOR

Architecture - Instruction set - Timing diagram- Programming examples: Looping -Counting - 16 bit arithmetic - Time delays - Stack and Subroutines - code conversion - BCD arithmetic. (10)

### SUPPORTING IC'S

Internal architecture, modes of operation and usage of 8255 Programmable Peripheral Interface, 8259 Programmable Interrupt Controller, 8253 Programmable Interval Timer / Counter, 8251 Universal Synchronous / Asynchronous Receiver / Transmitter. (9)

### INTERFACING

Basic interfacing concepts - Interfacing memory - Memory mapped I/O - Isolated I/O - 8085 interrupts - Interfacing applications: ADC & DAC interface, Traffic light control, Temperature control, and Stepper motor control using 8255 - Bus standards - RS 232C - USB. (8)

### PENTIUM MICROPROCESSOR

Superscalar architecture - Registers - Instruction Types - Addressing Modes-Pipelining- Branch Prediction - Floating Point Unit - Real mode-Protected mode- - Protection- Multitasking - Exception and Interrupts-Virtual 8086 mode. (9)

### MICROCONTROLLERS

Basic Principle - Advantages over microprocessors - 8051 architecture - Internal RAM - registers - I/O ports - Interrupt system - Memory map - developing microprocessor based systems - Design process - Development systems - Logic analyzer - In circuit Emulators - Troubleshooting and testing. (9)

**TOTAL : 45**

### TEXT BOOKS

1. Ramesh S. Gaonkar, "Microprocessor Architecture Programming and Applications with the 8085/8080A", Penram International Publications, Fifth edition, 2002.
2. James L.Antonakos "The Intel Microprocessor Family: Hardware and Software Principles and Applications", Cengage Learning India -Pvt Ltd, 2010.( For Pentium Microprocessor)
3. Gilmore, "Microprocessors- Principles and Applications", Tata McGraw-Hill, Second Edition, 2000.(For Microcontrollers)

### REFERENCE BOOKS

1. Douglas V Hall, "Microprocessors and Interfacing", McGraw-Hill, Revised Second Edition, 2006.
2. Barry B. Brey "Intel Microprocessors 8086/88, 80186/80286,80486, Pentium and Pentium Pro Processor, PII, P4-Architecture, Programming & Interfacing", Prentice Hall of India, Eighth Edition, 2009.

## 15CI09 - DATA STRUCTURES AND ALGORITHMS LABORATORY

L	T	P	C
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ASSESSMENT : PRACTICAL

### *COURSE OUTCOME*

*C01* : Selection and application of suitable data structures in implementing practical problems.

*C02* : Apply searching and sorting algorithms that suit the given problem statement.

*C03* : Identify suitable graph based algorithms and apply them for solving problems that arise in real world scenarios.

### EXPERIMENTS USING THE FOLLOWING CONCEPTS

1. Operations on Stacks, Queues, Linked lists.
2. Applications using Stacks and Queues.
3. Polynomial operations using Linked List.
4. Trees - Binary Tree traversals, Binary Search Tree operations.
5. Traversals on Graphs.
6. Implementation of Shortest path Algorithms -Single Source, All pairs shortest path.
7. Applying suitable searching and internal sorting algorithms for given applications.

## 15CI10 - DATABASE MANAGEMENT SYSTEMS LABORATORY

L	T	P	C
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### ASSESSMENT : PRACTICAL

#### *COURSE OUTCOME*

**CO1** : Practice various DDL, DML, TCL commands to perform various database operations for the given applications.

**CO2** : Demonstrate open database connectivity by establishing connections between front end and databases.

**CO3** : Experiment various PL/SQL features such as procedures, functions, triggers and report generation.

#### EXPERIMENT USING THE FOLLOWING CONCEPTS

1. Database Creation, Insertion and Deletion.
2. Queries based on DML commands.
3. Aggregate Functions.
4. Sub-Queries and Joins.
5. Group by clause and DATE functions.
6. Views and Triggers.
7. PL/SQL Procedures.
8. Using Cursors and Functions in PL/SQL blocks.
9. ODBC Connectivity.

# 15IT04 - MICROPROCESSORS AND MICROCONTROLLERS LABORATORY

L	T	P	C
0	0	2	1

## ASSESSMENT : PRACTICAL

### *COURSE OUTCOME*

*C01 : Develop assembly language programs and analyze their performance.*

*C02 : Implement the interfaces for peripheral devices to microprocessors.*

### EXPERIMENTS USING THE FOLLOWING CONCEPTS

#### ASSEMBLY LANGUAGE PROGRAMMING (8085, 8051)

1. Code conversion from one base to another
2. Multiplication/division
3. Sorting /Searching
4. Arithmetic Expression Evaluation
5. Matrix Operation
6. Simulation of Digital Clock
7. Bit Addressable Memory
8. Power Management

#### INTERFACING

1. Matrix keyboard interface
2. Seven segment display interface
3. ADC & DAC interface
4. Stepper motor & DC motor interface
5. Elevator interface
6. Interrupts handling using 8259

# 15CI11 - COMPUTER NETWORKS

L	T	P	C
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## ASSESSMENT : THEORY

### COURSE OUTCOME

- CO1** : Describe the layered architecture of computer networks, factors influencing the performance of networks and discuss the various flow control mechanisms.
- CO2** : Discuss IP address range for subnets and routing protocols used in computer networks.
- CO3** : Demonstrate the working of IP, TCP and UDP protocols.
- CO4** : Discuss the services of application protocols and develop applications for client server model using socket functions

### NETWORK ARCHITECTURE

Layering and Protocols -OSI model-Internet Architecture - Performance: Bandwidth and Latency, Delay x Bandwidth product, Throughput-Framing: PPP, HDLC- Reliable Transmission: Stop-and-wait, Sliding Window protocol-Ethernet - Wi-Fi. (9)

### INTERNETWORKING

Switching and Bridging: Datagrams, Virtual circuit switching, Source routing, Bridges and LAN switches. Internet protocol (IP): IPv4, Global address, Datagram forwarding in IP, Sub netting and Classless addressing-ARP-DHCP-ICMP. Routing Protocols: RIP,OSPF,BGP-Multicast Routing: Distance vector multicast routing protocol(DVMRP),Protocol independent multicast(PIM),Inter domain multicast(MSDP)-MPLS-VPN and Tunnels-IPv6. (12)

### END-TO-END PROTOCOLS

UDP- TCP: Connection establishment and Termination, Triggering retransmission, Adaptive retransmission. TCP Congestion Control: Additive increase/Multiplicative decrease, Slow start, Fast retransmit and Fast recovery-Congestion Avoidance Mechanisms: DECbit, Random early detection (RED), Source based congestion avoidance.

QoS: RSVP, Differentiated services (EF, AF). (10)

### APPLICATIONS

E-Mail-Domain Name Service (DNS): Domain hierarchy, Name servers, Name resolution-Network Management (SNMP). Multimedia Applications: RTP, Session control and call control (SIP, SDP). (6)

### SOCKET PROGRAMMING

Socket address structure- Byte ordering functions-Elementary TCP socket functions - Concurrent servers - Elementary UDP socket functions - Name and address conversions - Day time client/ server - echo client/ server. (8)

**TOTAL : 45**

### TEXT BOOKS

1. Larry L.Peterson and Bruce S.Davie, "Computer Networks: A Systems Approach", Morgan Kaufmann Publishers., San Francisco, Fifth Edition, 2011
2. W.Richardstevens, Bill finner, Andrew M Rudoff, "UNIX Network Programming, the sockets Networking API", Vol 1, Pearson Education Asia, Third edition, 2004. (Socket Programming only).

### REFERENCE BOOKS

1. William Stallings, "Data & Computer Communications", Pearson Education, Tenth Edition, 2014.
2. Behrouz A Forouzan, "Data Communication & Networks", McGraw Hill, Fifth Edition, 2013.

# 15CI12 - UNIX INTERNALS

L	T	P	C
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## ASSESSMENT : THEORY

### COURSE OUTCOME

- CO1** : Outline the architecture of UNIX Operating System and the internal operations of file system and process management.
- CO2** : Discuss Allocation of Disk Blocks and Manipulation of inode for process and File Management.
- CO3** : Examine Process Scheduling and memory management strategies on Unix Operating System.
- CO4** : Summarize the working Methodology of various IPC Mechanisms and device driver Interfaces.

### INTRODUCTION TO KERNEL

Architecture of UNIX operating system - Introduction to system concepts - Kernel data structures. The Buffer Cache: Buffer headers - Structure of Buffer pool - Scenarios for retrieval of a buffer - Reading and writing disk blocks - Advantages and disadvantages of Buffer Cache. (9)

### INTERNAL REPRESENTATION OF FILES

Inodes - Structure of regular file - Directories - Conversion of pathname to an inode - Super block - Inode assignment to a new file - Allocation of disk blocks - Overview of System Calls for the file system. (9)

### STRUCTURE OF PROCESSES

Process States and Transitions - Layout of System Memory - The Context of a Process - Saving the Context of a Process - Manipulation of the Process Address Space - Sleep - Process Control. (9)

### PROCESS SCHEDULING AND MEMORY MANAGEMENT POLICIES

Process Scheduling: Algorithm - Scheduling parameters - examples of Process Scheduling - Controlling Process priorities - Fair Share Scheduler. Memory Management Policies: Swapping - Demand Paging - A Hybrid system with Swapping and Demand Paging. (9)

### I/O SUB SYSTEM AND INTERPROCESS COMMUNICATION

Driver Interfaces - Disk Drivers - Terminal Drivers - Streams. Inter Process Communication: Process tracing - System V IPC - Network communication - Sockets. Case Study: Comparison of UNIX and LINUX. (9)

**TOTAL : 45**

### TEXT BOOK

1. Maurice J Bach, "The Design of Unix Operating System ", Pearson Education, First Edition Revised, 2015.

### REFERENCE BOOKS

1. Uresh Vahalia, "Unix Internals: The New frontiers", Pearson Education, Second Edition, 2010.
2. Robert Love, "Linux Kernel Development - Developer's Library", Third Edition, Pearson Education, 2010.
3. John Strang, Jerry Peek, Grace Todino, "Learning the UNIX OS", O'Reily, Fifth Edition, 2002.
4. Remy Card, Eric Dumas, Franck Mevel, "The Linux Kernel Book", Wiley India, First Edition 2013.



# 15CI13 - SOFTWARE ENGINEERING

L	T	P	C
3	0	0	3

## ASSESSMENT : THEORY

### COURSE OUTCOME

- CO1** : Describe the various software life cycle models and choose an appropriate model for a given application.
- CO2** : Identify the functional requirements, apply data flow, ER diagrams and prepare Software Requirement Specifications
- CO3** : Employ architectural styles, software design methodologies, coding standards in developing practical applications
- CO4** : Identify suitable testing techniques and design test cases for the software modules.
- CO5** : Estimate effort, prepare project schedules and Plans, monitor and Control project activities.

### INTRODUCTION

The Software Engineering Discipline-Software Development Projects - Software Life Cycle Models: Use of Life Cycle Models - Classical Waterfall Model - Iterative Waterfall Model-Prototype model - Evolutionary Model - Spiral Model - Extreme Programming and Agile Processes. (8)

### SOFTWARE REQUIREMENTS ANALYSIS AND SPECIFICATION

Value of a good SRS - Requirement process - Requirements Specification-desirable characteristics of an SRS - Components-Structure of a requirements document - Functional specification with use cases - Other Approaches for Analysis-Data flow diagrams-Entity Relationship diagrams-Validation. (8)

### SOFTWARE ARCHITECTURE

Software Architecture: Role of Software Architecture - Architecture Views -Component and Connector View - Architecture Styles for C & C View : Pipe & Filter, Shared Data and Client Server styles. (7)

### DESIGN AND CODING

Design: Design concepts - Coupling - Cohesion - Open-closed Principle - Function Oriented Design : Structure Charts - Structured Design Methodology.

Object Oriented Design : OO Concepts - Unified Modeling Language - Class Diagram- Sequence - Collaboration diagrams - Design Methodology.

Detailed Design : Logic/Algorithm Design - State Modeling of Classes.

Coding : Programming principles and guidelines - Structured programming - Information hiding - some programming practices - coding standards - Code inspection - Planning-self review - group review meeting. (10)

### TESTING

Testing-Basic concepts and Terminologies - Reasons for designing test cases-Unit testing-Driver and Stub modules-Black Box Testing: Equivalence class partitioning, Boundary Value Analysis-White box Testing: Basic Concepts, Statement Coverage, Branch Coverage, Condition Coverage, Path Coverage, McCabe's Cyclomatic Complexity Metric-Integration Testing-Phased versus Incremental Integration Testing - System Testing. (8)

### PROJECT PLANNING

Project Planning-Metrics for Project Size Estimation-Lines of code-Function Points, Use case points -Scheduling-Work breakdown Structure (WBS)-Gantt charts-Risk Management-Risk Identification-Risk Assessment-Risk containment.

Software Configuration Management- Necessity of software configuration Management-configuration Management activities - Source code control system and RCS. (4)

**TOTAL : 45**

## **TEXT BOOKS**

1. Pankaj Jalote, *"Software Engineering A precise Approach"*, Wiley India, 2012, Reprint
2. Rajib Mall, *"Fundamentals of Software Engineering"*, PHI Learning Private Limited, Third Edition 2013. (Introduction, Testing, Project Planning)

## **REFERENCE BOOKS**

1. Roger.S.Pressman, *"Software Engineering A Practitioner's Approach"*, McGraw Hill International Edition, Seventh Edition, 2014.
2. Ian Sommerville, *"Software Engineering"*, Dorling Kindersley (India) Private Ltd, Eighth Edition, 2008.
3. Chandramouli Subramanian, Chandramouli Seetharaman, *"Software Engineering"*, Pearson India Education Services Private Limited, First Edition, 2015.

# 15CI14 - RESOURCE MANAGEMENT TECHNIQUES

L	T	P	C
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## ASSESSMENT : THEORY

### COURSE OUTCOME

- CO1** : Describe optimization problems using Linear and dynamic programming, queuing theory and scheduling.
- CO2** : Apply the knowledge gained on simulation, queuing theory and scheduling methods to provide optimum solution for common business problems.
- CO3** : Determine the replacement policies for better replacement of resources at right time.

### LINEAR PROGRAMMING

Linear inequalities - Feasible solutions - Equality principles - Simplex algorithm and its variants: Artificial Variables Techniques, Duality in LPP-Primal - Dual relationship - transportation and assignment problems-Integer Programming: Gomory's cutting plane methods. (10)

### INVENTORY

Functions of inventories - Costs associated with inventory - Elementary inventory models - Price break model - Economic order quantities - Safety stocks. (6)

### QUEUING THEORY AND SIMULATION

Poisson arrivals - Exponential service times - Basic equations - Single channel model: (M/M/1): (?/FCFS), (M/M/1) : (N/FCFS), Simulation: Monte - Carlo technique, use of random numbers. (7)

### PERT/CPM

Critical Path Methods (CPM) - Program evaluation and review techniques (PERT) -Time - Cost analysis - Crashing (6)

### DYNAMIC PROGRAMMING

Characteristic features, functions, equations - Analysis - Computational procedures for solution - Stage Coach problem, Cargo loading problem, Resource allocation problem. (8)

### REPLACEMENT MODELS

Individual replacement Policy: Basic concept Money Value, Present Worth Factor (PWF) and Discount Rate, Group replacement policy. (8)

**TOTAL : 75**

## TEXT BOOK

1. Dharani Venkatakrishnan, "Operations Research -Principles and Problems", Keerthi Publication, First Edition, 2005.

## REFERENCE BOOKS

1. Hamdy A.Taha, "Operations Research: An Introduction", Pearson Education, Ninth Edition 2011.
2. Operations Research - Kandiswarup, P. K. Gupta, Man Mohan, S. Chand & Sons Education Publications, New Delhi, Fifteenth Edition, 2010.
3. Sasieni, Yaspan and Friedman, "Operation Research - Methods and Problems", Literary Licensing, LLC,First Edition, 2013.
4. F.S. Hillier and G.J. Lieberman: Introduction to Operations Research- Concepts and Cases, Ninth Edition, Tata McGraw Hill, 2010.

# 15IT05 - DISTRIBUTED SYSTEMS

L	T	P	C
3	0	0	3

## ASSESSMENT : THEORY

### COURSE OUTCOME

- CO1** : Discuss the challenges and issues in applying various distributed system models in real time applications.
- CO2** : Demonstrate interprocess communication using Remote Method Invocation and Remote Procedure Call
- CO3** : Describe the architecture and security provided by OS layer to support distributed Systems
- CO4** : Identify the design issues related to naming services, synchronization and use Synchronization algorithms in various distributed system scenarios.
- CO5** : Classify various consistency models and describe the approaches to achieve fault tolerance in distributed environment.

## INTRODUCTION

Characterization of Distributed Systems - Examples - Resource Sharing - Challenges Web - System Models - Architectural and Fundamental Models. (9)

## PROCESSES AND DISTRIBUTED OBJECTS

Interprocess Communication - The API for the Internet Protocols - External Data Representation and Marshalling - Client-Server Communication - Group Communication - Distributed Objects and Remote Invocation - Communication Between Distributed Objects - Remote Procedure Call. (9)

## OPERATING SYSTEM SUPPORT AND NAMING SERVICES

The OS Layer - Protection - Processes and Threads - Communication and Invocation - OS Architecture. Distributed File Systems: File Service Architecture-Name Services: Name Services and the domain Name System-Directory Services. (8)

## SYNCHRONISATION AND MUTUAL EXCLUSION

Time and Global States : Clocks, Events and Process States - Synchronizing Physical Clocks - Logical Time And Logical Clocks - Global States. Coordination and Agreement : Distributed Mutual Exclusion - Elections - Multicast Communication -Consensus and related problems. (9)

## CONSISTENCY & REPLICATION

Data-centric consistency models: Continuous consistency- Consistent ordering of operations. Client-centric consistency models: Eventual consistency - Monotonic Reads - Monotonic Writes - Read your writes - Writes Follow Reads. Replica Management: Replica-Server Placement - Content Replication and Placement -Content Distribution. Consistency protocols: Continuous Consistency - Primary-Based Protocols - Replicated-Write Protocols - Cache-Coherence Protocols. (10)

**TOTAL : 45**

## TEXT BOOKS

1. George Coulouris, Jean Dollimore and Tim Kindberg, *Distributed Systems Concepts and Design*, Pearson Education, Fifth Edition, 2012.
2. Andrew S Tanenbaum, Maarten van Steen, *Distributed Systems -Principles and Paradigms*, Pearson Education, Second Edition, 2015. (consistency & replication only)

## REFERENCE BOOKS

1. Ajay. D Kshem Kalyani, Mukesh Singhal, *Distributed computing principles, Algorithms and Systems*, Cambridge University Press, First edition, 2011.
2. Mukesh Singhal, Niranjana G. Shivaratri, *Advanced concepts in Operating Systems*, Tata McGraw Hill, 2011.
3. M.L. Liu, *Disributed computing Principles and Applications*, Pearson Education, 2004.

## 15CI15 - NETWORKS LABORATORY

L	T	P	C
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### ASSESSMENT : PRACTICAL

#### *COURSE OUTCOME*

**CO1** : *Implement different models of servers using Socket functions.*

**CO2** : *Simulate the working of protocols used in different layers of networks.*

#### EXPERIMENTS USING THE FOLLOWING CONCEPTS

1. TCP Socket
2. UDP Socket
3. Concurrent Server
4. Sliding window protocol
5. Error detection and control
6. FTP, TELNET
7. Multicasting
8. Broadcasting
9. Case Study on Software Defined Network (SDN)

# 15CI16 - OPERATING SYSTEMS LABORATORY

L	T	P	C
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## ASSESSMENT : PRACTICAL

### COURSE OUTCOME

**CO1** : Knowledge in using different system and I/O calls, UNIX commands and shell programming

**CO2** : Demonstrate Inter process communication, algorithms for process scheduling, memory management and process synchronization

### EXPERIMENTS USING THE FOLLOWING CONCEPTS

1. System calls - fork, exec, getpid, exit, wait, close, stat, opendir, readdir.
2. I/O system calls -open, read, write and so on.
3. Simulate UNIX commands like ls, grep, etc.
4. Shell programming.
  - Simple functions.
  - Basic tests.
  - Loops.
  - Patterns.
  - Expansions.
  - Substitutions.
5. Process Scheduling- FCFS, SJF, Priority and Round robin.
6. Implementation of Inter process Communication.
7. Synchronization using semaphores.
8. Implementation of memory management schemes -first fit, Best fit, worst fit and page replacement algorithms.

## 15CI17-SOFT SKILLS DEVELOPMENT

L	T	P	C
0	0	2	1

### ASSESSMENT : PRACTICAL

#### COURSE OUTCOME

- CO1** : Specify appropriate responses and construct summary for the given long speeches, news, programmes, discussions, conversation over Television & Radio, TED talks and podcasts.
- CO2** : Demonstrate Project Communication, Documentation and Report writing skills and ability to write job applications..
- CO3** : Specify appropriate responses for the given mock tests(IELTS,TOEFL,GRE).
- CO4** : Set Career goals and formulate strategies by Prioritizing, organizing and scheduling the required tasks
- CO5** : Asses the problem, analyze the approaches of team members and devise solutions to resolve the conflict.

#### LISTENING, SPEAKING AND READING SKILLS

Listening to lectures, discussions, talk shows, news programmes, dialogues from TV/radio/TEDtalk/Podcast.Ice-breakers - Self introduction - Role Play -Debate - Group Discussion: Purpose - Group Behavior - Analyzing Performance. Job Interviews: Identifying Job Openings - Interview Process - Types of Questions - Mock Interviews - Professional Grooming. Reading Comprehension - Speed Reading Necessary for Reading Letters and Files - Vocabulary Development. (7)

#### COMMUNICATION AND DOCUMENTATION SKILLS

Preparing Job Applications - Writing Covering Letter and Résumé - Applying for Jobs Online - Creative Writing. Project Communication: Internal and External Communication-Documentation and Report Writing: Documenting Requirements, Project Plans and Schedules - Reporting Project Status - Audit Reports. (7)

#### ENGLISH FOR NATIONAL AND INTERNATIONAL EXAMINATIONS AND PLACEMENTS

International English Language Testing System (IELTS) - Test of English as a Foreign Language(TOEFL) - Graduate Record Examination (GRE) - Civil Service (Language related) - Verbal Reasoning. (5)

#### GOAL SETTING AND TIME MANAGEMENT

Goal Setting - Immediate, Short Term and Long Term Goals - Smart Goals - Strategies to Achieve Goals - Confidence Building, Self-esteem, Motivation - Time Management -Identifying Time Wasters - Time Management Skills. (5)

#### LEADERSHIP AND TEAM MANAGEMENT

Qualities of a Good Leader - Leadership Styles - Decision Making - Problem Solving - Etiquettes - Email, Professional, Dining & Telephone - Team Building - Team Work - Delegation. (6)

**TOTAL : 30**

#### REFERENCE BOOKS

1. *International English Language Testing System Practice Tests, Cambridge University Press*
2. *Robert M Sherfield and et al. "Developing Soft Skills" Fourth edition, New Delhi: PearsonEducation, 2009.*
3. *Thomas T.Barker,"Writing software documentation:- a task oriented approach", Allyn & bac series of technical communication, Second Edition, Longman Publishers, 2004.*
4. *ArunaKoneru. "Professional Communication". Tata MacGraw Hill Publishing Company Limited. New Delhi, 2008.*
5. *Jones, Leo and Richard Alexander. "New International Business English" Cambridge University Press, First Published 2003 Updated Edition.*
6. *Cornelissen, Joep. "How to Prepare for Group Discussion and Interview". New Delhi: Tata-McGraw-Hill, 2009.*

## WEB SOURCES

1. <http://www.slideshare.net/rohitjsh/presentation-on-group-discussion>
2. [http://www.washington.edu/doi/TeamN/present\\_tips.html](http://www.washington.edu/doi/TeamN/present_tips.html)
3. <http://www.oxforddictionaries.com/words/writing-job-applications>
4. <http://www.kent.ac.uk/careers/cv/coveringletters.htm>
5. [http://www.mindtools.com/pages/article/newCDV\\_34.htm](http://www.mindtools.com/pages/article/newCDV_34.htm)



# 15CI18 - DATA WAREHOUSING AND DATA MINING

L	T	P	C
3	0	0	3

## ASSESSMENT : THEORY

### COURSE OUTCOME

- C01** : Describe the basic concepts, modelling, architectures of data warehouse and sketch different Data warehouse schema for the given real world applications
- C02** : Demonstrate the multidisciplinary fields of data mining and illustrate the techniques for data pre-processing.
- C03** : Find frequent item set and generate association rules for the given transactions and analyze the performance of different association rule mining algorithms.
- C04** : Analyze different types of data using classification and clustering techniques.
- C05** : Discuss mining of various complex data types like text, Web, multimedia, time-series, and spatial data.

### DATA WAREHOUSE

Data Warehouse: Basic concepts - Data Warehouse Modeling: Data Cube and OLAP - Design and Usage - Implementation (6)

### DATA MINING AND DATA PREPROCESSING

Data Mining-On What Kind of Data-Data Mining Functionalities- Data Mining Technologies- Targeted Applications - Major Issues in Data Mining. Data Preprocessing: Major tasks in data preprocessing - Data Cleaning- Data Integration - Data Reduction: Attribute subset selection - Clustering - Data Transformation by normalization (10)

### ASSOCIATION RULES

Definition - Apriori Algorithm-Partitioning Algorithm-Pincer Search -Dynamic Item Set Counting Algorithm-FP Tree Algorithm-Discussion on different Algorithms-Incremental Algorithm-Border Algorithm-Generation of Association Rules (10)

### CLUSTERING AND CLASSIFICATION

Cluster analysis - Types of data -Requirements for cluster analysis - Categorization of major clustering methods - Partitioning - K-Means and K-Medoid algorithm - CLARA - CLARANS - Hierarchical clustering - BIRCH - Density based clustering - DBSCAN - Decision tree induction - Attribute selection measures - Tree Pruning (10)

### MINING COMPLEX TYPES OF DATA

Mining Complex Data Types: Mining sequence data: Time - Series, Symbolic sequences & Biological sequences - Mining graphs and networks - Mining other kinds of data - Other methodologies of data mining (9)

**TOTAL : 45**

### TEXT BOOKS

1. Jiawei Han & Micheline Kamber, "Data Mining-Concepts and Techniques" Morgan Kaufmann Publishers, Third Edition, 2012.
2. Arun K Pujari, "Data Mining Techniques" Universities Press India Ltd., Third Edition, 2012. (Association Rules)

### REFERENCE BOOKS

1. Dunham, "Data Mining- Introductory and Advanced Topics", Pearson Education, New Delhi, First Edition, 2006.
2. Pieter Adriaans, Dolf Zantinge, "Data Mining", Pearson Education, Third Edition, Delhi 2009.
3. Sam Anahory, Dennis Murray, "Data Warehousing in the Real World", Pearson Education, Seventh Indian Reprint New Delhi, 2003.
4. George M. Marakas, "Modern Data Warehousing, Mining, & Visualization Core concepts", Pearson Education, First Edition, 2003
5. Paulraj Ponnaiah, "Data Warehousing Fundamentals", Wiley Publishers, Singapore, First Edition, 2001.

# 15CI19 - CRYPTOGRAPHY AND NETWORK SECURITY

L	T	P	C
3	0	0	3

## ASSESSMENT : THEORY

### COURSE OUTCOME

- CO1** : Apply the symmetric key encryption algorithms to solve the security attacks and threats.
- CO2** : Compute the cipher text from the given plaintext using public key cryptography.
- CO3** : Describe the concepts of key management and authentication techniques.
- CO4** : Select suitable Intrusion detection system and Firewall to prevent intrusion.
- CO5** : Use of hashing and message authentication concepts to generate digital signature and certificates.

### INTRODUCTION

Security Attacks - Security Services - Security Mechanisms - Basics of number theory : Euler's and Fermet's-Modular arithmetic- Euclid Algorithm - Classical Encryption Techniques : Symmetric Cipher Model - Substitution Techniques - Transposition Techniques. Block Cipher : Cipher Principles - Modes of Operation -Data Encryption Standard - Strength of DES. Advanced Encryption Standard: Evaluation criteria for AES. (12)

### PUBLIC KEY CRYPTOGRAPHY

Principles of Public key Cryptosystem - RSA Algorithm. Diffie-Hellman Key Exchange - Elliptic Curve Arithmetic - Elliptic Curve Cryptography- Pseudorandom number generation based on an Asymmetric Cipher. (9)

### AUTHENTICATION AND HASH FUNCTION

Message Authentication Codes -Authentication Requirements - Authentication Functions -Message Digest Algorithm (MD5) - Secure Hash Algorithm-SHA-3 - Digital Signatures-RSA-PSS Digital Signature Algorithm (8)

### KEY MANAGEMENT AND USER AUTHENTICATION

X.509 Certificates- Public-Key Infrastructure- Kerberos - Electronic-Mail Security: PGP-S/MIME - IP Security Policy- Web Security Considerations-Secure Sockets Layer-Transport Layer Security. (8)

### INTRUSION DETECTION SYSTEM

Intruders - Intrusion detection - Password Management - Malicious Software: Viruses and Related Threats - Virus Countermeasures - Distributed DoS attacks. Firewalls: Firewall Design Principles - Trusted Systems. (8)

**TOTAL : 45**

### TEXT BOOKS

1. William Stallings, "Cryptography and Network Security - Principles and Practices", Prentice Hall of India, Seventh Edition, 2017.
2. Behrouz A.Forouzan, Debdeep Mukhopadhyay, "Cryptography and Network Security", Tata McGraw Hill, Second Edition, 2013.

### REFERENCE BOOKS

1. Atul Kahate, "Cryptography and Network Security", Tata McGraw-Hill, Third Edition, 2013.
2. Wade Trappe, Lawrence C.Washington, "Introduction to Cryptography with coding theory", Pearson Education, Second Edition, 2011.
3. Wenbo Mao, "Modern Cryptography-Theory and Practice", Prentice Hall, First Edition2004.
4. Bruce Schneier, "Applied Cryptography", John Wiley and Sons, New York, Second Edition, 2006.

# 15CI20 -WEB TECHNOLOGY

L	T	P	C
3	0	0	3

## ASSESSMENT : THEORY

### COURSE OUTCOME

- CO1** : Identify working model and learn basic web concepts to develop Static and Dynamic web pages.
- CO2** : Demonstrate an ability to use static and dynamic web page design techniques to construct an interactive web pages using Client/Server side technologies.
- CO3** : Demonstrate use of Ruby on Rails framework in developing interactive web applications.
- CO4** : Understand and discuss the concepts in e-business models and e-marketing.

### INTRODUCTION

Basic Web Concepts - Web based Client/Server model -Web Protocols- Working of web browser - Browser & Server Communication - History of HTML / XHTML / HTML5 - HTML5 Structural Elements-Images - HTML5 Form Elements and Attributes - DHTML - CSS3-Selectors-Positioning elements-Colors-Shadows-Gradients-Transitions and Transformations. **(9)**

### XML

Introduction to XML - XML fundamentals - Well formed XML documents - components of XML document - XML tools - XML Namespaces - XML Vocabularies : Document Object Model(DOM) - Simple API for XML(SAX) - Extensible Style Sheet Languages (XSL) - XML database program. **(10)**

### SCRIPTING LANGUAGES

Client Side scripting - Introduction to Java Script - Arrays - Control statements -Events - Cookies - Introduction to CGI Concepts - Server Side Technologies : PERL ; Arrays - Strings - files - Database. **(9)**

### SERVER SIDE TECHNOLOGIES

Java Server Pages : System Architecture -Basic JSP life cycle-JSP elements: Variables and objects - Methods-Implicit objects- Parsing Request Strings-Session Management - Java Servlets : Design-Servlet life cycle- Reading HTTP Request Headers-Writing HTTP Response Headers. Introduction to ASP **(9)**

### WEB BASED APPLICATIONS AND ITS TECHNOLOGIES

Rails: Overview of Rails - Document request - Processing forms - Rails application with databases - Layouts - e-Business Models - e-Marketing - online payments and Security. **(8)**

**TOTAL : 45**

### TEXT BOOKS

1. Deital & Deital, "Internet and World Wide Web-How to Program", Pearson Education Fifth Edition, 2011.
2. Rashim Mogha, Preetham. V.V. "Java Web Services Programming", Wiley Dreamtech, New Delhi, Java 2 Enterprise Edition, 2003. (Server Side Technologies)
3. Robert W.Sebesta, "Programming with World Wide Web", Pearson Education, Eighth Edition, 2015.(Web Based Applications and its Technologies)

## REFERENCE BOOKS

1. Scot Johnson, Keith Ballinger, Davis Howard Chapman, *"Special Edition Using Active Server Pages"*, Prentice Hall of India, paperback 1999.
2. Ravi Kalakota and Andrew B Whinston, *"Frontiers of e-commerce"*, Addison Wesley, Ninth Edition, paperback 1999.
3. Jeffrey C. Jackson, *"Web Technologies: A Computer Science Perspective"*, Pearson Education, Second Edition 2007

# 15IT06 - SOFTWARE TESTING AND QUALITY ASSURANCE

L	T	P	C
3	0	0	3

## ASSESSMENT : THEORY

### COURSE OUTCOME

- CO1** : Describe testing fundamentals, Testing principles, TMM levels and classify the defects
- CO2** : Apply suitable Black box and White Box testing techniques and design Test cases in practice.
- CO3** : Describe Levels of Testing, develop Test Plans, Testing goals & policies and perform reviews for practical applications.
- CO4** : Describe Software Quality attributes and Software Quality Assurance functions and Prepare Software Quality Assurance plans.
- CO5** : Discuss Testing of Web Applications, ISO 9001 Quality Standards and CMM /CMMI Process models.

### INTRODUCTION TO TESTING AND TEST DESIGN STRATEGIES-I

Introduction to Testing as an Engineering Activity: The role of Process in Software Quality, Testing as a Process, Overview of Testing Maturity Model(TMM) - Testing Fundamentals: Basic Definitions, Software Testing Principles, Tester's Role in a Software Development Organization - Defects, Hypothesis and Test: Origins of Defect, Defect Classes, the defect Repository and Test Design.

Strategies and Methods for Test Case Design I: Test Case Design strategies -Black Box Approach to Test Case Design- Random Testing- Equivalence Class Partitioning- Boundary Value Analysis- Other Black Box Test Design Approaches- COTS-Black box Methods and TMM level 2 goals. **(9)**

### TEST DESIGN STRATEGIES-II

Strategies and methods for test case design II: White Box Approach to Test Case Design- Test Adequacy Criteria -Coverage and Control flow graphs - Covering Code Logic- Paths- Additional White Box Test Design Approaches: Data Flow, Loop Testing, Mutation Testing- White Box Testing Methods and the TMM. **(6)**

### LEVELS OF TESTING

Need for levels of testing - Unit Test : Functions, Procedures, Classes, and Methods as Units- Unit Test planning - Designing the Unit Tests - The Class as a Testable Unit and Special Considerations - Test Harness.

Integration test: Goals - Integration strategies for Procedures, Functions and Classes- Designing Integration Tests- Integration test Planning.

System test: Functional testing, Performance testing, Stress Testing, Configuration Testing, Security Testing, Recovery Testing- Regression Testing- Alpha, Beta, Acceptance Testing.

Testing Goals, Policies & Plans: Introductory concepts -Testing/Debugging goals & Policies - Test planning -Test Plan Components- Reporting test results -Role of three critical groups.

Reviews: Types of Reviews-Inspection - walkthroughs - Components of Review plan-Review Check List-Review Metrics.**(13)**

### TESTING WEB APPLICATIONS

Testing Concepts for Web Apps- the Testing Process- Content Testing- User Interface Testing- Component Level Testing- Navigation Testing- Configuration Testing- Security Testing - Performance Testing. **(5)**

### SOFTWARE QUALITY ASSURANCE, STANDARDS AND PROCESS MODELS

Quality Concept - Quality - Software Quality - Garvin's Quality Dimensions - McCall's Quality Factors - software Quality Dilemma - Cost of Quality - Achieving software Quality.

### ISO 9126 Quality factors

Software Quality Assurance: Elements of SQA - SQA tasks, Goals, Attributes & Metrics - Statistical SQA - Software Reliability - SQA Plan and its contents - Software configuration management : Base line - Configuration item - the SCM process.

## Software process Improvements

ISO 9000 standards: Overview of ISO 9001 standard -Various Sections/Elements of ISO 9001 Standards - Capability Maturity Model (CMM) - Levels and KPA's of CMM- CMMI- Continuous Representation - Capability Levels - Staged Representation- Maturity Levels and KPAs.

(12)

TOTAL : 45

## TEXT BOOKS

1. *Ilene Burnstein, "Practical Software Testing", Springer International Edition, 2010, Reprint.*
2. *Roger. S. Pressman "Software Engineering A Practitioner's Approach, 7e", McGraw Hill International Edition, 2014. (Testing Web Applications, Software Quality And Quality Assurance, Quality Standards And Process Models)*

## REFERENCE BOOKS

1. *Yogesh Singh, " Software Testing", Cambridge University Press, 2012.*
2. *Kshirasagar Naik, Priyadhrshini Tripathy, "Software Testing and Quality Assurance", John wiley& sons Inc Publication, 2008.*
3. *Nina S Godbole." Software Quality Assurance-Principles and Practice",Narosa Publishing, Second Edition, 2016.*

## 15CI21 - SOFTWARE ENGINEERING LABORATORY

L	T	P	C
0	0	2	1

### ASSESSMENT : PRACTICAL

#### *COURSE OUTCOME*

*C01 : Identify and analyze the requirements using CASE tools*

*C02 : Develop the design of software using CASE tools*

*C03 : Write Test cases and conduct manual and automated testing of software using testing tools*

*C04 : Estimate project scheduling and tracking using project management tool*

#### EXPERIMENTS USING THE FOLLOWING CONCEPTS

1. Choosing Project Scenario.
2. Requirement Analysis - using Rational Requisite Pro
3. Logical Design - using Rational Rose
4. Testing of Errors and Memory Leaks - Using Rational Purifier
5. Test case Design - using Rational Test Manager
6. Manual Testing and Management - Using Rational Test Manager and Quantifier.
7. Automated Testing - using Rational Robot and QTP
8. Automated Report Generation - using Rational SODA
9. Case Study on Selenium Software Testing Tool.
10. Case Study on Functional tester Quality Manager.

## 15CI22-WEB PROGRAMMING LABORATORY

L	T	P	C
0	0	2	1

### ASSESSMENT : PRACTICAL

#### *COURSE OUTCOME*

*C01 : Demonstrate an ability to develop web pages using CSS, Frames and filters.*

*C02 : Develop dynamic web pages using CGI concepts.*

*C03 : Design an interactive web applications using XML parser (DOM, SAX).*

*C04 : Design and develop E- Commerce Applications.*

#### EXPERIMENTS USING THE FOLLOWING CONCEPTS

1. Simple web page designing.
2. Web page designing using CSS, Frames, Filters etc.,
3. Dynamic web page design using CGI.
4. Case studies like a trading system, a portal system, a reservation system etc., using Server Side Technologies
5. Applications using XML.
6. Case study on E-Commerce.



## 15IT07 - MINI PROJECT

L	T	P	C
0	0	6	3

**ASSESSMENT : PRACTICAL**

### ***COURSE OUTCOME***

- C01*** : *Apply computing algorithms and techniques in designing simple solutions and examine the outcome of real- time projects.*
- C02*** : *Integrate various interdisciplinary areas to enhance domain knowledge.*
- C03*** : *Develop technical skills in providing feasible solutions for real-life problems and enhance technical writing ability.*
- C04*** : *Demonstrate effective communication and collaborative working in peer groups.*

# 15IT08 - INFORMATION CODING TECHNIQUES

L	T	P	C
3	2	0	4

## ASSESSMENT : THEORY

### COURSE OUTCOME

- CO1** : Gain insight on the fundamentals of probability, essential parameters of information theory and employ it in source coding and channel coding techniques to compute various operational parameters.
- CO2** : Determine the final code word by choosing the suitable text compression technique for the given scenario.
- CO3** : To analyze image and video compression techniques and infer about the encoding and decoding of digital data streams and discuss various kinds of speech and audio coders.
- CO4** : Identify and devise error detecting and error correcting capabilities of the code and sketch the syndrome decoding table for the received code word.
- CO5** : Sketch the encoder configurations and decoding procedures and apply the viterbi decoding mechanism for the received sequence to identify the minimum metric so as to find the surviving path.

### FUNDAMENTALS OF INFORMATION THEORY

Uncertainty - Information and Entropy - Information rate - conditional and Joint entropies - Mutual information.

**Source Coding** : Prefix codes - Kraft McMillan Inequality.

**Entropy Coding** : Source Coding Theorem - Shannon - Fano Coding - Static Huffman Coding.

**Channel Coding** : Discrete Memory less Channel - Channel models - Cascaded channels - Channel capacity - Channel coding theorem - Information capacity theorem. (10)

### SOURCE CODING : TEXT, AUDIO AND SPEECH COMPRESSION

**Text Compression** : Dynamic Huffman Coding - Arithmetic coding - Dictionary Techniques: LZ - LZW.

**Speech Compression** : Adaptive Subband coding - Channel Vocoder - Linear Predictive Coder - Code excited Linear Predictive Coder

**Audio compression** : Perceptual coding - MPEG Audio coding -Dolby Audio coders. (10)

### SOURCE CODING: IMAGE AND VIDEO COMPRESSION

**Image and video formats**: GIF, TIFF, SIF, CIF, QCIF.

**Image Compression**: Digitized documents - JPEG

**Video Compression**: Video Compression principles- H.261 - MPEG video standards. (8)

### ERROR CONTROL CODING: BLOCK CODES

Linear Block codes: Introduction to Error Control Coding- Basic Definitions- Matrix description of linear block codes - Decoding of Linear Block codes - Syndrome decoding.

Cyclic codes: Generator polynomial - Parity check polynomial - Encoder of cyclic codes - Calculation of syndrome. (10)

### ERROR CONTROL CODING: CONVOLUTIONAL CODES

Convolution codes: Introduction - Code Tree, Trellis, State diagram - Encoding - Decoding: Feedback decoding, Sequential decoding and Viterbi algorithm. (7)

**TOTAL : 75**

### TEXT BOOKS

1. Ranjan Bose, "Information Theory, Coding and Cryptography", Second Edition, Eighth Reprint, 2010.
2. Fred Halsall, "Multimedia Communications: Applications, Networks, Protocols and Standards", Pearson Education Limited, Fourth impression, 2009. (Source Coding: Text, Audio And Speech Compression, Source Coding: Image And Video Compression only)

## REFERENCE BOOKS

1. Khalid Sayood, *"Introduction to Data Compression", Fourth Edition, Elsevier, 2012.*
2. Thomas M. Cover and Joy A. Thomas, *"Elements of Information Theory", John Wiley & Sons, Second Edition, 2006.*
3. Todd K.Moon, *"Error Correction Coding: Mathematical Methods and algorithms", John Wiley & Sons, First Edition, 2005.*

# 15IT09 - CLOUD AND VIRTUALIZATION

L	T	P	C
3	0	0	3

## ASSESSMENT : THEORY

### COURSE OUTCOME

- CO1** : Recognize the need for cloud computing and state the services and building blocks of cloud computing environments.
- CO2** : Define and classify the virtualization and its techniques.
- CO3** : Illustrate the cloud architecture and discover the requirement in industries.
- CO4** : Analyze the major security challenges and privacy problems in the cloud and virtual environment.

## INTRODUCTION

**Cloud computing at a glance:** Vision of cloud computing - Defining a cloud- Cloud computing reference model- characteristics and benefits -Challenges - Historical Developments: Distributed systems-Virtualization- web 2.0- Service Oriented Computing- Utility -Oriented Computing- Building cloud computing environments. (9)

## VIRTUALIZATION

Introduction-Characteristics of Virtualized Environments-Taxonomy of Virtualization Techniques-Virtualization and Cloud Computing-Pros and Cons of Virtualization - Technology Examples: Xen Para virtualization - VM ware Full virtualization - Microsoft hyper -V (9)

## CLOUD COMPUTING ARCHITECTURE

**Cloud reference model:** Architecture, Infrastructure / Hardware as a service, Platform as a service-Software as a service, Types of cloud: Public clouds, Private clouds, Hybrid Cloud, Community Clouds-Economics of the Cloud-Open Challenges. (9)

## CLOUD PLATFORMS IN INDUSTRY

**Amazon web services:** Compute services- Storage services- Communication services-additional services-Google App Engine: Architecture and core concepts- Application life cycle- cost model-

**Microsoft Azure:** Azure core concepts- SQL Azure- Windows Azure platform appliance. (9)

## SECURITY IN THE CLOUD

Security Overview - Cloud Security Challenges and Risks - Software-as-a-Service Security - Security Governance - Risk Management.

Security Monitoring - Security Architecture Design - Data Security - Application Security - Virtual Machine Security - Identity Management and Access Control - Autonomic Security. (9)

**TOTAL : 45**

## TEXT BOOKS

1. Rajkumar Buyya, Christian Vecchiola, and Thamarai Selvi, "Mastering Cloud Computing", Tata McGraw Hill, 2013.
2. John W.Rittinghouse and James F.Ransome, "Cloud Computing: Implementation, Management, and Security", CRC Press, 2010. (Security In The Cloud only)

## REFERENCE BOOKS

1. Kai Hwang, Geoffrey C Fox, Jack G Dongarra, "Distributed and Cloud Computing, From Parallel Processing to the Internet of Things", Morgan Kaufmann Publishers, 2012.
2. Toby Velte, Anthony Velte, Robert Elsenpeter, "Cloud Computing, A Practical Approach", McGraw-Hill Osborne Media, Reprint 2010.
3. Tom White, "Hadoop: The Definitive Guide", Yahoo Press, Third Edition, 2012.
4. Jim Smith, Ravi Nair, "Virtual Machines: Versatile Platforms for Systems and Processes", Elsevier/Morgan Kaufmann, 2005.

## 15IT10 - CRYPTOGRAPHY LABORATORY

L	T	P	C
0	0	2	1

**ASSESSMENT : PRACTICAL**

### ***COURSE OUTCOME***

***CO1*** : *Design secure application development using various symmetric and asymmetric algorithms.*

***CO2*** : *Design and develop various key Exchange and authentication techniques for trusted applications.*

### **EXPERIMENTS USING THE FOLLOWING CONCEPTS**

1. To study various cryptography techniques.
2. Implement transposition cipher.
3. Implement block cipher algorithm.
4. Simple Application Development Using DES algorithm.
5. Simple Application Development Using AES algorithm.
6. Simple Application Development Using RSA algorithm.
7. Key Exchange using Diffie-Hellman Approach.
8. MD5, SHA.
9. Authentication using Digital Signature Algorithm.
10. Study and Implementation of Wire shark tool to capture packets.

# 15IT11 - CLOUD AND VIRTUALIZATION LABORATORY

L	T	P	C
0	0	2	1

## ASSESSMENT : PRACTICAL

### COURSE OUTCOME

- C01** : Set up a virtualized environment by installing various Hypervisors like VMware, VirtualBox, Xen KVM and perform different types of virtualization(Para, Full and Hybrid)
- C02** : Demonstrate network virtualization using Open source tools.
- C03** : Set up cloud and virtual environments using open source tools and develop cloud based applications.

### EXPERIMENTS USING THE FOLLOWING CONCEPTS

1. Installation of various hypervisors and instantiation of VMs with image file using open source hypervisors such as Virtual Box, VMWare Player, Xen and KVM.
2. Vitalizing Windows Server 2008 with Virtual Box, VMWare, Xen etc.,
3. Client server communication between two virtual machine instances, execution of chat application. (guest to guest, guest to host, guest to neighboring guest)
4. Implementation of full virtualization using VMware VSphere and performs client server communication / VM Migration / SSH Installation /Security Applications/Web Hosting.
5. Implementation of Hybrid virtualization using VMware VSphere and VMware Workstation and perform client server communication / VM Migration / SSH Installation /Security Applications/Web Hosting.
6. Creation of simple network topology using open source network virtualization tools.(like mininet,nmap tool and others)
7. Implementation of simple network protocols using open source network controllers (like Open Daylight,advance IPlookup)
8. Familiarization and usage of the following cloud services with open source cloud tools (like Eucalyptus, Open stack, Open Nebula and others) a) scheduling mechanisms b) load balancing mechanisms c) hashing and encryption mechanisms
9. Implementing applications using Google App Engine.
10. Develop MapReduce application (example-URL Pattern count and others) using Hadoop cluster set up (Single node and multi node).

# 15HSS02 - INDUSTRIAL ECONOMICS AND CORPORATE MANAGEMENT

L	T	P	C
3	0	0	3

## ASSESSMENT : THEORY

### COURSE OUTCOME

- C01** : Given an economic case study or problem analyze the demand and supply and sketch a demand and supply curve
- C02** : For given stock market analysis identify, and devise investment plan,
- C03** : Given an inflation rate of India, analyze and specify the causes and provide the solution to each cause
- C04** : For a job requirement formulate the steps involved in a selection process as a chart and interpret it
- C05** : For a given scenario write the procedure to file a patent for a product in India or abroad
- C06** : Determine the Break even and find out the strength and weakness of the Market Structure.

### ECONOMICS

Definition- Relationship between Economics and Engineering- Demand Analysis and Supply Analysis, Elasticity of Demand and Supply- Cost Of Production- Break-Even Analysis- Pricing Under Perfect Competition, Monopoly and Monopolistic Market. (9)

### INDUSTRIAL FINANCE AND ACCOUNTING

Needs for Finance, Types of Finance- Sources of Finance- Business Cycle and Business Policies- Demand Recession in India- Causes, Indicators and Prevention- Stock Exchange. (9)

### MONEY AND EMPLOYMENT

Estimation of National Income, Methods and Problems- Inflation and Deflation- Unemployment- Money and Changes in Value of Money, Commercial Banks, Central Banking- New Economic Environment- Privatisation, Liberalisation and Globalisation- Importance of Patent Rights. (9)

### HUMAN RESOURCE MANAGEMENT

Principles of Management, Evolution of Management, Development of Managerial Skills- Human Resource Management- Importance- Objectives- Job Analysis- Recruitment- Selection and Placement and Training Development. (9)

### MARKETING AND INSURANCE

Marketing -Definition, Aims, Need for Marketing- Marketing Function- Marketing Management and its Functions- Marketing Versus Selling- Concept of Insurance- Life Insurance, Fire Insurance, Marine Insurance. (9)

**TOTAL : 45**

### TEXT BOOKS

1. P.L.Mehta, "Managerial Economics", S.Chand & Co, 2013 (Economics, Industrial Finance and Accounting)
2. C.D.Balaji, "Business Organization and Management", Margham publication, 2015 (Industrial Finance and Accounting, Human Resource Management and Marketing and Insurance)
3. M.L.Jhingan, "Macro Economic Theory" Vrinda publications (P) Ltd, Twelfth Edition 2012 (Money and Employment)

### REFERENCE BOOKS

1. Prasanna Chandra, "Fundamental of financial management "McGraw Hill Education India Pvt ltd 1990
2. Appannaiah, reddy and shanthi, "Economics for Business" Delhi, 2004
3. V.S.Bagad, "Principles of Management", Technical Publication Pune, 2009
4. Philip Kotler, "Marketing Management", Thirteenth Edition, Pearson Education.
5. R.S.N.Pillai and Bagavathi, "Marketing Management", Sultan Chand & Sons, 2009.

# 15IT12 - SOFTWARE PROJECT MANAGEMENT

L	T	P	C
3	0	0	3

## ASSESSMENT : THEORY

### COURSE OUTCOME

- CO1** : Describe project management knowledge areas, project management tools and techniques and identify suitable process models
- CO2** : Develop project scope, project schedules, perform project monitoring tasks and practice the use of project management tools
- CO3** : Construct work break down structure, perform time estimation and cost management using PERT, CPM and Earned Value methods.
- CO4** : Apply the principles and practices of human resource and communication management in delivering quality products
- CO5** : Identify and analyze project risks, device risk management strategies and apply quality control and quality assurance techniques
- CO6** : Describe the project procurement management process, project implementation and project closure and evaluation activities

## INTRODUCTION TO PROJECT MANAGEMENT

Introduction - Project attributes - Constraints - Project Stakeholders - Project Management knowledge areas - Project management tools and techniques - The Role of the Project Manager - Project Management Profession - PMI, Certification, ethics in Project Management - A systems view of Project Management - Systems Approach - Three sphere model for Systems Management - Understanding Organizations : Four frames of Organization - Organization structure and culture - Project Phases and the Project Life Cycle - Product Life cycles - waterfall - Spiral - prototyping - RAD - Agile models.

Recent Trends affecting Information Technology Management: Globalization - outsourcing - virtual teams and Agile Project Management. (7)

## PROJECT INTEGRATION MANAGEMENT

Strategic Planning and Project Selection - Strategic Planning - Identifying Potential Projects - Methods for selecting Projects - Net Present Value Analysis - Return on Investment - Payback Analysis - Weighted Scoring Model - Balanced Score Card - Developing Project Charter - Developing Project Management Plans - Monitoring and Controlling Project Work - Integrated Change Control - Closing Projects. Project Management Software and Tools: Gantt chart - Slip Chart - Time Line - Use of MS Project. (6)

## PROJECT SCOPE, TIME AND COST MANAGEMENT

**Project scope management** : Scope management plan - Collecting requirements - Defining Scope - Creating the work breakdown structure - WBS Dictionary - Scope Validation and Control.

**Project time management** : Importance of project schedules - Planning Schedule Management - Defining and sequencing Activities - Estimating activity resources and duration - Schedule development: Gantt chart, Critical Path Method (CPM), Critical Chain Scheduling, PERT - Controlling the Schedule.

**Project cost management** : Basic Principles - Planning Cost Management - Cost estimating - Types of cost estimates - cost estimation tools & Techniques - Cost budgeting - Cost control: Earned Value Management, Project Portfolio Management. (9)

## PROJECT HUMAN RESOURCE AND COMMUNICATION MANAGEMENT

**Human Resource Management** : Importance of HR Management - Motivation Theories - Maslow's hierarchy of needs - Herzberg Theory - Developing the Human resource Plan - Project organizational charts - Responsibility Assignment Matrices - Developing the Project Team - Training - Team building - Rewards and Recognition - Tools and techniques for managing project Teams.

**Project Communications Management** : Keys to good Communications - Planning Communications Management - Managing and Improving project Communications. (6)



## RISK AND QUALITY MANAGEMENT

**Project Risk management** : Planning Risk Management - Common sources of risk -Identifying - quantitative risk analysis - qualitative risk analysis - planning risk responses-Controlling risks.

**Project Quality Management** : Importance of quality management - Planning quality management - Performing quality Assurance - Controlling quality - Tools and Techniques for quality control -Six Sigma concepts - cost of quality. (9)

## PROCUREMENT MANAGEMENT

**Project Procurement management** : Importance of project procurement management -Planning Procurement Management - types of contracts -tools and techniques for planning purchases and acquisitions: make or buy analysis - statement of work - Procurement Documents -Source selection criteria - controlling and closing Procurements. (4)

## PROJECT COMPLETION

**Project Implementation** : Introduction - Product release or system Implementation - Direct cutover - Parallel - Phased.

**Project Closure** : Normal - Premature - Perpetual - Failed - Changed Priorities - Project sponsor Acceptance - Final Project Report.

**Project Evaluation** : Individual Performance Review - Team close out Meeting - Project Audit - Evaluation of Projects - Measuring Organizational Value (MOV). (4)

**TOTAL : 45**

## TEXT BOOKS

1. *Kathy Schwalbe, "Information Technology Project Management", Cengage Learning India Private Limited, New Delhi, Seventh Edition, 2014.*
2. *Jack T.Marchewka, "Information Technology Project Management - Providing Measurable Organizational Value", Wiley Publication, Fifth Edition,2015.(Project Completion)*

## REFERENCE BOOKS

1. *Subramaniam Chandramouli, Saikat Dutt "Software Project Management" Pearson Education,First Edition 2015.*
2. *Bob Hughes, Mike Cotterell "Software Project Management", Fifth Edition, Tata McGraw Hill, 2011.*

## 15IT13 - PROJECT AND VIVA - VOCE

L	T	P	C
0	0	16	8

### ASSESSMENT : PRACTICAL

#### *COURSE OUTCOME*

- C01 : Apply algorithm and design techniques in the project and experience their outcome in their own real time project scenario*
- C02 : Develop the management skills to achieve the project goal by working as a team and enhance technical writing skills*
- C03 : Examine mathematical techniques in various fields for solving computer engineering problems.*
- C04 : Working with various interdisciplinary project to extend the teams domain knowledge*
- C05 : Demonstrate the technical skills acquire to provide feasible solution for real-life problems*
- C06 : Effectively communicate and collaboratively work with in peer groups to develop optimized hardware/software solutions.*

# 15CIE01 - GRAPHICS AND MULTIMEDIA SYSTEMS

L	T	P	C
3	0	0	3

## ASSESSMENT : THEORY

### COURSE OUTCOME

- C01** : Demonstrate the working of graphics output primitive algorithms, clipping algorithms and apply two dimensional geometric transformations
- C02** : Illustrate three dimensional object representation, transformations and concepts involved in spline representation.
- C03** : Describe the Multimedia concepts, its architecture and its real world applications.
- C04** : Construct various Multidimensional index structures and identify suitable file format standard for the efficient storage of Multimedia data.
- C05** : Explain various compression techniques for the efficient transmission of Multimedia data.

### GRAPHICS PRIMITIVES, 2D TRANSFORMATION AND VIEWING

Output primitives: points and lines - line drawing algorithms - circle and ellipse drawing algorithms - polygon generating and filling algorithms. 2D Transformations: Basic Transformations - matrix representation - translation - rotation - scaling - general pivot point rotation - general fixed point scaling - general scaling directions - reflection - shear. Viewing: window to view port coordinate transformation - point clipping - Cohen and Sutherland line clipping algorithm - Sutherland and Hodgeman polygon clipping algorithm. (9)

### 3D CONCEPTS, TRANSFORMATION AND VIEWING

3D display methods. 3D object representation: polygon surfaces - curved lines and surfaces - Quadric surfaces - Introduction to Spline Representations - Bezier curves and surfaces. 3D Transformations: Translation - Rotation - Scaling. 3D Viewing: view plane - projections - clipping. (9)

### MULTIMEDIA SYSTEM DESIGN

Elements - Applications - Multimedia system architecture - Evolving technologies for Multimedia system - Defining objects - Multimedia Data Interface standards - Multimedia databases. (9)

### DATA AND FILE FORMAT STANDARDS

Rich Text Format - TIFF- RIFF - MIDI - JPEG DIB - AVI Indeo File Format - MPEG Standards- TWAIN: Objectives - Architecture - New WAVE RIFF file format - PDF File Format.

**Multidimensional Index Structures:** k-d Trees - Point QuadTree - M-X QuadTree - R Trees. (9)

### COMPRESSION AND DECOMPRESSION

The Need for Data Compression - Types - Binary Image Compression Schemes - Color, Gray Scale and Still Video Image Compression -Video Image Compression - Audio Compression. (9)

**TOTAL : 45**

### TEXT BOOKS

1. Donald Hearn and Pauline Baker M., "Computer Graphics", Prentice Hall of India, Second Edition, 2008.
2. Prabhat K Andleigh and Kiran Thakrar, "Multimedia Systems and Design", Prentice Hall of India, Reprint 2007. (Multimedia Systems Design, File Format Standards, Compression only)
3. K.SelcukCandan and Maria Luisa Sapino, "Data Management for Multimedia Retrieval", Cambridge University Press, First Edition, 2010. (Multidimensional Index Structures only)

### REFERENCE BOOKS

1. Steve Harrington, "Computer Graphics - A Programming Approach", McGraw Hill Book Co., Second Edition, 2007.
2. John F.Koegal Buford, "Multimedia System", Pearson Education Limited, Reprint 2008.
3. Ranjan Parekh, "Principles of Multimedia", Tata McGraw Hill, Second Edition, 2013.
4. [http://www.images.adobe.com/content/dam/Adobe/en/devnet/pdf/pdfs/PDF32000\\_2008.pdf](http://www.images.adobe.com/content/dam/Adobe/en/devnet/pdf/pdfs/PDF32000_2008.pdf)(PDF file format)

# 15CIE02 - OPEN SOURCE SYSTEMS

L	T	P	C
3	0	0	3

## ASSESSMENT : THEORY

### COURSE OUTCOME

- C01** : State the various open source Licenses and understand the Linux build systems.
- C02** : Discuss the configuration of Apache web servers and Describe the Basic concepts of Model Driven Architecture.
- C03** : Illustrate the concept of NoSQL Database and to Choose the Appropriate No-SQL Data Base Types
- C04** : Demonstrate ability to learn and use programming language/scripts (such as PHP & Python) to Develop simple applications.

### INTRODUCTION TO OPEN SOURCE TECHNOLOGIES

Introduction to open source software: Overview of Free/Open Source Software - Definition of FOSS & GNU - History of GNU/Linux and the Free Software Movement - Linux Distribution - Advantages of Free Software and GNU/Linux - Free Software Licenses- Understanding build systems - constructing make files and using make, using autoconf and autogen.

Apache Web Server: Introduction - Starting, Stopping and restarting Apache- Configuring - Securing Apache - MDA. (8)

### OPEN SOURCE NON RELATIONAL DATABASES

Why NoSQL - Aggregate Data Models - More Details on Data Models - Distribution Models -Consistency. (10)

### IMPLEMENTATION OF NON RELATIONAL DATABASES

Key Value Databases - Document Databases - Column-Family Stores - Graph Databases - Beyond NoSQL.Case study: Querying on Non relational Databases. (10)

### OPEN SOURCE PROGRAMMING LANGUAGES

PHP: Introduction - Programming in web environment - variables - constants - data types -operators - Statements - Functions - Arrays - OOP - String Manipulation and regular expression - File handling and data storage - PHP and MYSQL database- Debugging and error handling. (9)

### PYTHON

Syntax and Style - Python Objects - Numbers - Sequences - Strings - Lists and Tuples -Dictionaries - Conditionals and Loops - Files - Input and Output - Errors and Exceptions - Functions - Modules - Classes and OOP. (8)

**TOTAL : 45**

### TEXT BOOKS

1. James Lee and Brent Ware, "Open Source Web Development with LAMP: Using Linux, Apache, MySQL, Perl, and PHP", Addison Wesley Publiser, First Edition, 2002. (Introduction to Open Source Technologies, Open Source Programming Languages)
2. Pramod J. Sadalage and Martin Fowler, "NoSQL Distilled A Brief Guide to the Emerging World of Polyglot Persistence", AddisonWesley, Reprint 2013.(Open Source Non Relational Databases, Implementation Of Non Relational Databases)
3. Mark Lutz, "Learning Python", O'Reilly Media Fifth Edition, 2013.(Python)

### REFERENCE BOOKS

1. N. B. Venkateshwartu, "Introduction to Linux: Installation and Programming (Ed)", BS Publishers (An NRCFOSS Publication) Reprint 2014.
2. Steven Holzner," PHP: The Complete Reference", TMH Edition Second Reprint 2007
3. Wesley J.Chun, "Core Python Programming" Prentice Hall, Second Edition, 2007.
4. Stephen J. Mellor and Marc Balces, "Executable UMS: A foundation for MDA", AddisonWesley, First Printing 2002.

# 15CIE03 - DIGITAL IMAGE PROCESSING

L	T	P	C
3	0	0	3

## ASSESSMENT : THEORY

### COURSE OUTCOME

- C01** : Classify the fundamental process of image processing.
- C02** : Apply image transformation in spatial and frequency domain.
- C03** : Evaluate the methodologies for image segmentation, restoration and apply various compression techniques as per the requirement
- C04** : Demonstrate the working of image segmentation algorithms.

### IMAGE FUNDAMENTALS

Introduction to Digital image Processing - Fundamental steps in Image processing -components of Digital Image processing systems. Reading, Storing and Displaying Elements Using MATLAB-Elements of Visual perception - Sampling and Quantization - Basic relationships between pixels (8)

### IMAGE ENHANCEMENT IN THE SPATIAL DOMAIN

Basic intensity transformation functions - Histogram Equalization - Histogram Matching - Gray level transformations and Histogram plotting using MATLAB - Fundamentals of spatial filtering - Smoothing spatial filters - sharpening spatial filters - use of first and second derivatives for enhancement. (9)

### IMAGE ENHANCEMENT IN THE FREQUENCY DOMAIN

**Fourier transforms and frequency domain:** one dimensional Fourier transforms and its inverse - two dimensional DFT and its inverse -Computing and Visualizing 2D DFT using MATLAB- Basics of filtering in the frequency domain - correspondence between filtering in the spatial and frequency domain - fast Fourier transform. Smoothing frequency domain filters: Gaussian low pass filters. Sharpening frequency domain filters: Gaussian high pass filters. (10)

### IMAGE RESTORATION AND COMPRESSION TECHNIQUES

**Image Restoration:** Noise models: spatial frequency properties of noise - Important noise probability Density Functions. **Periodic Noise Reduction:** Band pass filters. Image Compression: Fundamentals: Coding Redundancy- spatial and temporal redundancy - Measuring Image information - Fidelity criteria - image compression models - image compression standards - Run length Coding - Block transform coding - Color image processing : Color fundamentals - Color models (RGB, HSI, CMY & CMYK) (10)

### IMAGE ANALYSIS

**Image segmentation** : Edge linking and boundary detection - Thresholding -Region-based segmentation - use of motion in segmentation. **Image representation and description:** Representation schemes: Border Following - chain codes -Boundary descriptors, Regional descriptors: Simple descriptors - topological descriptors - Texture (8)

**TOTAL : 45**

### TEXT BOOKS

1. Rafael C.Gonzalez, Richard E.Woods, "Digital Image Processing", Pearson, Third Edition, 2014.
2. Rafael C.Gonzalez, Richard E.Woods and Steven L. Eddins, "Digital Image Processing Using MATLAB", Second Edition, Tata McGraw Hill, 2010(Reading, Storing and Displaying Elements Using MATLAB, Computing and Visualizing 2D DFT using MATLAB).

### REFERENCE BOOKS

1. Jahne Bernd, "Digital Image Processing", Springer-Verlag Berlin Heidelberg, Sixth Revised and Extended Edition 2009.
2. Anil K. Jain, "Fundamentals of Digital Image Processing", Pearson Education, New Delhi, First edition, 2015.
3. William. K.Pratt, "Digital Image Processing", John Wiley, New York, Fourth Edition, 2006.

# 15CIE04 - MOBILE COMPUTING

L	T	P	C
3	0	0	3

## ASSESSMENT : THEORY

### COURSE OUTCOME

- C01** : Identify the strength, limitations of mobile networks and discuss the technologies for mobile communication.
- C02** : Describe the basic working principle of Mobile IP and express different scenarios for performing mobile communication.
- C03** : Analyze TCP variations for mobility support and discuss about WAP architecture.
- C04** : Explain different types of data dissemination and synchronization mechanisms for mobile computing.
- C05** : Develop simple android mobile application using development tools.

### INTRODUCTION

Mobile Communication - Mobile Computing - Mobile Computing Architecture - Mobile Devices - Mobile System Networks - Data Dissemination - Mobility Management - Security - Introduction to Cellular Systems - Global System for Mobile Communication - General Packet Radio Services and their architectures. (9)

### MOBILE IP NETWORK LAYER

Mobile IP overview - IP packet delivery - Agent Discovery registration - Tunneling and Encapsulation - Route optimization - Reverse Tunneling - IPv6 - IP Micro Mobility Support - Dynamic Host Configuration Protocol. (9)

### MOBILE TRANSPORT AND APPLICATION LAYER

Mobile TCP - Fast Retransmit / Fast Recovery - Transmission Timeout Freezing - Selective Retransmission - Transaction oriented TCP - TCP over 2.5/3G Wireless Networks. WAP Architecture : Datagram Protocol, Transport Security - Transaction Protocol - Session Protocol - Application Environment-WML - WML Script - Wireless Telephony Application. (9)

### DATA DISSEMINATION AND SYNCHRONIZATION

Data Delivery Mechanisms - Synchronization - Synchronization Software - Synchronization Protocol- SyncML - Synchronized Multimedia Markup Language (SMIL). (9)

### MOBILE APPLICATION DEVELOPMENT

Features of Palm OS, Symbian OS, Android OS: Development framework - Developing application for android - Development tools - Application Lifecycle - Externalizing Resources - Application class - Android activities. (9)

**TOTAL : 45**

### TEXT BOOKS

1. Raj Kamal, "Mobile Computing", Oxford University Press, New Delhi, Second Edition 2014.
2. Jochen Schiller, "Mobile Communications", Pearson Education India, Second Edition, 2008. (Mobile Transport and Application Layer)
3. Reto Meier, "Professional Android 4 Application Development", Wiley India Pvt Ltd, Third, 2012. (Mobile Application Development)

### REFERENCE BOOKS

1. Stojmenovic and Cacute, "HandBook of Wireless Networks and Mobile Computing", Wiley, 2006.
2. Reza Behravanfon, " Mobile Computing Principles: Designing and Developing Mobile Applications with UML & XML ", Cambridge University Press, 2004.

# 15CIE05 - DIGITAL FORENSICS

L	T	P	C
3	0	0	3

## ASSESSMENT : THEORY

### COURSE OUTCOME

- CO1** : Discuss various applications of computer forensics.
- CO2** : Describe the fundamentals of Computer Forensics its related technologies and services.
- CO3** : Demonstrate the skills for collecting digital evidence and analyze using Forensic Analysis techniques.
- CO4** : Illustrate the investigative measures and surveillance tools used in forensics applications.

### INTRODUCTION TO COMPUTER FORENSICS

Computer Forensics - Use of Computer Forensics in Law Enforcement - Assistance to Human Resources/Employment Proceedings - Computer Forensics Services - Benefits of Professional Forensics Methodology - Steps by Computer Forensics Specialists (8)

### COMPUTER FORENSICS TECHNOLOGY, SYSTEMS AND SERVICES

Types of Computer Forensics Technology : Military, Law Enforcement, Business- Spyware and Adware - Encryption Methods and Vulnerabilities- Internet Tracing Methods - Security and Wireless Technologies- Avoiding Pitfalls with Firewalls - Biometric Security Systems.

Types of Computer Forensics Systems: Internet Security - Intrusion Detection -Firewall - Instant Messaging (IM) Security - Net Privacy - Identity Theft - Biometric Security - Homeland Security

Types of Vendor and Computer Forensics Services: Occurrence of Cyber Crime - Cyber Detectives - Computer Forensics Investigative Services (9)

### COMPUTER FORENSICS EVIDENCE

Data recovery: Definition and solution, Evidence collection and data seizure: Collection options - Obstacles - Types of evidence - Rules of evidence - Volatile evidence, Duplication and preservation of digital evidence, Computer image verification and authentication. (9)

### COMPUTER FORENSICS ANALYSIS

Discovery of electronic evidence, E-Discovery, Identification of data, Reconstructing past events, Network forensics scenario, System testing, Damaging computer evidence. (9)

### SURVEILLANCE

The Information Warfare Arsenal of the Future: Weapons of the Future - The Global Positioning System - Snoop, Sniff, and Snuff Tools -IW Weapons of the Future

Surveillance Tools for Information Warfare of the Future :Cyber Surveillance - The Cyber Footprint and Criminal Tracking

**Civilian Casualties** : The Victims and Refugees of Information Warfare :The Destruction of Personal Assets in IWs - Short- and Long-Term Personal Economic Impact on Cyber Citizens - The Violation of Privacy During Information Wars - Monitoring Private Affairs in Cyberspace (10)

**TOTAL : 45**

### TEXT BOOK

1. John R. Vacca, "Computer forensics: Computer Crime Scene Investigation", Charles River Media, Firewall, Second Edition, 2009.

### REFERENCE BOOKS

1. Warren G Kruse II and Jay G Heiser, "Computer Forensics: Incident Response Essentials", Addison Wesley, USA, 2010.
2. Eogen Casey, "Digital Evidence and Computer Crime", Elsevier, USA, 2011.
3. Chad Steel, "Windows Forensics: The Field Guide for Conducting Corporate Computer Investigations" Wiley India, 2006.
4. Cory Altheide & Harlan Carvey, "Digital Forensics with Open Source Tools, First Edition", Elsevier, 2011.



# 15CIE06 - OBJECT ORIENTED ANALYSIS AND DESIGN

L	T	P	C
3	0	0	3

## ASSESSMENT : THEORY

### COURSE OUTCOME

- C01** : Describe the fundamental aspects of Object Models.
- C02** : Identify classes and Objects and establish relationship among objects and classes and objects.
- C03** : Selection and Application of appropriate object oriented design Methodologies in real world applications.
- C04** : Construct Class, Use Case and Interaction Diagrams for software specifications.
- C05** : Illustrate the object-oriented software development process and work flow.

### INTRODUCTION

Complexity : Structure of complex of systems - Inherent complexity of software - attributes of a complex system - Object Model: Evolution of object models - Foundations of Object model - Elements of Object. (7)

### CLASSES AND OBJECTS

Nature of an object- Relationships among objects - Nature of class - Relationship among classes - Interplay of Classes and objects - building quality classes and objects Classification: Importance of Proper Classification - Identifying classes and objects. (9)

### METHODOLOGY AND MODELING

Object Oriented methodologies : Rumbaugh - Booch - Jacobson - Patterns - Frameworks - Unified approach - patterns. (9)

### UNIFIED MODELING LANGUAGE

Diagram Taxonomy- static and dynamic models

**Class diagram** : Notation- Object diagram, Class interface notation, Binary Association notation, Association Rule - Qualifier - Multiplicity - OR Association - Association Class - N-ary association - Aggregation and Composition - Generalization.

**Use case diagram** : Actors-Use Cases-Use case Diagram-Include and Extend Relationships-Generalization.

**Interaction Diagrams** : Sequence Diagrams - Collaboration Diagrams - State chart diagram- Activity diagram

**Implementation diagrams** : Component diagram - Deployment diagram. (11)

### PROCESS

**Macro Process** : Content Dimension - Time Dimension - Milestones and Phases - Iterations

**Micro Process** : The analysis and Design Process - Micro process and levels of abstraction - Defining elements relationships. (9)

**TOTAL : 45**

### TEXT BOOKS

1. Grady Booch, Robert A. Maksimchuk, Michael W. Engle, Bobbi J. Young, JIM Conallen, Kelli A. Houston "Object Oriented Analysis and Design with Applications", Third Edition, Pearson Education Inc., USA, 2007.
2. Ali Bahrami, "Object Oriented System Development", McGraw Hill International Edition, Singapore, Second Reprint, 2008. (Methodology and Modeling only)

### REFERENCE BOOKS

1. Rumbaugh J, Blaha M, Premerlani W, Eddy F and Lorenzen W, "Object Oriented Modeling and Design", Prentice Hall of India/ Pearson Education, New Delhi, 2004.
2. Kendall Scott, Martin Fowler, "UML Distilled : A brief guide to the standard Object modeling Language", Addison Wesley, USA, 2009.
3. AtulKahate, " Object Oriented Analysis and Design ", Tata McGraw-Hill, New Delhi 2007.



# 15CIE07 - BIG DATA ANALYTICS

L	T	P	C
3	0	0	3

## ASSESSMENT : THEORY

### COURSE OUTCOME

- CO1** : Describe the basics of big data analytics and exposure to state-of-the-art data analytic tools and techniques.  
**CO2** : Apply appropriate Map Reduce Logic for solving computational problems.  
**CO3** : Demonstrate Big data tools like HBase, zookeeper, Hive, Scoop to develop Data centric applications.  
**CO4** : Express R Programming Language concepts and apply in Analytical Projects

### BIG DATA

Characteristics- Data in the Warehouse and Hadoop. Use cases: Patterns for Big Data Deployment-IT for IT log analytics-Fraud detection patterns -Social media pattern-Risks, Big Data and the energy sector. (8)

### MAPREDUCE

MapReduce (MR) basics, MR algorithm design, Inverted Indexing for Text Retrieval, Graph algorithms, Limitations of MR. (10)

### HADOOP

Hadoop distributed file system, Hadoop I/O, Developing a Map Reduce application- Setting up Hadoop Cluster- Administering Hadoop. (9)

### PIG AND HBASE

**PIG- HBASE:** Pig Latin, User defined functions, Data processing operators, HBasics, Installation, Clients, Examples, HBase Vs RDBMS. (8)

### R LANGUAGE

**Overview, Programming structures:** Control statements -Operators -Functions -Environment and scope issues -Recursion -Replacement functions, R data structures: Vectors -Matrices and arrays -Lists -Data frames -Classes, Input/output, String manipulations. (10)

**TOTAL : 45**

### TEXT BOOKS

1. Paul Zikopoulos et al, "Understanding Big Data: Analytics for Enterprise Class Hadoop and Streaming Data", McGraw Hill Professional, USA, First Edition, 2012.(Big Data)
2. Jimmy Lin and Chris Dyer, "Data Intensive Text Processing using MapReduce", Morgan and Claypool Publishers, USA, First Edition, 2010.(MapReduce, Hadoop)
3. Tom White, "Hadoop: The Definitive Guide", O`Reilly Publishers, USA, Third Edition,2012.( PIG AND HBASE)
4. Norman Matloff, "The Art of R Programming: A Tour of Statistical Software Design", No Starch Press, USA, First Edition, 2011.(R Language)

### REFERENCES BOOKS

1. Frank J Ohlhorst, "Big Data Analytics: Turning Big Data into Big Money", Wiley and SAS Business Series, First Edition, 2012.
2. Colleen Mccue, "Data Mining and Predictive Analysis: Intelligence Gathering and Crime Analysis", Elsevier, First Edition, 2007.
3. Michael Berthold, David J. Hand, Intelligent Data Analysis, Springer, 2007.
4. Anand Rajaraman and Jeffrey David Ullman, Mining of Massive Datasets, Cambridge University Press, Second Edition, 2012.

# 15CIE08 - AD-HOC NETWORKS

L	T	P	C
3	0	0	3

## ASSESSMENT : THEORY

### COURSE OUTCOME

- CO1** : Recognize the issues involved in designing MAC protocol and describe the different type of MAC protocols in wireless Ad-Hoc Network
- CO2** : Choose appropriate routing protocols for a given networking scenario and demonstrate the routing process with its merits and demerits
- CO3** : Point out the characteristics and compare the qualitative behavior of various multicast routing protocols.
- CO4** : Discuss various transport layer solutions employed in wireless Adhoc networks.
- CO5** : Outline the QoS support and energy management schemes in wireless Adhoc networks.

### MAC PROTOCOLS

Ad Hoc Wireless Networks : Introduction - Issues in Ad Hoc Wireless Networks - Issues in Designing a MAC Protocol for Ad hoc Wireless Networks - Classification of MAC Protocols - Contention-Based: MACAW, - Busy Tone Multiple Access Protocols - Contention-Based with Reservation Mechanisms: Distributed Packet Reservation Multiple Access Protocol - Collision Avoidance Time Allocation Protocol. Contention-Based with Scheduling Mechanisms: Distributed Priority Scheduling - MAC Protocols that Use Directional Antennas. (9)

### ROUTING PROTOCOLS

Issues in Designing a Routing Protocol for Ad hoc Wireless Networks - Classifications of Routing Protocols- Table-Driven Routing Protocols, On-Demand: Dynamic Source Routing - Ad Hoc On Demand Distance Vector Routing Protocol - Location-Aided Routing - Signal Stability based Adaptive Routing Protocol - Hybrid : Core Extraction Distributed Ad Hoc Routing Protocol - Zone Routing Protocol. (9)

### MULTICAST ROUTING

Issues in Designing a Multicast Routing Protocol - Operation of Multicast Routing Protocols - Classification of Multicast Routing Protocols - Tree-Based: Bandwidth efficient Multicast Routing Protocol - Multicast Core Extraction Distributed Ad Hoc Routing - MAODV - Mesh-based: On Demand Multicast Routing Protocol - Core Assisted Mesh Protocol - Multicasting with Quality of Service Guarantees - Application Dependent Multicast Routing. (10)

### TRANSPORT LAYER PROTOCOLS

Issues in Designing a Transport Layer Protocol for Ad Hoc Wireless Networks - Classification of Transport Layer Solutions - TCP over Ad Hoc Wireless Networks (7)

### QUALITY OF SERVICE & ENERGY MANAGEMENT

Issues and challenges in providing QoS in Ad Hoc Wireless Networks - Classifications of QoS Solutions: MAC Layer Solutions: Cluster TDMA - Network Layer Solutions: Ticket Based Protocol-QoS Frameworks for Ad Hoc Wireless Networks: INSIGNIA - INORA - SWAN - Energy Management in Ad Hoc Wireless Networks: Classification - Battery Management Schemes - System Power Management Schemes. (10)

**TOTAL : 45**

### TEXT BOOK

1. C.Siva Ram Murthy, B.S.Manoj, "Ad-Hoc Wireless Networks- Architectures and Protocols", Prentice Hall, First Edition, 2012.

### REFERENCES

1. C.K.Toth, "Ad Hoc Mobile Wireless Networks", Pearson Education, First Edition, 2009.
2. Carlos DE MoraesCordeiro. Dharma Prakash Agrawal, "Ad-Hoc and Sensor Networks -Theory and Applications", World Scientific Publishing Corporation Pvt Ltd, Second Edition, 2011

# 15CIE09 - INFORMATION SECURITY

L	T	P	C
3	0	0	3

## ASSESSMENT : THEORY

### COURSE OUTCOME

- CO1** : Identify and analyze the security threats and attacks and apply device suitable security policies and standards.
- CO2** : Assess the risks and apply suitable risk control strategies
- CO3** : Employ appropriate intrusion detection and prevention systems to ensure information security.
- CO4** : Discuss various national and international laws of information security and its framework.

### INTRODUCTION, NEED, ETHICAL AND PROFESSIONAL ISSUES

Introduction to Information Security - The History of Information Security- Critical Characteristics of Information - NSTISSC Security Model - Components of an Information System - Securing Components - Balancing Information Security and Access - The Systems Development Life Cycle - The Security Systems Development Life Cycle. The Need for Security: Introduction - Business Needs First -Threats -Attacks. Ethics and Information Security - Codes of Ethics and Professional Organizations.

(7)

### RISK MANAGEMENT AND INFORMATION SECURITY

Introduction - An Overview of Risk Management - Risk Identification -Risk Assessment - Risk Control Strategies - Selecting a Risk Control Strategy - Risk Management Discussion Points - Documenting Results - Recommended Practices in Controlling Risk.

(6)

### POLICIES, STANDARDS, PRACTICES AND BUSINESS CONTINUITY

Introduction - Information Security Policy, Standards and Practices -The Information Security Blueprint: ISO 17799/BS 7799, ISO 27001and its controls - NIST Security Models - Design of Security Architecture - Security Education, Training and Awareness Program - Continuity Strategies.

(9)

### SECURITY TECHNOLOGY: INTRUSION DETECTION, ACCESS CONTROL, AND SECURITY TOOLS

Introduction - Intrusion Detection and Prevention Systems: IDPS - Terminology, Use of IDPS, Strengths and Limitations of IDPS - Honey Pots, Honey Nets, and Padded Cell Systems - Scanning and Analysis Tools - Access Control Devices - Physical Security - Security and Personnel.

(11)

### BIOMETRIC CONTROLS

Biometrics - Nature of Biometrics Identification/Authentication Techniques - Biometric Techniques - Matching and Enrollment Process in Biometrics - Benefits Over Traditional Authentication Methods.

(4)

### SECURITY OF WIRELESS NETWORKS

Attacks on Wireless Networks: Other Security Risks in Wireless Networks - Management and Mitigations for Wireless Networks Attacks.

(3)

### LAWS AND LEGAL FRAMEWORK

Introduction - Information Security and the Law: The Rising Need -Understanding the Laws for Information Security: A Conceptual Framework - The Indian IT Act - Laws for Intellectual Property Rights (IPR) - Health Insurance Portability and Accountability Act (HIPAA) -Gramm-Leach-Bliley Act (GLBA) - Overview of Sarbanes-Oxley (SOX) - Building Security into Software/System Development Life Cycle.

(5)

**TOTAL : 45**

## TEXT BOOKS

1. *Michael E Whitman and Herbert J Mattord, "Principles of Information Security", Course Technology, New Delhi, Fourth Edition, 2012.*
2. *Nina Godbole, "Information Systems Security-Security Management, Metrics, Frameworks and Best Practices", Wiley India Pvt. Ltd., New Delhi, First Edition, 2009.(Biometric Controls, Security of Wireless Networks, Laws and Legal Framework)*

## REFERENCE BOOKS

1. *Thomas R.Peltier, "Information Security Fundamentals", Auerbach Publications, Second Edition, 2013.*
2. *Micki Krause and Harold F.Tipton, "Information Security Management Handbook", Auerbach Publications, Sixth Edition, 2008.*
3. *Mark Merkow and Jim Breithaupt," Information Security - Principles & Practices", Second Edition, Pearson Education, 2014.*

# 15CIE10 - MACHINE LEARNING

L	T	P	C
3	0	0	3

## ASSESSMENT : THEORY

### COURSE OUTCOME

- CO1** : Describe and give examples of supervised and unsupervised learning methods.
- CO2** : Discuss probability theory, make rational decisions to minimize risk and learn association rules from data.
- CO3** : Illustrate how a function of multiple inputs can be learned from a multivariate sample.
- CO4** : Apply clustering methods to learn the mixture of parameters from data and grouping it.
- CO5** : Use decision trees for classification, regression and describe learning algorithms to build the decision trees.

### INTRODUCTION

Machine Learning - Examples of Machine Learning Applications - Learning Associations - Classification - Regression - Unsupervised Learning - Reinforcement Learning - Supervised Learning: Learning a Class from Examples - Vapnik - Chervonenkis (VC) Dimension - Probably Approximately Correct (PAC) Learning - Noise - Learning Multiple Classes - Regression - Model Selection and Generalization - Dimensions of a Supervised Machine Learning Algorithm. (10)

### BAYESIAN DECISION THEORY

Classification - Losses and Risks - Discriminant Functions - Association Rules - Parametric Methods: Introduction - Maximum Likelihood Estimation - Evaluating an Estimator: Bias and Variance - The Bayes' Estimator - Parametric Classification - Regression (9)

### MULTIVARIATE METHODS

Multivariate Data - Parameter Estimation - Estimation of Missing Values - Multivariate Normal Distribution - Multivariate Classification - Tuning - Complexity - Discrete Features - Multivariate Regression (8)

### CLUSTERING

Mixture Densities - k-Means Clustering - Expectation-Maximization Algorithm - Mixtures of Latent Variable Models - Supervised Learning after Clustering - Hierarchical Clustering - Choosing the Number of Clusters (9)

### DECISION TREES

Univariate Trees - Pruning - Rule Extraction from Trees - Learning Rules from Data - Multivariate Trees - Linear Discrimination : Introduction - Generalizing the Linear Model - Geometry of the Linear Discriminant - Pairwise Separation - Parametric Discrimination Revisited - Gradient Descent - Logistic Discrimination - Discrimination by Regression (9)

**TOTAL : 45**

### TEXT BOOKS

1. *Ethem Alpaydin, "Introduction to Machine Learning", The MIT Press, Third Edition, 2014, ISBN 978-0-262-02818-9.*
2. *Tom Mitchell, "Machine Learning", McGraw-Hill, First Edition, 1997. (Reinforcement Learning, Vapnik - Chervonenkis (VC) Dimension - Probably Approximately Correct (PAC) Learning, Decision Tree Learning, Bayesian Learning)*

### REFERENCE BOOKS

1. *Stephen Marsland, "Machine Learning: An Algorithmic Perspective", Chapman Hall/CRC Second Edition, 2015, ISBN 978-1-4200-6718-7.*
2. *Mehryar Mohri, Afshin Rostamizadeh, Ameet Talwalkar "Foundations of Machine Learning", MIT Press 2012, ISBN 978-0-262-01825-8.*

# 15CIE11 - INTERNET OF THINGS

L	T	P	C
3	0	0	3

## ASSESSMENT : THEORY

### COURSE OUTCOME

- CO1** : Describe the challenges for Smart objects, architecture and paradigms for Internet of things.
- CO2** : Demonstrate knowledge of MAC & routing protocols developed for Low Power and Lossy Networks.
- CO3** : Discuss the concepts and implementation of CoAP.
- CO4** : Assess the different IOT technologies and select suitable solutions for an application.

### SMART OBJECTS

Smart Objects - Challenges for Smart Objects - IP for Smart Objects - IPv6 for Smart Object Networks and the Internet of Things - Security for Smart objects - Web services for Smart Objects - Connectivity models for Smart Object Networks - Hardware and Software - Energy Management - Communication for Smart Objects : IEEE 802.15.4. (12)

### 6LoWPAN

Low Power and Lossy Networks (LLN) - Introduction to 6LoWPAN - 6LoWPAN architecture: simple, extended and ad-hoc networks - 6LoWPAN Format:Functions of 6LoWPAN adaptation layer - addressing- forwarding: route-over and mesh under approaches. (8)

### ROUTING IN LOW POWER AND LOSSY NETWORKS

Mesh-under and route-over solutions - Routing Requirements - Routing metrics - The IPv6 Routing Protocol for LLNs (RPL): Protocol overview - use of destination oriented directed acyclic graphs - DODAG formation - RPL Messages. (9)

### CoAP

Interaction Model - Messages and Request/Response Model - Resource observing - Service discovery - Resource discovery - CORE Link Format (9)

### APPLICATIONS

Smart Cities and Urban automation - Home Automation - Building Automation - Structural Health Monitoring (7)

**TOTAL : 45**

### TEXT BOOKS

1. J.-P. Vasseur, A. Dunkels, "Interconnecting Smart Objects with IP: The Next Internet", Morgan Kaufmann, 2010. (Smart Objects, Routing in Low Power and Lossy Networks, Applications)
2. Z. Shelby, C. Bormann. 6LoWPAN: The Wireless Embedded Internet", Wiley, First Edition,2011. (6LoWPAN)
3. Z. Shelby, K. Hartke,,C. Bormann, "The Constrained Application Protocol (CoAP)", RFC 7252, 2014. (COAP)

# 15CIE12 - INFORMATION STORAGE MANAGEMENT

L	T	P	C
3	0	0	3

## ASSESSMENT : THEORY

### COURSE OUTCOME

- CO1** : Describe Data Centre Infrastructure, various storage technologies and disk performance.
- CO2** : Discuss Intelligent Storage Systems, Analyze and implement RAID solutions.
- CO3** : Analyze Storage Attached Networks and Network Attached Storage technologies and identify suitable solutions for practical applications.
- CO4** : Describe Content Addressed Storage and storage virtualization techniques.
- CO5** : Compare different backup, restoration and replication methods and select suitable Solutions to ensure business continuity

### INTRODUCTION TO STORAGE TECHNOLOGY

Information Storage - Evolution of Storage Technology and Architecture - Data Centre Infrastructure - Key challenges in Managing Information - Information Lifecycle. Storage System Architecture: Component Storage System Environment - Disk Drive Components and Performance - Laws Governing Disk Performance - Logical Components of Host - Application Requirement and Disk performance. (7)

### DATA PROTECTION AND INTELLIGENT STORAGE SYSTEMS

Implementation of RAID - RAID Array Components - RAID levels - RAID Comparison - RAID impact on Disk Performance - Hot Spares - Component of an Intelligent Storage System - High - end Storage Systems - Midrange Storage System. (6)

### DIRECT ATTACHED STORAGE AND SCSI

**Directly Attached Storage and Introduction to SCSI:** Types of DAS - DAS benefits and limitations - Disc Drive Interfaces - Introduction to parallel SCSI - SCSI Command Model (4)

### SAN AND NAS

**Storage Area Networks:** Fibre Channel overview - The SAN and its evolution - Components of SAN - FC Connectivity - Fibre Channel Ports - Fibre Channel Architecture- Zoning - Fibre Channel Login Types - FC Topologies

**Network Attached Storage :** General Purpose Servers vs NAS devices - Benefits of NAS - NAS file I/O- Components of NAS- NAS Implementation - NAS File Sharing Protocols - NAS I/O operations - factors affecting NAS performance and availability. (9)

### IP SAN, CONTENT ADDRESSED STORAGE AND STORAGE VIRTUALIZATION

**IP SAN :** iSCSI- FCIP - Content Addressed Storage: fixed content and archives - types of archives - features and benefits of CAS - CAS Architecture

**Storage Virtualization :** overview- Forms of Virtualization- Storage Virtualization Challenges- Types of storage Virtualization. (10)

### INFORMATION AVAILABILITY AND MONITORING

Introduction to Business Continuity - Information Availability - BC Terminology - Failure Analysis - Backup and Recovery - Backup Purpose - Backup Consideration - Backup - Granularity - Methods - Backup and Restore operations - Local Replication - source and target - uses of local replica - Data Consistency - Local Replication Technologies - Restore and Restart consideration - Creating Multiple replicas - Remote replication - Modes of remote Replication - Remote replication Technology - Network infrastructure. (9)

**TOTAL : 45**

### TEXT BOOK

1. *Emc<sup>2</sup> Corporation, "Information Storage and Management", Wiley, First Edition, 2012.*

### REFERENCE BOOK

1. *Robert Spalding, "Storage Network - The Complete Reference", Tata McGraw Hill, Osborne, First Edition, 2003.*



# 15CIE13 - SOFTWARE METRICS AND MEASUREMENT

L	T	P	C
3	0	0	3

## ASSESSMENT : THEORY

### COURSE OUTCOME

- CO1** : Explain representational theory of measurement, scales and various software metrics.
- CO2** : Classify software measures, design data collection procedures and apply suitable data analysis techniques
- CO3** : Formulate measures for various internal and external product attributes
- CO4** : Develop Product quality metrics, Process quality metrics and Software Maintenance metrics
- CO5** : Describe software reliability problem and reliability models to measure software reliability.

### FUNDAMENTALS OF SOFTWARE MEASUREMENT

**Measurement** : Measurement in software engineering - scope of software metrics.

**Basics of Measurement** : representational theory of measurement-measurement and models- measurement scales and scale types - nominal scale - ordinal scale- interval scale- ratio scale- absolute scale - meaningfulness in measurement. (7)

### GOAL BASED FRAMEWORK AND DATA COLLECTION

Classifying software measures - determining what to measure - software measurement validation. Empirical Investigation - Principles of empirical studies.

**Software metrics data collection** : Defining good data, data collection for incident reports, how to collect data, reliability of data collection procedures.

**Analyzing software measurement data** : Statistical Distributions and hypothesis testing, classical data analysis techniques, examples of simple analysis techniques, overview of statistical tests (10)

### PRODUCT ATTRIBUTES MEASUREMENT

**Measuring internal product attributes** : size - properties of software size - code size - design size - requirements analysis and specification size - functional size measures and estimators.

**Measuring internal product attributes** : structure - Aspects of structural measures - control flow structure of program units - design level attributes.

**Measuring external product attributes** : modeling software quality - measuring aspects of quality - usability measures - security measures. (13)

### QUALITY METRICS

Product quality metrics, In- Process quality metrics - software maintenance metrics.

**In-process metrics for software Testing** : Test Progress S curve, Testing defect arrivals over time, Testing defect backlog over time. (7)

### SOFTWARE RELIABILITY MEASUREMENT

Basics of reliability theory- software reliability problem - parametric reliability growth models: Jelinski - Moranda Model, other models based on Jelinski Moranda, little wood model, little wood-verrall model - the recalibration of software reliability growth predictions. (8)

**TOTAL : 45**

### TEXT BOOKS

1. Norman Fenton and James Bieman, "Software Metrics - A Rigorous & Practical Approach", CRC press, Third Edition, 2014.
2. Stephen H Kan, "Metrics and Models in Software Quality Engineering", Pearson Education, Second Indian Reprint, New Delhi, 2007.( In-process metrics for software Testing)

### REFERENCE BOOKS

1. Capers Jones, "Applied Software Measurement: Global Analysis of Productivity and Quality", McGraw Hill Publishing, Third Edition 2008.
2. International Function Point Users Group "IT Measurement - A Practical Advice from the Experts ", Pearson Education, Asia, 2002.



# 15CIE14 - WIRELESS SENSOR NETWORKS

L	T	P	C
3	0	0	3

## ASSESSMENT : THEORY

### COURSE OUTCOME

- CO1** : Describe the sensor network architecture and its applications.  
**CO2** : Describe the different protocols used in wireless sensor networks and their applications.  
**CO3** : Outline the features of OS and performance models of wireless sensor networks

### INTRODUCTION

Basic sensor network Architecture-Generation of sensor network - challenges - hardware and software components of wireless nodes-operating environment - Applications: Home control, Building Automation, Medical applications. (9)

### MAC PROTOCOLS

Schedule based protocols: Self-organizing MAC for Sensornets (SMACS), Low Energy Adaptive Clustering Hierarchy (LEACH) - Random Access based protocols - Sensor MAC protocol, IEEE 802.15.4 and Zigbee Reference Model - Super frame structure - Frame types - Modes of operation : Contention based channel Access, Beacon less mode. (10)

### ROUTING PROTOCOLS

Data Dissemination and Gathering - Challenges and Design Issues - Flooding - Sensor Protocols for Information via Negotiation (SPIN) - LEACH - Power Efficient Gathering in Sensor Information System (PEGASIS) - Directed Diffusion - Geographical routing. (11)

### TRANSPORT CONTROL PROTOCOLS

Design issues - Congestion Detection and Avoidance (CODA) - Event to Sink Reliable Transport (ESRT) - Reliable Multi Segment Transport (RMST) - Pump Slowly Fetch Quickly (PSFQ) - GARUDA - Ad-hoc Transport Protocol (ATP). (8)

### OPERATING SYSTEM AND PERFORMANCE MODELS

OS Design Issues - Features of Tiny OS, MANTIS - Performance Modeling of WSN : Performance Metrics - Basic Models: Traffic Models - Energy Models - Node model - Network models: MAC model - Routing Model - System Model. (7)

**TOTAL : 45**

### TEXT BOOK

1. Kazem Sohraby, Daniel Minoli, & Taieb Znati, "Wireless Sensor Networks-Technology, Protocols, and Applications", Second Edition, John Wiley, 2011.

### REFERENCE BOOKS

1. Feng Zhao and Leonides Guibas, "Wireless Sensor Networks", Elsevier Publication, First Edition, 2005.
2. Holger Karl and Andreas Willig "Protocols and Architectures for Wireless Sensor Networks", Wiley, First Edition, 2007
3. Anna Hac, "Wireless Sensor Network Designs", John Wiley, First Edition, 2010.
4. Jun Zheng, Abbas Jamalipour, "Wireless Sensor Networks - A Networking Perspective", Wiley India, First Edition, 2014.

# 15CIE15 - SOFT COMPUTING

L	T	P	C
3	0	0	3

## ASSESSMENT : THEORY

### COURSE OUTCOME

- CO1** : Outline the basic concepts of fuzzy sets, neural networks and genetic algorithms  
**CO2** : Demonstrate the applications of supervised and unsupervised learning networks.  
**CO3** : Develop suitable neuro-fuzzy models for solving real world problems.  
**CO4** : Describe the heuristic algorithms and their applications.

### FUZZY SET THEORY

Introduction to Neuro-Fuzzy and Soft Computing - Fuzzy Sets - Basic Definition and Terminology - Set-theoretic Operations - Member Function Formulation and Parameterization - Fuzzy Rules and Fuzzy Reasoning - Extension Principle and Fuzzy Relations - Fuzzy If-Then Rules - Fuzzy Reasoning - Fuzzy Inference Systems - Mamdani Fuzzy Models - Sugeno Fuzzy Models - Tsukamoto Fuzzy Models -Defuzzification strategies. (10)

### SUPERVISED LEARNING NEURAL NETWORKS

Introduction- Single layer and Multi layer Perceptrons- Backpropagation networks - Adaline -Madaline- Radial Basis Function Networks -Modular Networks.Self supervised Learning- Adaptive Resonance Technique. (9)

### UNSUPERVISED LEARNING NEURAL NETWORK

Unsupervised Learning Neural Networks - Competitive Learning Networks - Kohonen Self-Organizing Networks - Learning Vector Quantization - Hebbian Learning -Principal Component Networks - The Hopfield Network. (9)

### NEURO FUZZY MODELING

Adaptive Neuro-Fuzzy Inference Systems - Architecture - Hybrid Learning Algorithm - Learning Methods that Cross-fertilize ANFIS and RBFN - Coactive Neuro Fuzzy Modeling - Framework- Neuron Functions for Adaptive Networks - Neuro Fuzzy Spectrum. (8)

### HEURISTIC ALGORITHMS

Genetic Algorithm-Particle Swarm Optimization- Tabu search-Simulated annealing (9)

**TOTAL : 45**

### TEXT BOOKS

1. Jang J.S.R., Sun C.T., and Mizutani E., "Neuro-Fuzzy and Soft Computing", Pearson Education, First Edition, 2015.
2. Davis E.Goldberg, "Genetic Algorithms: Search, Optimization and Machine Learning", Pearson Education, First Edition, 2008.( Heuristic Algorithms)

### REFERENCE BOOKS

1. Timothy J.Ross, "Fuzzy Logic with Engineering Applications", Wiley, Third Edition, 2011.
2. Laurene Fausett, "Fundamentals of Neural Networks, Architectures, Algorithms and Applications", Pearson Education, First Edition, 2008.
3. Eberhart R., Simpson P., and Dobbins R., "Computational Intelligence - Concepts to Implementations", Morgan Kaufmann, First Edition, 2007.
4. Vijayalakshmi Pai and Rajasekaran, "Neural networks, Fuzzy Logic and Genetic algorithms-Synthesis and Applications", Prentice Hall of India, First Edition, 2006.

# 15CIE16 - SERVICE ORIENTED ARCHITECTURE AND WEB SERVICES

L	T	P	C
3	0	0	3

## ASSESSMENT : THEORY

### COURSE OUTCOME

- CO1** : Describe web browser, Web service frame works and recognize its internal functionalities.
- CO2** : Discuss various SOA delivery strategies, service oriented analysis and modeling guidelines.
- CO3** : Select suitable business process design for structured, unstructured data and security mechanism using xml.
- CO4** : Design and implement business logic for real time systems using advanced web service technologies and standards.
- CO5** : Describe the types of security issues and security attacks related to web services.

### SOA AND WEB SERVICES FUNDAMENTALS

Introduction to SOA: Fundamental SOA - Common characteristics of contemporary SOA - Common misperceptions about SOA - Common tangible benefits of SOA - Common pitfalls of adopting SOA. Evolution of SOA: SOA timeline - Continuing evolution of SOA - The roots of SOA. Web Services and Primitive SOA: The Web services framework - Services (as Web services) - Service descriptions (with WSDL) - Messaging (with SOAP). (9)

### BUILDING SOA (PLANNING & ANALYSIS)

SOA Delivery Strategies: SOA delivery lifecycle phases - The top-down strategy - The bottom-up strategy - The agile strategy. Service Oriented Analysis: Introduction to service oriented analysis - Benefits of business centric SOA - deriving business services - Service modeling - Service modeling guidelines - classifying service model logic - contrasting service modeling approaches. (9)

### BUILDING SOA (TECHNOLOGY & DESIGN)

Service Oriented Design: Introduction to service oriented design - WSDL related XML schema language basics - WSDL language basics - SOAP language basics - service interface design tools - SOA Composition Guidelines: Steps to composing SOA - considerations for choosing service layers - considerations for positioning core SOA standards - considerations for choosing SOA extensions - Service Design - Business Process Design. (9)

### ADVANCED WEB SERVICES TECHNOLOGIES AND STANDARDS

Conversations overview- Web Services Conversation Language(WSCCL)-WSCCL interface components-Relationship between WSCCL and WSDL - Workflow-Business Process Management-Workflows and work flow management system - BPEL-ACID Transactions-Scaling Transactions to web services-Other web services Transaction Protocols. (9)

### SECURITY IN WEB SERVICES

Web service security issues-Types of security attacks and threads-web services security roadmap-WS-security-Quality of service(QoS)Overview -QoS metrics for web services - Holes- Design patterns and best practices- Building QoS into web services and applications-QoS enabled web services -QoS enabled applications. (9)

**TOTAL : 45**

### TEXT BOOKS

1. Thomas Erl, "Service-Oriented Architecture: Concepts, Technology and Design", Prentice Hall of India, Ninth Edition, 2009.
2. Sandeep Chatterjee, "Developing Enterprise Web services, An architect's Guide", Pearson Education, First Edition 2004. (Advanced Web Services Technologies and Standards, Security in Web Services)

### REFERENCE BOOKS

1. Dirk Kraefzig, Karl Banke, Dirk Salma, "Enterprise SOA: Service- Oriented Architecture Best Practices", Pearson Education, First Edition, 2004.
2. Thomas Erl, "SOA Principles of Service Design", Prentice Hall of India, First Edition, 2007.
3. Frank P.Coyle, "XML, Web services and the Data Revolution". Pearson Education, First Edition, 2002.

# 15ITE01 - ENTERPRISE RESOURCE PLANNING

L	T	P	C
3	0	0	3

## ASSESSMENT : THEORY

### COURSE OUTCOME

- CO1** : Describe the operational aspects of ERP system and its related technologies.
- CO2** : Demonstrate the steps required for ERP Project management and implementation process by choosing the right vendors/consultants, employee training and monitoring.
- CO3** : Categorize the business modules of an ERP package in order to define the functionality of various departments in a company.
- CO4** : Analyze the ERP marketplace and its vendors, and assess how Enterprise Application Integration (EAI), e-business help the company use ERP to its utmost benefit.

### INTRODUCTION

Enterprise - An Overview - Introduction to ERP - Benefits Of ERP - ERP and Related Technologies - Business Process Reengineering (BPR) - Data Warehousing - Data Mining -OLAP - SCM. (9)

### ERP IMPLEMENTATION

ERP Implementation Lifecycle - Implementation Methodologies - ERP deployment methods - Package Selection - Process Definition - Vendors and Consultants - Contract with Vendors, Consultants and Employees - Training and education- Project Management and Monitoring. (10)

### THE ERP BUSINESS MODULES

Business modules of an ERP Package - Finance - Manufacturing - Human Resources - Plant Maintenance - Materials Management - Quality Management - Sales and Distribution. (9)

### THE ERP MARKET & ERP - Present and Future

ERP Marketplace and Marketplace Dynamics - ERP Vendors - SAP AG, Oracle Corporation, Microsoft Dynamics, EPICOR, QAD, RAMCO Systems - Enterprise Application Integration (EAI)- ERP and E-Business- Future Directions and Trends in ERP. (9)

### SAP

Gateway to SAP: Architecture of SAP R/3 -SAP Integrated-Three Tier Architecture - SAP Easy Access - Understanding ABAP Workbench (8)

**TOTAL : 45**

### TEXT BOOKS

1. Alexis Leon," ERP Demystified", Tata McGraw Hill, New Delhi, Third Edition, 2014.
2. Dreamtech Press, "SAP R/3, Black Book", Dreamtech Software Team, 2006 (SAP).

### REFERENCE BOOKS

1. Ellen F.Monk, Bret Wagner, "Concepts in Enterprise Resource Planning", Course Technology Ptr, Fourth Edition, 2013.
2. Vinod Kumar Garg and Venkitakrishnan N.K., "Enterprise Resource Planning - Concepts and Practice", Prentice Hall of India, New Delhi, Second Edition, 2012.

## 15ITE02 - BUSINESS INTELLIGENCE

L	T	P	C
3	0	0	3

### ASSESSMENT : THEORY

#### COURSE OUTCOME

- CO1** : Describe the steps and stages involved in Business Intelligence Solutions.
- CO2** : Identify business requirements and develop project management plan for BI Projects.
- CO3** : Identify and apply suitable analytical techniques to design business problems.
- CO4** : Apply the concepts of Data Extraction, Transformation and loading for Data Integration
- CO5** : Describe Balanced Scorecard, Enterprise Dash Board and Enterprise Reporting Techniques

#### INTRODUCTION TO BUSINESS INTELLIGENCE

Business Intelligence Definition- BI Decision Support Initiatives- Development Approaches: Traditional Development Approach, Cross Organizational Development Approach - Engineering Stages and the Development Steps - Parallel Development Tracks - BI Project Team Structure. Business Case Assessment: Business Justification Business Drivers- Business Analysis Issues- Cost-Benefit Analysis- Risk Assessment- Business Case Assessment Activities- Deliverables (9)

#### BI PROJECT PLANNING AND REQUIREMENTS DEFINITION

Project Planning: Managing the BI Project-Defining the BI Project-Planning the BI Project-Project Planning Activities-Deliverables - Roles.

Project Requirements Definition: General Business Requirements- Project Specific Requirements - Project Requirements Definition Activities - Deliverables- Roles (9)

#### DATA ANALYSIS AND APPLICATION PROTOTYPING

Data Analysis: Business Focused Data Analysis - Top-Down Logical Data Modeling- Bottom Up Source Data Analysis- Data Cleansing- Data Analysis Activities

Application Prototyping: Purposes of Prototyping- Best Practices for Prototyping- Types of Prototypes- Building Successful Prototypes- Application Prototyping Activities (8)

#### EXTRACT/TRANSFORM/LOAD DESIGN AND DEVELOPMENT

ETL Design: Implementation Strategies- Preparing for the ETL Process- Designing the Extract Programs - Designing the Transformation Programs- Designing the Load Programs-Designing the ETL Process Flow- Evaluating ETL Tools- ETL Design Activities

ETL Development: Source Data Transformation - Reconciliation- Peer Reviews- ETL Testing- Formal Test Plan ETL Development Activities (10)

#### MEASURES, METRICS, KPIs PERFORMANCE MANAGEMENT AND ENTERPRISE REPORTING IN BI

Understanding Measures and Performance-Terminologies-Attributes of good metrics-SMART test-Supply Chain Associated with metrics-"Fact-Based Decision Making" and KPIs-KPI Usage-Sources of Business Metrics and KPIs-Connecting the Dots: Measures to Business Decisions

Enterprise Reporting Perspectives -Common Report Layout Types-Balanced Scorecard-Dashboard- Balanced Scorecard vs. Dashboard. (9)

**TOTAL : 45**

#### TEXT BOOKS

1. Larissa Terpeluk Moss, S. Atre, "Business Intelligence Roadmap: The Complete Project Lifecycle for Decision-support Applications", Addison-Wesley Professional, 2003.
2. RN Prasad and Seema Acharya , "Fundamentals of Business Analytics", Second Edition, Wiley India, 2016.

#### REFERENCE BOOKS

1. David Loshin, "Business Intelligence", Second Edition, Elsevier Science and Technology, 2012.
2. Mike Biere, "Business Intelligence for the Enterprise", Pearson, 2010.

# 15ITE03 - HUMAN COMPUTER INTERACTION

L	T	P	C
3	0	0	3

## ASSESSMENT : THEORY

### COURSE OUTCOME

- CO1 : Describe the importance and need for effective user friendly Graphical User Interfaces (GUI).
- CO2 : Choose suitable interactions devices/tools to meet application specific Requirements.
- CO3 : Design Graphical User Interfaces(GUI) using apt components and apply the Design guidelines for user-friendly navigation and presentation.
- CO4 : Asses graphical user interfaces for compliance against the screen design guidelines.

### INTRODUCTION

**Importance of User Interface** : Definition-Importance of good design-Benefits of good design-Human-centered development and Evaluation-Human Performance models-A Brief history of screen design. (9)

### THE GRAPHICAL USER INTERFACE&DESIGN PROCESS

**GUI** : Popularity of graphics-The concept of direct manipulation-Graphical system -Characteristics-Web user-Interface Popularity-Characteristics and Principles of User Interface.

**Design process** : Human Interaction with computers- Importance of Human Characteristics- Human Consideration- Human Interaction Speeds and Understanding Business Junctions. (9)

### SCREEN DESIGNING

Design Goals- Screen Planning and Purpose- Organizing Screen Elements- Ordering of Screen Data and Content- Screen Navigation and Flow- Visually Pleasing Composition- Amount of Information- Focus and Emphasis- Presenting Information Simply and Meaningfully- Information retrieval on web- Statistical Analysis- Technological considerations in Interface Design. (11)

### WINDOWS & COMPONENTS

**Windows** : New Navigation Schemes-Selection of Window-Selection of Devices Based on Screen Based Controls.

**Components** : Text and Messages- Icons and Increases - Multimedia-Colors - Uses -Problems-Choosing colors. (9)

### SOFTWARE TOOLS AND INTERACTION DEVICES

Specification Methods- Interface Building Tools- Keyboard and Function Keys- Pointing Devices Speech Recognition. (7)

**TOTAL : 45**

### TEXT BOOKS

1. Wilbert O Galitz, "The Essential Guide to User Interface Design", Third Edition, Wiley India Pvt., Ltd., 2007.
2. Ben Shneidermann, "Designing the User Interface", Fifth edition, Pearson Education Asia, 2013.(Software Tools And Interaction Devices)

### REFERENCE BOOK

1. Alan Dix, Janet Finlay, G D Abowd and Russel Beale, "Human Computer Interaction", Pearson Education, Third Edition,2004.

# 15CS12 - ARTIFICIAL INTELLIGENCE

L	T	P	C
3	0	0	3

## ASSESSMENT : THEORY

### COURSE OUTCOME

- C01** : Illustrate real world problems from the perspective of intelligent agents to achieve problem oriented goal
- C02** : Apply various informed search strategies in optimal decision making
- C03** : Employ first order logic for building knowledge base to infer reasoning using knowledge engineering
- C04** : Express different plans to deal with problems and describe knowledge representation and reasoning of uncertain domain
- C05** : Describe several learning algorithms to improve the performance of intelligent agents

### INTRODUCTION

Foundation of AI-Agents and Environments- Concept of Rationality - Nature of Environments-Structure of Agents-Problem-Solving Agents and examples-Uninformed Search Strategies-Searching with Partial Information. (8)

### SEARCH TECHNIQUES

**Search Strategies** : A\* Search -Heuristic Functions -Local Search Algorithms and Optimization Problems -Constraint Satisfaction Problems -Backtracking Search for CSPs - Local Search for Constraint Satisfaction Problems - Structure of Problems - Games - Optimal Decisions in Games - Alpha-Beta Pruning. (8)

### KNOWLEDGEAND REASONING

Logic -Propositional Logic - Syntax and Semantics of First-Order Logic - Using First-Order Logic - Knowledge Engineering in First-Order Logic - Propositional vs. First-Order Inference - Forward Chaining -Backward Chaining -Resolution (8)

### PLANNING

Definition of classical planning-Algorithms for Planning as State-Space Search - Planning Graphs - Hierarchical Task Network Planning - Planning and Acting in Nondeterministic Domains - Multi agent Planning -Uncertainty : Bayes' Rule and Its Use - Representing Knowledge in an Uncertain Domain : Bayesian Networks - Semantics of - Efficient representation of Conditional distribution - Exact inference in Bayesian networks. (9)

### LEARNING

Forms of Learning - LearningDecision Trees-Artificial Neural Networks-Ensemble Learning-Logical Formulation of Learning-Knowledge in Learning-Explanation-Based Learning -Learning Using Relevance Information -Inductive Logic Programming - Statistical Learning -Learning with Complete Data -EM Algorithm- Passive Reinforcement Learning-Active Reinforcement Learning. (12)

**TOTAL : 45**

### TEXT BOOKS

1. *Stuart J Russell and Peter Norvig, "Artificial Intelligence- A Modern Approach", Pearson Education Series, Third Edition, 2010.*

### REFERENCE BOOKS

1. *Deepak Khemani, "A First Course in Artificial Intelligence", McGraw Hill Education, First Edition, 2013.*
2. *Dan W.Patterson "Introduction to AI and ES", Pearson Education, First Edition, 2007*
3. *Patrick Henry Winston, "Artificial Intelligence", Addison Wesley publishers, Third Edition, 1992.*
4. *Elaine Rich, Kevin Knight and Shivashankar, "Artificial Intelligence", McGraw Hill, Third Edition, 2009*



# 15CS13 - EMBEDDED AND REAL TIME SYSTEMS

L	T	P	C
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## ASSESSMENT : THEORY

### COURSE OUTCOME

- C01** : Analyze Processor's power consumption in various modes and write optimized code for embedded systems development
- C02** : Demonstrate the Scheduling of given set of real-time tasks using the appropriate scheduling algorithms
- C03** : Examine the characteristics of real-time databases and real-time communications
- C04** : Outline embedded software testing process
- C05** : Design and develop simple embedded applications

### INTRODUCTION

Characteristics of Embedded system - Challenges in Embedded System - Embedded System Design Process - Features of 8051, ARM, PIC microcontrollers - CPU Power Consumption. (7)

### DESIGN AND ANALYSIS

Components for embedded programs - Models of programs - Performance analysis and optimization of program size - Power analysis and optimization. (7)

### REAL-TIME OPERATING SYSTEM

Characteristics of Real-Time Systems - Safety and Reliability - Types of Real-Time Tasks - Timing Constraints - Modeling Timing Constraints - Real Time Task Scheduling: Characteristics - Classification - Clock driven scheduling - Event driven scheduling - Hybrid schedulers - Earliest deadline first scheduling - Rate Monotonic Algorithm - Deadline Monotonic Algorithm - Self suspension with Context switching overhead - Handling Resource sharing and Dependencies among Real-time tasks. (12)

### REAL-TIME DATABASES & NETWORKS

Characteristics of Temporal data - Concurrency Control: Locking Based Protocols, Optimistic Concurrency Control protocols - Real-Time Communications: Soft and Hard Real-Time Communication in a LAN - Bounded Access Protocol - Inter-Integrated Circuit bus - Field bus -CAN bus - Systems-on-Chip. (9)

### DEVELOPMENT AND TESTING

Host and target machines - Tool chain for building Embedded software - In-Circuit Emulator - Logic analyzer - Testing: Fault models, Test Pattern Generation - Design for Testability: Scan design, BIST, Boundary scan - IEEE 1149 - Applications: Alarm Clock, Audio Player - CASE STUDY: VxWorks, RT Linux. (10)

**TOTAL : 45**

### TEXT BOOKS

1. Marilyn Wolf, "Computers as Components: Principles of Embedded Computing System Design", Morgan Kaufman, Third Edition, 2012.
2. Rajib Mall, "Real-Time Systems: Theory and Practice", Pearson Education, First Edition, 2009.(Real-Time Operating System, Real-Time Databases & Networks)

### REFERENCE BOOKS

1. Gilmore, "Microprocessors- Principles and Applications", Tata McGraw-Hill, Second Edition, 2000..(For 8051 Microcontroller)
2. David. E. Simon, "An Embedded Software Primer", Pearson Education, First Edition, 2012.
3. <http://www.nptel.ac.in/courses/108105057/>( For Testing)



# 15CS16 - PRINCIPLES OF COMPILER DESIGN

L	T	P	C
3	0	0	3

## ASSESSMENT : THEORY

### COURSE OUTCOME

- CO1** : Cite and Explain with example the analysis aspects of compiler analysis and synthesis Phases.
- CO2** : Design of Compiler aspects using LEX and YACC tool.
- CO3** : Demonstrate their understanding by solving problems.

### INTRODUCTION

Compilers and Interpreters - The structure of a Compiler - Phases of a compiler : Lexical analysis, Syntax analysis, Intermediate code generation, Code optimization, Code generation, Error handling - Passes of a compiler - Interleaving phases - Preprocessors - Compiler construction tools. (3)

### HIGH-LEVEL PROGRAMMING LANGUAGES

Definition of Programming languages -The Lexical and Syntax structure of a language - Data environment - Parameter transmission - Storage management. (2)

### LEXICAL ANALYSIS

**Finite Automata and Lexical Analysis** : The role of Lexical Analyzers, Input Buffering - A simple approach to the design of Lexical analyzer - Regular expressions - Finite automata - Regular expression to Finite Automata - Minimizing the states of a DFA - A language for specifying lexical analyzers - Implementation of a lexical analyzer. (7)

### SYNTACTIC SPECIFICATION OF PROGRAMMING LANGUAGES

**Grammar** : Definition, Context sensitive, Context free, Regular grammar - Regular expression and Regular Grammers - Context Free Grammars: Notations - Derivations and Parse trees. (4)

### BASIC PARSING TECHNIQUES

**Bottom up parsing** : Handle, Handle pruning - Operator precedence parsing - Simple precedence parsing- Top down parsing: Recursive descent parsing, Predictive parsers-LR parsers: SLR parser, LALR Parser. (9)

### SYNTAX DIRECTED TRANSLATION

Syntax directed translation schemes- Synthesized and Inherited attributes - Implementation of syntax directed translators - Intermediate code - Postfix notation - Parse trees and Syntax trees - Three address code, Quadruples and Triples - Translation of assignment statement - Boolean expressions - Statements that alter the flow of control - Array references - Symbol tables: Contents, Structure. (8)

### INTRODUCTION TO CODE OPTIMIZATION

The Principle Sources of Optimization -Loop Optimization - The DAG representation of Basic Blocks - Global data flow analysis - Dominators- Reducible flow graphs - Loop invariant computations - Induction variable elimination - Other loop optimizations. (7)

### CODE GENERATION

Object programs - Issues in Code generation - A simple code generator - Register allocation and assignment - Code generation from DAG's - Peephole optimization. (5)

**TOTAL : 45**

## **TEXT BOOKS**

1. *Alfred V. Aho, Monica S. Lam, Ravi Sethi and Jeffrey D. Ullman "Compilers: Principles, Techniques and Tools", Pearson Education, Inc., Second Edition, 2013.*
2. *Alfred V. Aho and Jeffrey D. Ullman, "Principles of Compiler Design", Narosa Publishing House pvt. ltd., Twenty fifth Reprint 2002.*

## **REFERENCE BOOK**

1. *Jean Paul Tremblay and Paul G. Sorenson., "Theory and Practice of Compiler Writing", BS Publication, Reprint 2008.*

# 15CEE35 - DISASTER MANAGEMENT

L	T	P	C
3	0	0	3

## ASSESSMENT : THEORY

### COURSE OUTCOME

*At the end of this course, the student will be able to*

**CO1** : *Identify natural and manmade disasters*

**CO2** : *Explain in detail about causes and effects of natural and manmade disasters.*

**CO3** : *Apply geospatial techniques (including GIS) that can enhance vulnerability assessments*

**CO4** : *Identify and analyse the factors that give rise to differential vulnerabilities and levels of community resilience and suggest necessary mitigation plans*

**CO5** : *Assess and manage these vulnerabilities through disaster planning and policy-making.*

### NATURAL DISASTERS

Cyclones, Floods, Drought and Desertification - Earthquake, Tsunami, Landslides and Avalanche.

(9)

### MAN MADE DISASTERS

Chemical industrial hazards, major power breakdowns, traffic accidents, Fire, War, Atom bombs, Nuclear disaster- Forest Fire- Oil fire -accident in Mines.

(9)

### GEOSPATIAL TECHNOLOGY

Remote sensing, GIS and GPS applications in real time disaster monitoring, prevention and rehabilitation- disaster mapping.

(9)

### RISK ASSESSMENT AND MITIGATION

Hazards, Risks and Vulnerabilities - Disasters in India, Assessment of Disaster Vulnerability of a location and vulnerable groups- Preparedness and Mitigation measures for various Disasters- Mitigation through capacity building -Preparation of Disaster Management Plans.

(9)

### DISASTER MANAGEMENT

Legislative responsibilities of disaster management- Disaster management act 2005- post disaster recovery & rehabilitation, Relief & Logistics Management; disaster related infrastructure development- Post Disaster, Emergency Support Functions and their coordination mechanism.

(9)

**TOTAL : 45**

### TEXT BOOKS

1. *Khanna B K, "All You Wanted To Know About Disasters", New India Publishing Agency, New Delhi, 2005.*
2. *Ramana Murthy, "Disaster Management", Dominant, New Delhi, 2004.*
3. *Rajdeep Dasgupta, "Disaster Management and Rehabilitation", Mittal Publishers, New Delhi, 2007.*

### REFERENCE BOOKS

1. *Disaster Management in India- A Status Report- Published by the National Disaster Management Institute, Ministry of Home Affairs, Govt. of India, 2004.*
2. *Murthy D. B. N., "Disaster Management: Text and Case Studies", Deep and Deep Publications (P) Ltd., New Delhi, 2007.*
3. *Sundar I. and Sezhiyan T., "Disaster Management", Sarup and Sons, New Delhi, 2007.*

# 15CEE36 - RENEWABLE ENERGY RESOURCES

L	T	P	C
3	0	0	3

## ASSESSMENT : THEORY

### COURSE OUTCOME

After successful completion of the course, student will be able to

- CO1** : Explain the current energy scenario and future energy usage in India.
- CO2** : Explain the concepts of solar energy, wind energy, tidal energy and biomass energy.
- CO3** : Compare the energy utilization from wind energy, solar energy, biomass energy and tidal energy.
- CO4** : Discuss the challenges and problems associated with the use of energy sources.

### ENERGY PERSPECTIVES

Conventional and non conventional energies - Energy and sustainable development - Global energy scenario - Energy scenario in India - Energy consumption pattern in rural and urban regions in India - Energy efficiency and economy - Energy losses and its control - Renewable energy potential mapping - Plant load factor (9)

### SOLAR ENERGY PERSPECTIVES

Concept of solar energy - Solar energy to light and to thermal conversions - Total energy and necessary infrastructure - Units and measurement of solar radiation - Temperature dependent collecting devices and their efficacies - Design aspects - Typical applications: heating, cooling, lighting, power generation and cooking. (9)

### WIND ENERGY PERSPECTIVES

Wind potential in India - Wind turbines and their types - Merits and demerits - Wind power and appropriate coefficient - Efficiency and performance of wind machines -Energy conversion and storage - Synchronous invertors - Various storage aspects: battery, fly wheel, hydrogen and compressed air. (9)

### BIOMASS ENERGY PERSPECTIVES

Biomass potential in India - Gobar gas and producer gas - Characteristics of biomass - Operation and design of biogas plants - Objectives, principles and operational aspect of biogassifiers - Pyrolysis and incineration - Power generation from municipal solid waste and industrial Sludges - Application of biodiesel plants - Fuel cells. (9)

### TIDAL ENERGY PERSPECTIVES

Tidal aspects in coastal India - Tidal energy conversion system: mechanical to electrical and thermal to electrical - Tidal force calculation and power generation - conceptualization and potential of geothermal energy - Geothermal vents. (9)

**TOTAL : 45**

### TEXT BOOK

1. Sukathme, S.P, "Solar Energy", Tata McGraw-Hill Book Co., New Delhi, 1993.

### REFERENCE BOOKS

1. Rai, G.D., "Solar Energy Utilization", Khanna Publishers, New Delhi, 1993.
2. Angrist, S.W, "Direct Energy Conversion", Allied Publishers Ltd., Boston, 1971.

# 15CEE38 - ENVIRONMENTAL IMPACT ASSESMENT

L	T	P	C
3	0	0	3

## ASSESSMENT : THEORY

### COURSE OUTCOME

At the end of this course, the student will be able to

- CO1** : Outline the overall perspectives of Environmental Impact Assessment.
- CO2** : Design the necessary tools pertaining to assessment of various impacts.
- CO3** : Recognize and synthesis the diversified socio-economic impacts on the society.
- CO4** : Design and develop the significant protocols for Environment Management Plan.
- CO5** : Synthesize and discretise the various impacts originating from typical developmental projects.

### ENVIRONMENTAL IMPACT ASSESMENT PERSPECTIVES

Impact assessment introduction -Historical perspective -Scope and goals of EIA - Legal and Regulatory aspects in India - Types and limitations of EIA - Scope studies for Environmental Impact Studies (EIS). Preparation for EIS Planning, Public Participation and Review of EIS. (9)

### ASSESSMENT AND MONITORING

Environmental setting - environmental impact assessment methodology- cost benefit analysis, environmental indices and indicators for describing affected environment, Life cycle assessment. Role of remote sensing and GIS in Environmental Impact Assessment (9)

### SOCIO-ECONOMIC IMPACT ASSESMENT

Types, steps in performing socio-economic impact assessment, analysis of public services and facilities impacts, social impacts, impacts of economic profile of the community. (9)

### ENVIRONMENTAL MANAGEMENT PLAN

Environmental Management Plan - preparation, implementation and review - Mitigation and Rehabilitation Plans - Policy and guidelines for planning and monitoring programmes - Post project audit - Ethical and Quality aspects of Environmental Impact Assessment. (9)

### SECTORAL ENVIRONMENTAL IMPACT ASSESMENT

EIA related to the following sectors - Infrastructure -construction and housing Mining - Industrial - Thermal Power - River valley and Hydroelectric projects-Nuclear Power- EIA for coastal projects. (9)

**TOTAL : 45**

### TEXT BOOKS

1. *Canter.R.L, "Environmental Impact Assessment", McGraw Hill, New Delhi, 1996.*
2. *Shukla,S.K., Srivastava.P.R., "Concepts in Environmental Impact Analysis", Common Wealth Publishers, New Delhi, 1992.*

### REFERENCE BOOKS

1. *Rao, J.G., and Wotten, D.C., "Environmental Impact Analysis, Handbook", McGraw-Hill, 1980.*
2. *Van Nostr, and Reinhold, J.E. Heer, Hagerty,D. J., "Environmental Assessment and Statement", 1977.*
3. *Canter, L.W., "Environmental Impact Assessment", McGraw-Hill, New York, 1996.*
4. *"Environmental Assessment Source book", Vol. I, II &III, The World Bank, Washington, D.C, 1991.*

# 15CEE39 - SOLID AND HAZARDOUS WASTE MANAGEMENT

L	T	P	C
3	0	0	3

## ASSESSMENT : THEORY

### COURSE OUTCOME

After successful completion of the course, student will be able to

**CO1** : Outline the salient features of solid waste management and handling.

**CO2** : Deduce the source reduction, recycling and reuse techniques of solid waste.

**CO3** : Analyze the collection systems and method of transfer of solid waste.

**CO4** : Describe the processing techniques for solid and hazardous waste.

**CO5** : Select the suitable methods for disposal of solid and hazardous waste.

**CO6** : Interpret the legislation for management, handling and disposal of solid and hazardous waste.

### CHARACTERISTICS AND SOURCE REDUCTION OF SOLID WASTE

Definition, sources, and types of solid waste - Composition, physical, chemical and biological properties of solid wastes - Per capita generation rates - Sampling and characterization of solid waste - Source reduction of wastes -Waste exchange - Recycling and reuses - Salient features of Indian legislations on management and handling of municipal solid wastes. (9)

### COLLECTION AND TRANSPORT OF SOLID WASTE

Estimation of solid waste and factors affecting generation rates - On-site handling, storage, and processing- Collection services: municipal and commercial - Industrial services - Collection systems: Hauled-container system (HCS) and stationary container system (SCS) - Vehicle and labour assessment - Assessment of collection route - Transfer and transport - Transfer station location- Means and methods of transfer. (9)

### PROCESSING AND DISPOSAL OF SOLID WASTE

Objective of processing - material separation and processing technologies- biological, chemical and thermal conversion technologies- disposal in Landfills: site selection methods and operations, leachate and gas generations and movement and control of gas and leachate techniques - Composting: aerobic and anaerobic - Resource and energy recovery schemes. (9)

### HAZARDOUS WASTE CHARACTERIZATION AND MANAGEMENT

Definitions and Identifications of hazardous waste - Origin and characterization of hazardous solid waste- Typical hazardous wastes in MSW - Hazardous waste management: minimization, collection, storage, handling, transport, and disposal - design of hazardous waste landfills - TCLP tests - National and International legislation for hazardous waste management - Atomic Energy Regulatory Board -International Atomic Energy Agency - Department of Atomic Energy - Nuclear Power Corporation - Nuclear power plants in India. (9)

### NUCLEAR WASTE AND e-WASTE

Sources - classification - effects of nuclear waste- initial treatment of nuclear waste - vitrification, ion exchange, synroc - long term management - above ground disposal, geological disposal, ocean dumping, transmutation, space disposal - reuse of waste - nuclear safety and waste regulation - case study on nuclear disaster - source of e-waste - material composition of e-waste - recycling and recovery - integrated approaches to e-waste recycling - socio economic factors - treatment option - disposal option - e-waste legislation. (9)

**TOTAL : 45**

### TEXT BOOKS

1. Tchobanoglous, G. et al., "Integrated Solid Waste Management", McGraw-Hill Publication., New York, 1993.
2. Ronald E. Hester, Roy M. Harrison "Electronic Waste Management", Royal Society of Chemistry, 2009.

### REFERENCE BOOKS

1. Peavy, SH, Rowe, RD and Tchobanoglous, G, "Environmental Engineering", McGraw-Hill Inter Edition, 1985.
2. Charles, A.W., "Hazardous Waste Management", McGraw-Hill Publication, 2002

# 15CEE40 - PRINCIPLES OF SUSTAINABLE DEVELOPMENT

L	T	P	C
3	0	0	3

## ASSESSMENT : THEORY

### COURSE OUTCOME

At the end of this course, the student will be able to

**CO1** : Outline the concepts, components and factors affecting Sustainable development.

**CO2** : Discuss the significance of International summits, conventions and agreements on Sustainable development.

**CO3** : Describe the necessity and importance of Indian and International legal aspects in Sustainability.

**CO4** : Illustrate the socio economic policies and public participation in Sustainable development.

**CO5** : Discuss the role and commitment of developed countries in Sustainable development.

**CO6** : Describe the concepts of Life cycle Assessment and Environmental Standards.

### CONCEPTS OF SUSTAINABLE DEVELOPMENT

Sustainable development- Evolution of Environmental awareness and Sustainable development, global Sustainable development goals -components and factors affecting Sustainable development-Demographic dynamics and sustainability- Environmental issues and crisis- ozone layer depletion, global warming and climate change -International Environmental summits, conventions and agreements- Action plan for Sustainable development- Transboundary issues - Role of developed and developing countries in sustainable development. (9)

### ENVIRONMENTAL ASPECTS

Biodiversity- Types of biodiversity-Threats to biodiversity- Ecological indicators- Ecological foot print- Carbon foot print- Conservation biology- Strategic species concepts- Ecological economics- Environmental impact of agriculture, animal husbandry, fishery and land use- Habitat fragmentation- Desertification- Natural disasters, geological, hydrological, meteorological and health- Nuclear issues. (9)

### ECONOMIC ASPECTS

Production, Consumption, Investment and Exchange of Goods and Services - Macroeconomic Aggregates, Circular Flow of Income and its Criticism- Methods of Calculating National Income- GNP and GDP- The Goods Market: determination of equilibrium output -Financial Markets: demand for money and interest rates- Goods and Financial markets: IS-LM Model- General Overview of Fiscal and Monetary Policies-relative effectiveness- International Transactions and exchange rates- Market failure & Incomplete markets Externalities -UN Sustainable development policies through trade- World Trade Organization- International monetary fund and World bank. (9)

### SOCIAL ASPECTS

Indigenous Knowledge and Natural Resource Management (NRM) - Commodification, marginalization and degradation - Indigenous knowledge and its relevance to sustainable development - Biopiracy and Biopolitics over Traditional Ecological knowledge (TEK)- Environmental Degradation in developing countries - Overview of development- Globalisation and the structural adjustments- Governance and welfare state- Development processes and social justice -Social inequality as a global challenge-marginalized/vulnerable groups, indigenous people, resettlement & rehabilitation and development. (9)

### STRATEGIES FOR SUSTAINABLE DEVELOPMENT

Economic growth, carrying capacity- Resource depletion and resource protection-Sustainable Management of Forest, Land, water, fishery, agriculture, energy and ecosystem- Natural Disaster management- Cleaner Production, definition, aim, application- Generic process of Cleaner Production Assessment- Life cycle Assessment- definition, necessity and elements- ISO Environmental standards- Environmental Audit. (9)

**TOTAL : 45**

## TEXT BOOKS

1. *Brian Snowdon and Howard R. Vane, "Modern Macroeconomics", Edward Elgar, USA, 2005*
2. *Gupta N.K., "Macroeconomics", National Council of Educational Research and Training, New Delhi, 2012*
3. *Arun Kumar, "Macroeconomic Aspects of Goods and Services Tax", Economic and Political Weekly, 2015*
4. *Ramakrishnan, P. S., "Ecology and Sustainable Development", National Book Trust, New Delhi, 2001*
5. *Paul Robbins, John Hintz, and Sarah A. Moore, "Environment and Society: A Critical Introduction", Wiley-Blackwell, 2014*

## REFERENCE BOOKS

1. *Nick Hanley, Jason F. Shogren and Ben White, "Environmental Economics in Theory and Practice", Macmillan Publishers, UK, 1997*
2. *Tietenberg T. and Lynne Lewis, "Environmental and Natural Resource Economics", Harper Collins, Routledge, 2016*
3. *Kolstad Charles D., "Environmental Economics", Oxford University Press, 2003*



# 15CEE41 - SAFETY ENGINEERING IN BUILDINGS

L	T	P	C
3	0	0	3

## ASSESSMENT : THEORY

### COURSE OUTCOME

After successful completion of the course, student will be able to

**CO1** : Demonstrate the safety concepts, policy and techniques.

**CO2** : Demonstrate the issues related to physical and chemical hazards and control methods to reduce hazards.

**CO3** : Outline the fire engineering and explosion control.

**CO4** : Identify the method of safety provision in execution of civil works.

**CO5** : Identify the safety consideration in erection and closing operations and material handling in civil construction works.

### CONCEPTS OF SAFETY ENGINEERING

Concept of safety - Evolution of modern safety concept- Safety policy - Safety Organization - line and staff - functions for safety- Safety Committee- budgeting for safety. Techniques- Incident Recall Technique (IRT), disaster control, Job Safety Analysis (JSA), safety survey, safety inspection, safety sampling, Safety Audit. (9)

### OCCUPATIONAL HEALTH AND HYGIENE

Physical hazards - Noise, noise exposure regulation, occupational damage, risk factors, and permissible exposure limit. Ionizing radiation, types, effects, monitoring instruments, control programs, control measures. Chemical hazards - Recognition of chemical hazards-dust, fumes, mist, vapour, fog, gases, types, concentration, Exposure vs. dose, Methods of Control. Concept and spectrum of health - functional units and activities of occupational health services, pre-employment and post-employment medical examinations - occupational related diseases, levels of prevention of diseases. (9)

### FIRE ENGINEERING AND EXPLOSION CONTROL

Fire chemistry - Dynamics of fire behavior - Fire properties of solid, liquid and gas - Fire spread - Toxicity of products of combustion. Building evaluation for fire safety - Fire load -Fire resistance materials and fire testing -Structural Fire protection - Exits and egress. Statutory Rules and Techniques of fire fighting - Indian Explosive acts and rules -Techniques of fire fighting and demonstration. (9)

### SAFETY IN CONSTRUCTION

General safety consideration - analyzing construction jobs for safety - Contract document -Safety certificate for statutory authorities for old building and construction. Safety in Erection and closing operation - Construction materials -Specifications - suitability - Limitations. Safety in typical civil structures - Dams-bridges-water Tanks-Retaining walls-Critical factors for failure-Regular Inspection and monitoring. (9)

### SAFETY IN MATERIAL HANDLING

General safety consideration in material handling - Ropes, Chains, Sling, Hoops, Clamps, Arresting gears. Selection, operation and maintenance of Industrial Trucks - Mobile Cranes - Tower crane -Checklist - Competent persons. (9)

**TOTAL : 45**

### TEXT BOOKS

1. Krishnan N.V., "Safety Management in Industry", Jaico Publishing House, Bombay, 1997.
2. "Accident Prevention Manual for Industrial Operations", NSC Chicago, 1982.

### REFERENCE BOOKS

1. "Handbook of Occupational Health and Safety", NSC Chicago, 1982.
2. James, D., "Fire Prevention Handbook", Butterworths, London, 1986.
3. Gupta R.S., "Handbook of Fire Technology", Orient Longman, Bombay, 1997.
4. Fulman, J.B., "Construction Safety, Security, and Loss Prevention", John Wiley and Sons, 1979.
5. Alexandrov, M.P., "Material Handling Equipment", Mir Publishers, Moscow, 1981.
6. Rudenko N., "Material Handling Equipments", Mir Publishers, Moscow, 1981.

# 15MEOE01 - ROBOTICS

L	T	P	C
3	0	0	3

## ASSESSMENT : THEORY

### COURSE OUTCOME

At the end of this course, the students will be able to

- C01** : Examine the configuration of a robot and suggest a robot for a particular operation (pick and place, welding, vision, climbing etc..).
- C02** : Calculate the position, velocity and acceleration for a robot manipulator and solve the forward and inverse kinematics for a specific robot.
- C03** : Calculate mass and inertia for the links of a robot manipulator and also find its forward and inverse dynamics.
- C04** : Choose appropriate vision system for the robot and extract images for the desired output.
- C05** : Write a program to determine a path for obstacle avoidance for a specific task using matrix laboratory software.

### INTRODUCTION

Brief history of robots, robot definitions, today's practical importance of robot applications, challenges faced by robots in industrial situations, future scope of robotics. (6)

### GENERAL CONSIDERATION OF ROBOTIC MANIPULATORS

Introduction - Brief history of robotics- Robot geometrical configurations - wrist and gripper subassemblies - robot drive systems - robot software. (7)

### KINEMATICS OF ROBOT MANIPULATORS

Homogeneous representation of objects, robot manipulator joint coordinate system, Euler angles and Euler transformations, Denavit- Hartenberg (D-H) representations, direct kinematics in robotics, inverse kinematic solutions, geometrical approach in inverse Kinematics, Jacobian of transformation in robotic manipulation. (13)

### ROBOT WORKSPACE AND MOTION TRAJECTORY DESIGN

General Structure of robotic workspaces, robotic workspace performance index, extreme reach of robotic hands, robotic task description, robotic motion, trajectory design, general design considerations on trajectories, 4-3-4 trajectory, 3-5-3 trajectory, simulation of robotic workspaces. (9)

### ROBOT SENSING AND ROBOT VISION SYSTEM

Desirable features of sensor- range sensors - proximity sensors - tactile sensors-force sensors, torque sensing detectors - TV cameras - illumination techniques - fundamentals of image processing visual data acquisition - image enhancement - image segmentation - image extraction and recognition- object and model matching - image extraction. Typical vision systems, robot programming languages - characteristics of robot- level languages - characteristics of task level languages, simulation languages. (10)

**TOTAL : 45**

### TEXT BOOK

1. Fu.K S, Gonzales.R.C., and Lee.C.S.G., "Robotic Control, Sensing, Vision and Intelligence", McGraw Hill International, 2006.

### REFERENCE BOOKS

1. Mikell.P.Groover, MitchellWeiss, Tooger.N.Nager, and NicholasG.Odrey, "Industrial Robotics Technology, Programming and Applications", McGraw Hill International, 2004.
2. Richard.D.Klafter, Thomas.A.Chmielewski, and Michaelnegin, "Robotic Engineering - An Integral Approach", Prentice Hall of India, 2002.

# 15MEOE02 - LOW COST AUTOMATION

L	T	P	C
3	0	0	3

## ASSESSMENT : THEORY

### COURSE OUTCOME

At the end of this course, the students will be able to

**CO1** : Design and control simple automation systems using fluidics.

**CO2** : Carry out design, selection and enhance existing automated system using fluidics.

**CO3** : Demonstrate the importance of using electro mechanical systems in automation.

**CO4** : Analysis and design of hydraulic circuits and some safety precautions in such circuits.

### INTRODUCTION

Fluid Power - Hydraulic and Pneumatic fluids - properties and selection. Advantages and applications of Fluid Power. (2)

### HYDRAULIC PUMPS AND MOTORS

Symbolic representation of fluid power elements. Hydraulic pumps and motors- principle of working, calculation of discharge, power and efficiency - simple problems. (8)

### HYDRAULIC VALVES

Pressure, flow and direction control valves, Electro hydraulic elements, accumulators, intensifiers, power calculations, size of accumulators - fluid seals - types and constructional details. (8)

### BASIC HYDRAULIC CIRCUITS

Unloading, speed control, regenerative and sequencing circuits. Servo systems, typical hydraulic circuits for machine tools and other industrial applications. Circuit design for given functional requirements. (9)

### PNEUMATICS

Air preparation units - Filter, Regulator and Lubricator. Valve configuration and controls. Pneumatic actuators, diaphragm actuators, back pressure sensors. Pneumatic circuits design - Cascade method. (7)

### HYDRO PNEUMATICS AND ELECTRO PNEUMATICS

Hydro-pneumatics and electro-pneumatic elements and circuits, KV map method and Ladder diagram (5)

### FLUIDICS

Fluidics - Coanda effect, wall attachment devices, digital and proportional devices. Fluidic amplifiers, typical application of fluidics for control in fluid power circuits. (6)

**TOTAL : 45**

### TEXT BOOKS

1. Anthony Esposito, "Fluid Power with Application", Prentice Hall, 2008.
2. Stewart, "Practical Guide to Fluid Power", Taraporevala Sons & Co., Bombay, 2002.

### REFERENCE BOOKS

1. Subir Kar, "An Introduction to Fluidics", Oxford and IBH Publishing Co., New Delhi, 1984.
2. Fitch, E.C. Jr., "Fluid Power and Control Systems", McGraw Hill Book Co., 1966.
3. Pippenger, J.J. and Hicks, T.G., "Industrial Hydraulics", McGraw Hill Book Co., 1979.
4. Andrew Parr, "Hydraulics and Pneumatics", Jaico Publishing House, 2008.

# 15MEOE03 - ADAPTIVE CONTROL AND PROCESS DYNAMICS

L	T	P	C
3	0	0	3

## ASSESSMENT : THEORY

### COURSE OUTCOME

At the end of this course, the students will be able to

**CO1** : Explain the different computer process control systems and its application.

**CO2** : Develop the different digital controllers to suitable processes with or without time delay systems.

**CO3** : Evaluate the advanced control concepts, system identification and process modeling.

### REVIEW OF SYSTEMS

Basic equation - Integral and instantaneous balances - Material and Energy balances - General form of dynamic models. Linearization of nonlinear systems in state space form - Response of lead-lag modules- Self-regulating system - transfer function analysis of higher order systems. (6)

### SECOND ORDER SYSTEMS

A second order system - Pole-Zero cancellation - Systems in series - Blocks in parallel - linear boundary value problems - Parameter estimation of discrete linear systems. Phase plane analysis - generalization of phase plane behavior - nonlinear systems - Introduction to nonlinear dynamics - bifurcation behavior of systems (9)

### APPLICATIONS

Stirred tank heaters, Absorption-isothermal, continuous stirred tank chemical reactors, Biochemical reactors - adiabatic continuous stirred tank reactor - ideal binary distillation columns. (6)

### LINEAR DYNAMIC SYSTEM IDENTIFICATION

System Identification: Introduction, dynamic systems, models, system identification procedure. Simulation and Prediction. Non-parametric time and frequency domain methods. Linear dynamic system Identification: Overview, excitation signals, general model structure, time series models, models with output feedback, models without output feedback. Convergence and consistency. (9)

### ADAPTIVE CONTROL

Parameter estimation methods, minimizing prediction errors, linear regressions and Least squares method, Instrumental - variable method, prediction error method. Recursive algorithms. Closed-loop Identification. Adaptive Control: Close loop and open loop adaptive control. Self-tuning controller. Auto tuning for PID controllers: Relay feedback, pattern recognition, and correlation technique. (9)

### ADAPTIVE ADVANCED CONTROL

Adaptive Smith predictor control: Auto-tuning and self-tuning Smith predictor. Adaptive advanced control: Pole placement control, minimum variance control, generalized predictive control. (6)

**TOTAL : 45**

### TEXT BOOKS

1. Bequette B.W., "Process Dynamics - Modeling, Analysis and Simulation", PHIPE, New Delhi, 1998.
2. Stephanopoulos G., "Chemical Process Control: An Introduction to Theory and Practice", Prentice Hall of India (P) Ltd., New Delhi, 2009.

## REFERENCE BOOKS

1. *Shinsky F.G., "Process Control Systems: Application, Design and Adjustment", 3rd Edition, McGraw Hill Book Co., New York, 1988.*
2. *Nelles O., "Nonlinear System Identification", Springer Verlag, Berlin, 2011.*
3. *Ljung L., "System Identification: Theory for The User", Prentice Hall, Englewood Cliffs, 1999.*
4. *Astrom K., "Adaptive Control", Second Edition, Pearson Education Asia Pvt. Ltd., 2002.*

# 15MEOE04 - PROJECT PLANNING AND MANAGEMENT

L	T	P	C
3	0	0	3

## ASSESSMENT : THEORY

### COURSE OUTCOME

At the end of this course, the students will be able to

**CO1** : Evaluate and select the most desirable projects.

**CO2** : Identify desirable characteristics of effective project managers.

**CO3** : Apply appropriate approaches to plan a new project and develop a project schedule.

**CO4** : Develop a suitable budget for a new project and Identify important risks.

**CO5** : Apply appropriate techniques to assess ongoing project performance.

## INTRODUCTION

Project management- an overview, project identification and Screening; Project Appraisal. Introduction to Production Systems and a Generalized Model of Production. Life cycle of a Production System and Major managerial Decisions. (7)

## PROJECT PLANNING

Project Planning- Development of Project Network; Project Representation; Consistency and Redundancy in Project Networks; Project Scheduling- Basic Scheduling with A-O-A Networks; Basic Scheduling with A-O-N Networks; Project Scheduling with Probabilistic Activity Times. (7)

## TIME MANAGEMENT

Time/Cost Tradeoffs in Projects -Linear Time - Cost Tradeoffs in Projects: A Heuristic Approach; Resource Considerations in Projects - Resource Profiles and leveling. Limited Resource Allocation. (8)

## PROJECT IMPLEMENTATION

Project Monitoring and Control with PERT / Cost. Team Building and Leadership in Projects; Project Completion, Review and Future directions. (8)

## DECISION MAKING IN MANAGEMENT

Financial Evaluation of Production Related Decisions- Performance Measures of a Production System. Financial Evaluation of Capital Decisions. Decision Trees and evaluation of risk; Designing Products & Services - Introducing New Products and Services, Product Mix Decisions. (8)

## MANAGEMENT CONTROLS

Fundamentals of MRP I & MRP-II, Toyota production system - evolution of JIT - Waste elimination techniques - Pull control - kanban, kaizen. Lean manufacturing - agile manufacturing, Value chain analysis, Theory of Constraints (TOC) - bottleneck vs constrained resource - bottleneck identification and elimination - drum buffer rope systems. (7)

**TOTAL : 45**

## **TEXT BOOKS**

1. *Shtub A., Bard J. F. & Globerson S., "Project management: engineering, technology, and implementation", 2nd Edition Prentice Hall, 2004.*
2. *Lock D., "Project management", Gower Publishing Ltd., 9th Edition, 2007.*
3. *Kerzner H., "Project Management: A Systems Approach to Planning, Scheduling and Controlling", John Wiley & Sons, 11th Edition, 2013.*

## **REFERENCE BOOKS**

1. *Murthy P.R., "Production and Operations Management", New Age International (P) Ltd. Publishers, 2nd Edition, 2006.*
2. *Mayer R.R., "Production management", McGraw-Hill, 1968.*
3. *Harding H.A., "Production management", Macdonald and Evans Ltd, 1974.*

# 15MEOE05 - SUPPLY CHAIN MANAGEMENT

L	T	P	C
3	0	0	3

## ASSESSMENT : THEORY

### COURSE OUTCOME

*At the end of this course, the students will be able to*

**CO1** : *Outline the manufacturing and product life cycle management process involved in a product.*

**CO2** : *Formulate the forecasting methods and inventory modelling*

**CO3** : *Estimate the right procurement and logistics strategy based on the supply chain and product criterion requirements.*

**CO4** : *Design and analyze the right supply chain structure for the product along with distribution network*

**CO5** : *Produce the supply chain network diagram incorporating supply chain strategy and competitive strategies involving material and information flow lines*

### INTRODUCTION

Supply Chain, Objectives & Stages, power of SCM - Process views of a supply chain - Strategic planning, Achieving a strategic fit in a supply chain and factors affecting the strategic fit - Value chain, supply chain flow lines - Understanding a product, Product life cycle, Fishers classification of products - Effective and efficient supply chain - case studies on products. (9)

### SUPPLY CHAIN PROCESS

Forecasting in supply chain, forecast error distribution order quantity and reorder point characteristics & components of forecasting - time series methods of forecasting, Demand Management in MPC - MTS - ATO - MTO. Inventory, role of cycle inventory, economies of scale to exploit fixed costs, Economies of scale to exploit quantity discounts, Short term discounting and trade promotions Managing multi-echelon cycle inventory - Bullwhip effect - Product substitution, Postponement. (9)

### PRODUCT PROCUREMENT & TRANSPORTATION

Procurement process, EOQ - Sourcing in a supply chain - deciding factors for in-house or outsourcing -Supplier selection - auctions and negotiations, risk management in sourcing Freight management, Transportation networks, Milk run, Cross Docking, tailored transportation, 3PL - 4 PL, Risk management in transportation. (9)

### DESIGNING A SUPPLY CHAIN

Supply chain drivers - Supply chain performance measures - SCOR Model - Network design in a supply chain, factors influencing design, Framework for network design network, models for facility location and capacity allocation - Uncertainty in network design - Discounted cash flow analysis, Decision trees in evaluating network design - Distribution, factors influencing distribution, design options for a distribution network. (9)

### INFORMATION TECHNOLOGY IN SUPPLY CHAIN

Lean Supply Chain, agile supply chain, Dynamic supply chain design, Impact of technology on SCM, Key trends in SCM, IT in supply chain coordination and design - MRP, ERP, CRM, ISCM - Performance metrics. Discussion on supply chain adopted by primary industrial sectors and case studies. (9)

**TOTAL : 45**

### TEXT BOOK

1. *Ayers J., "Hand Book of Supply Chain Management", The St. Lencie Press/ APICS Series on Resource Management, 2000.*



## REFERENCE BOOKS

1. *Burt N.D., Dobler. W.D. and Starling L.S., "World Class Supply Chain Management, The Key to Supply Chain Management", Tata McGraw Hill Publishing Company Limited, 2005.*
2. *Chopra S., Meindl P. and Kalra, D.V., "Supply Chain Management, Strategy, Planning and Operation", Pearson Education, Inc., 2008*
3. *Fredendall D.L. and Hill E., "Basics of Supply Chain Management", The St. Lucie Press / APICS Series on Resource Management, 2001.*
4. *Monczka R., Trent R. and Handfield R., "Purchasing and Supply Chain Management", 3rd edition, Thompson Learning Inc., 2007.*
5. *Sople V.V, "Supply Chain Management", Pearson Education, 2012*
6. *Vollmann T.E., Berry L.W., Whybark D.C. and Jacobs, R.F., "Manufacturing Planning and Control for Supply Chain Management", Tata McGraw Hill Publishing Company Limited, 2008.*
7. *Wild T., "Best Practice in Inventory Management", Butterworth - Heinmann, Elsevier Science Ltd.,2002.*

## ADDITIONAL READING

1. *European Journal of Innovation Management*
2. *Logistics Information Management an International Journal*
3. *Supply Chain Management an International Journal*
4. *Sethi P.S., Yan H. and Zhang H., "Inventory and Supply Chain Management with Forecast Updates", Springer International Series, 2006.*
5. *Mohantray P.R. and Deshmukh G.S., "Supply Chain Management, Theories and Practices", Published by Biztantra Innovations in Management, 2005.*
6. *Kulkarani S and Sharma A., "Supply Chain Management", Tata McGraw Hill Publishing Company Limited, 2008.*

# 15MEOE06 - RESOURCE MANAGEMENT TECHNIQUES

L	T	P	C
2	2	0	3

## ASSESSMENT : THEORY

### COURSE OUTCOME

At the end of the course, the students will be able to

- CO1** : Mathematically formulate a given engineering problem as a linear programming problem, and apply Graphical, Simplex, Two-Phase or Big-M methods to obtain the optimal solution.
- CO2** : Construct or modify objective functions and constraints using primal and dual relationship, and apply the Dual Simplex Method to obtain optimal solutions.
- CO3** : Justify the determined feasible solution (processing time and transportation cost) as optimal solution using MODI method and Hungarian method.
- CO4** : Determine the optimal project duration and cost using CPM and PERT technique, also construct complex project network and control the complex project.
- CO5** : Categorize (Inventory, Game Theory, Sequencing and Queuing) and solve various decision making problems using mathematical modeling.

### LINEAR PROGRAMMING

Linear programming formulation, graphical solutions, the essence of simplex method, setting up the simplex method, the simplex method in tabular form, Theory of simplex method, Big M Method, Two Phase Method. (5)

### DUALITY AND SENSITIVITY ANALYSIS

Primal - Dual construction, Symmetric and Asymmetric Dual, Weak Duality Theorem, Complimentary Slackness Theorem, Main Duality Theorem, Dual Simplex Method, Sensitivity Analysis. (4)

### TRANSPORTATION AND ASSIGNMENT

Formulation of Transportation Problem, Initial Feasible Solution Methods, Optimality Test, Degeneracy in Transportation Problem; Assignment Problem, Hungarian Method, Traveling Salesman Problem. (5)

### NETWORK MODELS

Definition of network models - minimal spanning tree algorithm, shortest route algorithm, maximal flow algorithms, PERT, CPM - LP formulation of minimal spanning, maximum flow and PERT, CPM calculations. (5)

### INVENTORY AND MODELS

Classical EOQ Models, EOQ Model with Price Breaks, EOQ with Shortage, Probabilistic EOQ Model, Newsboy Problem. (3)

### GAME THEORY AND SEQUENCING

Two Person Zero Sum Game, Pure and Mixed Strategies, Algebraic Solution Procedure, Graphical Solution, Solving by Linear Programming; Sequencing Problem, Processing of n Jobs Through Two Machines and m Machines, Graphical Method of Two Jobs m Machines Problem. (4)

### QUEUING AND SIMULATION

Elements of Queuing Model, Pure Birth Death Model, Single Server and Multi-server Markovian Models with Infinite and Finite Capacity, Machine Repair Model, Networks of Queues. System concepts - Types of systems and models - system simulation procedure - Monte- Carlo simulation method (simple problems) - Introduction to simulation languages. (4)

**TOTAL : 60**

## **TEXT BOOKS**

1. Mohan, C. and Deep, Kusum: "Optimization Techniques", New Age, 2009.
2. Mittal, K. V. and Mohan, C. "Optimization Methods in Operations Research and Systems Analysis", Fourth Edition, New Age, 2016.
3. Taha, H. A, "Operations Research - An Introduction", Pearson, (9th Edition), 2014.

## **REFERENCE BOOKS**

1. Ravindran, A., Phillips, D. T and Solberg, J. J. "Operations Research: Principles and Practice", John Willey and Sons, 2nd Edition, 2014.
2. Hiller, F. S. and Liebermann, G. J. "Introduction to Operations Research", Tata McGraw Hill, 2015.
3. S. S. Rao, "Engineering Optimization: Theory and Practice", 4th Edition, John Wiley & Sons, 2009.

# 15MEOE07 - SUSTAINABLE DEVELOPMENT

L	T	P	C
3	0	0	3

## ASSESSMENT : THEORY

### COURSE OUTCOME

At the end of the course, the students will be able to

- CO1** : Infer environmental sustainability and to implement in more suitable ways to the society.
- CO2** : Identify methods for reducing energy consumption and to implement lower carbon technologies to achieve sustainable society.
- CO3** : Collect and organize information about historical perspectives of sustainability and for further development of sustainable industries.
- CO4** : Compare the balance between food production and population growth to plan the optimal usage of water resources and to evaluate the solution for the problems of urban sprawl.
- CO5** : Explore the fossil fuels formation of oil, natural gas and coal, environmental effects of mining and metals processing and it's time to depletion.

### INTRODUCTION

The concept of environmental sustainability, Examples of non-sustainability and sustainability. The special role of engineers in helping society transition to a more sustainable state. Definitions, principles, and indicators of sustainability. Overall criteria for development that is sustainable. Indicator studies. (12)

### THE RISE OF SUSTAINABILITY

Historical perspectives in Europe and in the US. Modern debates: Sustainability extremists, Environmentalists, Traditional Engineers, and Anti-sustainability extremists. "Tragedy of the commons" and the ethics of sustainability. Models for achieving sustainable industries. (12)

### POPULATION GROWTH ON A FINITE EARTH

Population models, population growth, exponential and logistic growth, variation in population among nations, population policy, Food production, Protecting and Promoting Human Health - Food security and nutrition and sustainable agriculture- Water resources, Urban sprawl. (9)

### NON-RENEWABLE RESOURCES

Fossil fuels - Formation of fossil fuels: oil, natural gas, coal. Modelling of oil reserves. Mineral resources: Use and exploitation, environmental effects of extracting and using mineral resources, case studies-Time-to-depletion. (12)

**TOTAL : 45**

### TEXT BOOK

1. Tatyana P. Soubotina, "An Introduction to Sustainable Development", Washington, 2nd Edition, 2004.

### REFERENCE BOOKS

1. Jeffrey D. Sachs, "The Age of Sustainable Development", Columbia University Press, 4th Edition, 2015.
2. K.A.Rasure, "Globalization And Sustainable Development", Oxford book company, 2nd Edition, 2010.
3. Barry Dalal Clayton and Stephen Bass., "Sustainable Development Strategies- a resource book", Earthscan Publications Ltd, London, 2002.
4. Karel Mulder, "Sustainable Development for Engineers"- A Handbook and Resource Guide, Green Leaf Publishing, 2006.

# 15MEOE08 - PROCESSING AND APPLICATIONS OF BIOMATERIALS

L	T	P	C
3	0	0	3

## ASSESSMENT : THEORY

### COURSE OUTCOME

At the end of the course, the students will be able to

- CO1** : Identify the suitable material for human implants and perform mechanical and tribological characterization. (Tensile, compression, hardness, wear, corrosion and water absorption).
- CO2** : Choose a bio compact material (calcium phosphate, ceramic, glass, bioinert ceramics, polymeric, HDPE, hybrid, metals and alloys, Ti Alloys - Co-Cr-Mo, Ni or Ta-Based Alloys - Other Non-Ferrous alloys) for a orthopedic joints.
- CO3** : Develop successful implants (biological, mechanical, morphological Compatibility) for dental and bone applications.
- CO4** : Evaluate biomaterials, metals, ceramics, polymers, micro/nano for Surface modification, micro/nano fabrication to find the tensile strength and micro structure.
- CO5** : Estimate the percentage of reinforcement (particle, fiber, laminates) to increasing the strength (tensile, flexural, bending, fatigue, wear, and corrosion) under specified constraints (density) for human implants.
- CO6** : Design a suitable shape of the implants for orthopedic joint applications.

### FUNDAMENTALS OF BIOMATERIALS AND BIOCOMPATIBILITY

Introduction - definitions and their Implications - Biomaterial - Biocompatibility -Host response - Cell-Material Interactions - Experimental Evaluation of Biocompatibility - In vitro Tests - In vivo Tests - Steps for characterizations of biomaterials - Broad overview of Fundamentals. (7)

### MATERIALS FOR ORTHOPEDIC APPLICATIONS

Introduction - Structure and Properties of Hard Tissues - Processing and Properties of Bioceramics and Bioceramic Composites - Calcium Phosphate Based Biomaterials - Hydroxyapatite-Ceramic Composites - Glass-Ceramics Based Biomaterials - Mica Based Glass Ceramics - Other Bioglass-Ceramics - Bioinert Ceramics - Polymeric Biomaterials - Polymer-Polymer Composites - Polymer-Ceramic Composites - HDPE-Hap-Al<sub>2</sub>O<sub>3</sub> Hybrid Composites - Metals and Alloys in Biomedical Applications - Issues Limiting Performance of Metallic Biomaterials - Wear of Implants - Corrosion of Metallic Implants - Ti-Based Alloys - Co-Cr-Mo, Ni or Ta-Based Alloys - Other Non-Ferrous Metals and Their Alloys - Coating on Metals. (12)

### TITANIUM DENTAL IMPLANT SYSTEMS

Introduction - Requirements for Successful Implant Systems - Biological Compatibility - Mechanical Compatibility - Morphological Compatibility - Osseo integration and Bone/Implant Interface - Integrated Implant System. (7)

### PROCESSING OF BIOMATERIALS

Introduction - Processing of Biomaterials - Metals - Ceramics - Polymers - Biocomposites - Sterilization - Processing for Scale - Micro/Nano Surface Modification - Micro/Nano Fabrication-Tensile testing, microscopy (SEM,AFM)evaluation. (7)

### BIOMATERIAL APPLICATIONS

Introduction - Applications in Medicine, Biology, and Artificial Organs - Cardiovascular Medical Devices - Extracorporeal Artificial Organs - Orthopedic Implants - Dental Implantation - Bioadhesive - Ophthalmologic Applications - Cochlear Prosthesis - Drug Delivery - Tissue Engineering - 2-D and 3-D tissue engineering applications and their mechanical characterization -Array Technologies and Specific Medical Applications. (12)

**TOTAL : 45**

## TEXT BOOK

1. *Bikramjit Basu, Ashok Kumar and Katti S., 'Advanced Biomaterials - Fundamentals, Processing and Applications', John Wiley & Sons, INC, Publication, 2015.*

## REFERENCE BOOKS

1. *Joon. B. Park and Joseph D. Bronzino 'Bio Materials - Principles and Applications', CRC press, 2010.*
2. *Park J. B. and Lakes R.S., 'Bio Materials - An Introduction', Plenum Press, New York, 2009*
3. *Dee KC, Puleo and DA, Bizios R, 'An introduction to tissue-biomaterial interactions', John Wiley & Sons, 2007.*

# 15MEOE09 - NUMERICAL SIMULATION OF FLUID FLOW

L	T	P	C
3	0	0	3

## ASSESSMENT : THEORY

### COURSE OUTCOME

At the end of the course, the students will be able to

**CO1** : Demonstrate ability to use the Finite-Volume Method to analyze one and two-dimensional problems of heat transfer and irrotational fluid flow

**CO2** : Apply numerical techniques to solve systems of algebraic equations and integrate ordinary differential equations

**CO3** : Evaluate heat transfer rates, fluid flow rates, etc.

**CO4** : Judge the correctness of the numerical solutions;

**CO5** : Recognize the need for turbulence models

### CONSERVATION LAWS OF FLUID MOTION AND HEAT TRANSFER

Introduction - Governing equations of fluid flow and heat transfer - Navier-Stokes (N-S) equations for a Newtonian fluid (9)

### IRROTATIONAL FLOWS AND LAMINAR BOUNDARY LAYERS

Introduction - Potential functions and stream functions - Numerical treatment of steady irrotational flows in two dimensions - Simple two-dimensional laminar flows - Boundary layer over a flat plate - Blasius solution - Numerical treatment of ordinary differential equations related to Blasius solution. (9)

### NUMERICAL HEAT TRANSFER - FINITE VOLUME METHOD

Introduction - Discretization of governing partial differential equations of heat transfer- Applications to steady and unsteady heat conduction in one and two dimensions - Treatment of heat sources - Explicit and implicit solution schemes for steady and unsteady heat conduction. (9)

### NUMERICAL TREATMENT OF FLUID FLOW - FINITE VOLUME METHOD

Discretization of governing partial differential equations of fluid flow - Differencing schemes for convective-diffusive flows - Treatment of flow boundary conditions - Introduction to the SIMPLE Algorithm. (9)

### TURBULENT FLOWS

Introduction - Reynolds Averaged N-S equations for turbulent flows - Eddy viscosity concept - Mixing length models - Brief overview of turbulence kinetic energy and dissipation (k-e) models - Brief overview of advanced turbulent flow models. (9)

**TOTAL : 45**

### TEXT BOOKS

1. Ghoshdastidar.P.S, "Computer Simulation of Flow and Heat Transfer", Tata McGrawHill, New Delhi, 1999.
2. Versteeg. H.K. and Malalasekara.W, "An Introduction to Computational Fluid Dynamics - The Finite Volume Method", Pearson Education, 2nd Edition, England, 2007.

### REFERENCE BOOKS

1. Muralidhar. K., Sundararajan. T., "Computational Fluid Flow and Heat Transfer", Narosa Publishing House, New Delhi, 2003.
2. Niyogi P., Chakrabarthy. S.K., Laha. M.K., "Introduction to Computational Fluid Dynamics", Pearson Education, 2005.
3. Chung T.J., "Computational Fluid Dynamics", Cambridge Univ. Press, New York, 2002.
4. Anil W. Date, "Introduction to Computational Fluid Dynamics", Cambridge Press, UK, 2005.
5. Titus Petriola and Damian Trif, "Basics of Fluid Mechanics and Introduction to Computational Fluid Dynamics", Springer, Boston, 2005.

# 15MEOE10 - SOLAR ENERGY UTILISATION

L	T	P	C
3	0	0	3

## ASSESSMENT : THEORY

### COURSE OUTCOME

At the end of the course student will be able to

- CO1** : Calculate solar time, local time, earth-sun angles, direct and indirect solar radiation for the given location using earth-sun geometry.
- CO2** : Categorize solar cell materials with its properties and calculate energy conversion efficiency of solar cells using I-V characteristic curves.
- CO3** : Derive the expression for overall heat transfer coefficient using network resistance method, relations for collector efficiency factor and collector heat removal factor of non- concentrating solar collectors.
- CO4** : Calculate heating loads using F-chart method for air and liquid based solar heating systems.
- CO5** : Analyze the Performance of the following thermo-electric devices: generators, refrigerators and heat pumps.

## INTRODUCTION TO SOLAR ENERGY

Introduction, overview of applications - calculation of solar constant, terminology related to solar radiation, definition and calculation of solar times, definition and calculation of all solar angles and related earth angles. (4)

## PHOTOVOLTAICS

Fundamentals of solar cells: types of solar cells, semiconducting materials, band gap theory, absorption of photons, excitons and photoemission of electrons, band engineering; Solar cell properties and design; p-n junction photodiodes, depletion region, electrostatic field across the depletion layer, electron and holes transports, device physics, charge carrier generation, recombination and other losses, I-V characteristics, output power. (9)

## SOLAR CELL

Solar Cell Applications - Solar cell manufacturing processes: material resources, chemistry, and environmental impacts; low cost manufacturing processes - Thin film solar cells - Single crystal, polycrystalline and amorphous silicon solar cells, cadmium telluride thin-film solar cells, conversion efficiency. (6)

## SOLAR CALCULATION AND SOLAR COLLECTORS

Calculation of extra-terrestrial irradiation on a horizontal surface on a hourly and daily basis, relationship between radiation on titled and horizontal surfaces, effect of atmosphere on solar radiation, Hottel's estimation of clear sky radiation, types and classification of solar collectors, terminology related to non-concentrating collectors, efficiency of a solar collector. (4)

## THERMAL MODELLING OF NON- CONCENTRATING COLLECTORS

Modeling of heat transfer processes in flat plate collector, formula for effective transmittance-absorptance product, estimation of top, bottom and overall heat loss coefficient using resistance network method, collector stagnation temperature, temperature distribution between tubes and along tubes, collector efficiency factor F, collector heat removal factor FR, collector heat exchanger modeling and combined efficiency factor FR. (10)

## SOLAR THERMAL CONVERSION

Overview of active and passive heating - Calculation of space and water heating loads, degree-days, F-chart method for air and liquid based system. Low, medium and high temperature collectors, Heat storage, storage media, steam accumulator, other storage systems, heat exchangers and applications of stored energy. (6)

## THERMO- ELECTRIC SYSTEMS

Thermoelectricity, Peltier effect, Seebeck effect; thermoelectric materials, Bismuth telluride, automotive thermoelectric generators, radioisotope thermoelectric generator; thermoelectric power generators, thermoelectric refrigerators and heat pumps. (6)

**TOTAL : 45**



## TEXT BOOKS

1. *Principles of Solar Engineering*, D. Yogi Goswami, Taylor and Francis, 2000, ISBN 10: 1-56032- 714-6
2. Garg H.P., Prakash J., "Solar Energy: Fundamentals & Applications", Tata McGraw Hill, New Delhi, 1997.

## REFERENCE BOOKS

1. *Applied Photovoltaics*, Stuart Wenham, Martin Green, and Muriel Watt, Earthscan, 2007, ISBN 1-84407-407-3
2. *Photovoltaic Engineering Handbook*, F. Lasnier and T. G. Ang, IOP Publishing UK (Adam Hilger USA) 1990, ISBN 0-85274-311-4
3. *Semiconductor Devices, Physics, and Technology, Second Edition*, S. M., Sze, New York, NY: Wiley, 2001. ISBN: 0471874248
4. *Solar Cells: Operating Principles, Technology and system Applications*, Martin A. Green, Published by the University of New South Wales, 1998, ISBN 0 85823 580 3
5. S. P. Sukhatme, "Solar Energy", Tata McGraw Hill, New Delhi, 1999.
6. J. A. Duffie and W.A.Beekman, " Solar Engineering of Thermal Processes", John Wiley and Sons, New York, 2005.
7. Tiwari G.N.,Suneja S., "Solar Thermal Engineering System", Narosa Publishing House, New Delhi, 1997.
8. T.Bhattachariya, "Terrestrial solar Photovoltaic", Narosa Publishers, New Delhi, 2008.
9. H.S.Rauschenbach, "Solar Cell Array Design Hand Book", Van NostrandReinfold Company, New York, 1980.

# 15EEOE01 - ENERGY AUDITING

L	T	P	C
3	0	0	3

## ASSESSMENT : THEORY

### COURSE OUTCOME

After successful completion of this course, the students will be able to

**C01** : Understand the current energy scenario and the need for energy auditing.

**C02** : Describe the energy conservation schemes in steam systems.

**C03** : Identify the design considerations for minimizing energy consumption in compressors, fans and blowers.

**C04** : Understand the concepts of energy efficient electrical systems.

**C05** : List the techno commercial statement for the investment for energy saving.

### POWER AND ENERGY MANAGEMENT

Energy Scenario - Role of Energy Managers in Industries - Energy Monitoring, Auditing and Targeting - Economics of various energy conservation schemes - Total Energy Systems. (9)

### ENERGY CONSERVATION IN MECHANICAL PROCESSES

Energy Audit - Various Energy Conservation Measures in Steam - Losses in Boiler - Energy Conservation in Steam Systems - Case studies. (9)

### ENERGY CONSERVATION IN PRODUCTIVE PROCESSES

Energy Conservation in Centrifugal pumps, Fans, Blowers and Air compressor - Energy Consumption - Energy saving potentials - Design Consideration. (9)

### ENERGY CONSERVATION IN NON - PRODUCTIVE PROCESSES

Refrigeration and Air conditioning - Heat load estimation - Energy conservation in cooling towers and Spray ponds - Energy Efficiency in Lighting - Case studies. (9)

### ENERGY CONSERVATION CONTROL STRATEGIES AND IMPLEMENTATION

Control: Thermostats - Boiler controls - Proportional, Integral and Derivative control - Adaptive control - Compensators. Implementation: Investment and Pay back calculations for energy conservation measures - Organizational support for energy management motivation. (9)

**TOTAL : 45**

### TEXT BOOKS

1. Eastop T.D and Croft D.R, "Energy Efficiency for Engineers and Technologists", Logman Scientific & Technical publications, 1990.
2. Reay D.A, "Industrial Energy Conservation", Pergamon Press, 1<sup>st</sup> Edition, 1977.
3. Larry C Witte et. al, "Industrial Energy Management & Utilization". Springer Publication, 1<sup>st</sup> Edition, 1990.

### REFERENCE BOOKS

1. D P Kothari and I J Nagrath, "Power System Engineering", Tata McGraw-Hill Co, 2<sup>nd</sup> Edition, 2008.
2. <https://www.beeindia.gov.in/content/energy-auditors> (Guide Book link)

### GUIDE BOOKS

- 2.1. General Aspects of Energy Management & Energy Audit
- 2.2. Energy Efficiency in Thermal Utilities
- 2.3. Energy Performance Assistance for Equipment And Utility Systems
- 2.4. Energy Efficiency in Electrical Utilities

# 15EEOE02 - SOLAR AND WIND ENERGY SYSTEMS

L	T	P	C
3	0	0	3

## ASSESSMENT : THEORY

### COURSE OUTCOME

After successful completion of this course, the students will be able to,

**CO1** : Describe the solar radiation, measurements and characteristics of solar PV cell.

**CO2** : Develop the model of a PV system and its applications.

**CO3** : Describe the basic types and mechanical characteristics and model of wind turbine.

**CO4** : Analyse the electrical characteristics and operation of various wind-driven electrical generators.

**CO5** : Understand various power electronic converters used for hybrid system.

### SOLAR RADIATION AND SOLAR CELL FUNDAMENTALS

Basic characteristics of sunlight - Solar spectrum - Insolation specifics - Irradiance and Irradiation pyranometer - Solar energy statistics - Solar PV cell - I - V characteristics - P - V characteristics - Fill factor. Modeling of solar cell - Maximum Power Point Tracking. (9)

### SPV SYSTEM PERFORMANCE AND APPLICATIONS

PV module - Blocking diode and Bypass diodes - Composite characteristics of PV module - PV array - Solar cell array design concepts - Peak power operation - System components. PV - powered fan - PV fan with battery backup - PV - powered pumping system - PV powered lighting systems - Grid connected PV systems. (9)

### WIND ENERGY FUNDAMENTALS AND COMPONENTS

Wind source - Wind statistics - Energy in the wind - Basic principle of wind energy conversion - Nature of wind power - Wind - turbine power characteristics - Parts of wind turbines - Braking systems - Tower - Maximum power operation. (9)

### WIND TURBINE TYPES AND CONTROL

Classification of WECS - Generating Systems - DC generator, Synchronous generator, Induction generator, Doubly fed Induction generator - Direct Driven generator - Generator control - Load control. (9)

### SYSTEM INTEGRATION

Energy storage - Power electronic converters for interfacing wind electric generators - Power Quality issues - Hybrid system: Wind Diesel systems - Wind - Solar systems. (9)

**TOTAL : 45**

### TEXT BOOKS

1. S N Bhadra, S Banerjee and D Kastha, 'Wind Electrical Systems', Oxford University Press, 1<sup>st</sup> Edition, 2005.
2. Chetan Singh Solanki, 'Solar Photovoltaic's: Fundamentals, Technologies and Applications' PHI Learning Publications, 2<sup>nd</sup> Edition, 2011.

### REFERENCE BOOKS

1. Roger A. Messenger and Jerry Ventre, 'Photovoltaic Systems Engineering', Taylor and Francis Group Publications, 2<sup>nd</sup> Edition, 2003.
2. M.Godoy Simoes and Felix A. Farret, 'Alternative Energy Systems: Design and Analysis with Induction Generators', CRC press, 2<sup>nd</sup> Edition, 2008.
3. Ion Boldea, 'The Electric Generators Hand Book - Variable Speed Generators', CRC press, 2010.

# 15EEOE03 - HYBRID SMART VEHICLES

L	T	P	C
3	0	0	3

## ASSESSMENT : THEORY

### COURSE OUTCOME

After successful completion of this course, the students will be able to,

**CO1** : Explain the dynamics of vehicle motion and propulsion systems.

**CO2** : Identify various energy storage devices used in hybrid vehicles.

**CO3** : Understand the application of electric machines in electric vehicles.

**CO4** : Describe the working of hybrid electric drive train

**CO5** : Describe the control and energy management strategies in hybrid vehicles.

### INTRODUCTION

Introduction to Hybrid Electric Vehicles - Social and Environmental importance of hybrid and Electric vehicles - Components, - Vehicle mechanics - Roadway fundamentals - vehicle kinetics - Dynamics of vehicle motion - Propulsion system (9)

### ENERGY STORAGE

Energy Storage Requirements in Hybrid and Electric Vehicles. Battery, Fuel Cell, Super Capacitor - Flywheel based energy storage and its analysis - Hybridization of different energy storage devices. (9)

### DC AND AC ELECTRICAL MACHINES

Motor and Engine rating - Requirements, DC machines, Three phase AC machines - Induction machines - Permanent magnet machines - Switched reluctance machines. Matching the electric machine and Internal Combustion Engine (ICE), - Sizing the motor - Sizing the power electronics - Selecting the energy storage technology - Communications - Supporting subsystems. (9)

### HYBRID ELECTRIC DRIVE-TRAIN

Basic concept of electric traction, Transmission configuration - Components - Gears - Differential - Clutch - Brakes Regenerative braking, Motor sizing. Hybrid traction : Various hybrid drive-train topologies, Power flow control in hybrid drive-train topologies, Fuel Efficiency Analysis. (9)

### ENERGY MANAGEMENT STRATEGIES

Energy management strategies used in hybrid and electric vehicles, - Component level control and supervisory control- Comparison and its implementation issues of different energy management strategies. (9)

Case study: Volvo XC90 T8 Plug-In Hybrid, Nissan X-Trial hybrid

**TOTAL : 45**

### REFERENCE BOOKS

1. Iqbal Hussain, "Electric & Hybrid Vehicles - Design Fundamentals", CRC Press, 2<sup>nd</sup> Edition, New York, 2010,
2. Mehrdad Ehsani, Yi mi Gao, Sebastian E. Gay and Ali Emadi, "Modern Electric, Hybrid Electric and Fuel Cell Vehicles: Fundamentals, Theory and Design", CRC Press, 2004.
3. James Larminie and John Lowry, "Electric Vehicle Technology", Wiley Publishers, 2003.

# 15EEE07 - ELECTRICAL SAFETY

L	T	P	C
3	0	0	3

## ASSESSMENT : THEORY

### COURSE OUTCOME

After successful completion of this course, the students will be able to

**CO1** : Expand skills in identifying the presence of electrical hazards, implementing measures to minimize risks.

**CO2** : Develop skills in investigative techniques for determining the cause of electrical accidents, fires and explosions.

**CO3** : Analyze and apply various grounding and bonding techniques.

**CO4** : Select appropriate safety method for low, medium and high voltage equipment.

**CO5** : Assess and provide solutions to a practical case study.

### INTRODUCTION AND HAZARDS OF ELECTRICITY

Introduction - Hazard Analysis: Primary and Secondary hazards- Arc, Blast, Shocks - Causes and Effects - Summary of Causes - Protection and Precaution - Injury and Death protective strategies - IE Rules 1956 - Basic rules for new installations: Power system, Domestic and Industry.(Qualitative treatment only) (9)

### ELECTRICAL SAFETY EQUIPMENT

General inspection and Testing procedure for electrical safety equipment - Electrical safety equipment for external protection: Flash and Thermal protection - Head and Eye protection - Insulation protection. Electrical safety equipment for internal protection: Over voltage, Short circuit, Earth Fault, Leakage current, High/Low frequency - Single Line diagram of industrial power system with safety control - Electrician's Safety Kit and Materials. (9)

### SAFETY PROCEDURES

Introduction - Six-Step Safety Method - Job briefings - Energized or De-energized - Safe switching of power systems - General Energy Control Programs - Lockout - Tag out - Voltage measurement techniques- Placement of safety grounds - Flash hazard calculations and approach distances - Calculating the required level of arc protection (Flash hazard calculations) - Barriers and Warning signs - Tools and Test equipment - Field marking of potential hazards - Shock avoidance techniques- One-minute safety audit. (9)

### GROUNDING AND ELECTRICAL MAINTENANCE

Need for Electrical Equipment grounding - System grounding - Equipment grounding - Types of Earthing - Earth Testing for electrical equipment's in Power house and Industry - Eight Step Maintenance program - Maintenance requirements for specific equipment and location - IEC and UL standard. (9)

### VOLTAGE SAFETY SYNOPSIS AND MEDICAL SAFETY MANAGEMENT

Safety equipment's and safety procedures for low voltage and high voltage system - Electrical safety around electronic circuits - Electrical safety for medical equipment like Over current safety, Isolation, EMI and Harmonics - Battery Maintenance Procedure - Stationary Battery Safety - Accident Prevention - Accident Investigation - First Aid - Rescue Techniques - Electrical safety program structure and development - Safety Meetings - Safety Audits. (9)

**TOTAL : 45**

### TEXT BOOKS

1. John Cadick, Mary Capelli-Schellpfeffer and Dennis neitzel and Al Winfield "Electrical Safety Handbook", McGraw-Hill Publishing Company Ltd., 4<sup>th</sup> Edition, 2012.
2. Dennis Neitzel and Al Winfield, "Electrical Safety Handbook", McGraw-Hill Education, 4<sup>th</sup> Edition, 2012.

## REFERENCE BOOKS

1. *Mohamed A El-Sharkawi, "Electric Safety: Practice and Standards", CRC press, New York, 2013.*
2. *Martha J. Boss and Gayle Nicoll, "Electrical Safety: Systems, Sustainability, and Stewardship", CRC press, New York, 2014.*
3. *Ray A. Jones and Jane G. Jones, "The Electrical Safety Program Guide", National Fire Protection Association, Quincy, 2011.*
4. *James H. Wiggins JR., "Managing Electrical Safety", Abs Consulting, Maryland, 2011.*
5. *Maxwell Adams. J, "Electrical Safety- A Guide to the Causes and Prevention of Electric Hazards", The Institution of Electric Engineers, 1994.*
6. *Ray A. Jones and Jane G. Jones, "Electrical Safety in the Workplace", Jones & Bartlett Learning, Technology and Engineering, 2000.*
7. *Video Link: Electrical Safety in the Workplace Seminar DVD - NFPA National Fire Protection Association.  
<http://www.nfpa.org/training-and-events/archived/training-videos/electrical-safety-videos>*
8. *E-Book: Johncadick, Marycapelli-schellpfeffer, Dennis neitzel, "Electrical Safety Handbook", McGraw Hill publishing company Ltd., 3<sup>d</sup> Edition, 1994.  
<https://installist.files.wordpress.com/2009/12/electrical-safety-handbook.pdf>*

# 15EEE14 - ENERGY EFFICIENT LIGHTING SYSTEM

L	T	P	C
3	0	0	3

## ASSESSMENT : THEORY

### COURSE OUTCOME

After successful completion of this course, the students will be able to,

**CO1** : Understand the properties of light, importance of lighting in various fields and types of lighting.

**CO2** : Understand the properties and laws of illumination, working of discharge lamps, fluorescent lamps, tungsten filament lamps and light control.

**CO3** : Compare the various lighting techniques & employ lighting control methods.

**CO4** : Choose the building materials and construction techniques for energy efficient lighting.

**CO5** : Employ renewable energy methods for energy efficient lighting.

### LIGHTING

Lighting - Importance of lighting in buildings, Interior designing - Photography, Architecture - Difference between good and bad lighting - Challenges in lighting - Types of lighting. (9)

### ILLUMINATION FUNDAMENTALS & VARIOUS ILLUMINATION METHODS

Introduction - Terms used in illumination - Laws of illumination - Polar curves - Photometry - Integrating sphere - Sources of light - Discharge lamps, Incandescent lamps - MV and SV lamps. (9)

### ENERGY EFFICIENT LIGHTING

Smart lighting - Fluorescent lamps - Comparison between tungsten filament lamps and fluorescent tubes - Basic principles of light control - Types and Design of lighting and flood lighting.- CFL - LED - High Intensity Discharge lamps (9)

### BUILDING MANGEMENT SYSTEM

Energy Efficient landscape design - Natural lighting - Choice of building materials for energy efficient lighting - Light pipes - Light fixtures - Green buildings - Construction techniques (9)

### CASE STUDY

Solar lighting techniques - Lighting using wind power - Energy conservation building code - Energy efficient buildings in the country. (9)

**TOTAL : 45**

### TEXT BOOKS

1. Philip Gordon, 'Principles and Practices of Lighting Design: The Art of Lighting Composition', Blue Matrix Publications, 2011.
2. Jerry Yudelson, 'Green Building Through Integrated Design', The McGrawHill Publisher, 2009.

### REFERENCE BOOKS

1. Derek Phillips, "Daylighting: Natural Light in Architecture" Elsevier, 2004.
2. Jerry Yudelson, "Greening Existing Buildings", The Mc Graw Hill Companies, 1<sup>st</sup> Edition, 2009.
3. Sam Kubba, "Handbook of Green Building Design and Construction", Elsevier, 2012.
4. Solanki.C.S, 'Solar Photovoltaic Technology and Systems', PHI 2013.
5. J. F. Manwell, J.G. MCGowan and A.L. Rogers, "Wind Energy Explained : Theory, Design and Applications", Wiley Publications, 2<sup>nd</sup> Edition, 2009.

# 15ECOE01 - CONSUMER ELECTRONICS

L	T	P	C
3	0	0	3

## ASSESSMENT : THEORY

### COURSE OUTCOME

Upon completion of this course the students will be able to demonstrate an ability to

**CO1** : Describe the fundamental concepts, construction and working of Audio systems

**CO2** : Analyze the recording and reproduction techniques of Audio Systems

**CO3** : Differentiate between the types of electronic music synthesizers

**CO4** : Describe the fundamental concepts, construction and working of Video systems

**CO5** : Identify the problem and troubleshoot the consumer electronic products like TV, Washing Machines, Air Conditioners

### AUDIO SYSTEM

Microphone - Characteristics of Microphones - Gun Microphones - Wireless Microphones - Headphones and Headsets - Electrostatic Phones - Electret Electrostatic Headphones - Hearing Impairments - Hearing Aids - Ideal Loudspeaker - Basic Loudspeaker - Loudspeaker Construction - Woofers - Mid range, Extended range and High frequency Loudspeakers - Multispeaker systems - Baffles - Horns - Stereo Systems. (10)

### RECORDING AND REPRODUCTION

Making the Record - Stereo Pickup Techniques - Stereo Recording Systems - Disc Equipment: Recording and Playback Characteristics - Stereo Pickup heads - Magnetic recording and Playback - Magnetic Erasing - Optical Recording and Reproduction - Mono, Stereo and Quad - Stereo Multiplexing - Equalisers and Mixers. (9)

### ELECTRONIC MUSIC SYNTHESIZERS

Typical Generator - Basic Modifiers - Voltage Control - Envelope Generator - Electric Guitar - Electric Wind Instrument -Recording - Digital Computer - Public Address System - Speaker Matching Systems - Theater Sound System: Sound track, Types of sound film, Theater Sound Reproduction system, Working of a Projector. (9)

### VIDEO SYSTEMS AND DISPLAYS

Monochrome - Color TV standards - TFT, Plasma, HDTV, LCD,LED TV, Video Telephone and Video Conferencing (9)

### DOMESTIC AND CONSUMER APPLIANCES

In Car Computers - Washing machines - Microwave ovens - Air-conditioners and Refrigerators - Airline Reservations - Remote controls Automated Teller Machines - Set top Boxes - Bar Codes - RFID (8)

**TOTAL : 45**

### TEXT BOOKS

1. *Bali, Consumer Electronics, Pearson Education, 1st Edition, 2005.*
2. *Philip Hoff, Consumer electronics for Engineers, Cambridge University Press, 1st Edition, 1998.*

### REFERENCE BOOKS

1. *Sridhar Canumalla, Puligandla Viswanadham P.S.Bimbra, Portable Consumer Electronics: Packaging, Materials, and Reliability, Pennwell Books, 1st Edition, 2010.*
2. *Douglas Kinney, A Beginners Guide to Consumer Electronics Repair: Hand Book and Tutorial, iUniverse, Inc, 1st Edition, 2006.*
3. *Thomas M. Coughlin, Digital Storage in Consumer Electronics: The Essential Guide, Elsevier Inc., 1st Edition, 2008.*
4. *U.S. Consumer Electronics Industry in Review, Electronic Industries Association, Consumer Electronics Group, 1993.*
5. <https://www.pssurvival.com/ps/electronic>



# 15ECOE02 - ARM SYSTEM ARCHITECTURE

L	T	P	C
3	0	0	3

## ASSESSMENT : THEORY

### COURSE OUTCOME

Upon completion of this course the students will be able to demonstrate an ability to

**CO1** : Distinguish between the feature of ARM7 and cortex microcontroller and infer the architecture, instruction set and programming model of ARM Cortex.

**CO2** : Interpret interrupt service handler & exception types of ARM processor to develop ALP programs.

**CO3** : Exemplify memory mapping technique in ARM embedded system.

**CO4** : Illustrate the programming concepts in real time embedded application.

**CO5** : Examine debugging technique to develop application software for real time system.

### EMBEDDED HARDWARE

ARM Embedded system-CISC and RISC philosophy-Embedded system Hardwar-ARM and Cortex architecture- Programming model- Date flow- Operating modes - Instruction sets. (9)

### INTERRUPT AND EXCEPTIONS

Interrupts in ARM and cortex- Exception Types- Fault Exceptions- The NVIC and Interrupt Control - Interrupt Behavior. (9)

### MEMORY SYSTEMS

Memory System Features Overview- Memory Maps- Memory Access Attributes- Default Memory Access Permissions- Bit-Band Operations- Unaligned Transfers- Exclusive Accesses and Endian Mode (9)

### PROGRAMMING

Exceptions Programming- Advanced Programming Features and System Behavior- Efficient C Programming- FIR and IIR filter implementation-Introduction to RTOS (9)

### SYSTEM DEBUGGING

Debugging Features- CoreSight- Debug Modes- Debugging Events- Breakpoint- Accessing Register - Debugging Components- Case study: Embedded system (using ARM/cortex) for monitoring- controlling and industrial automation. (9)

**TOTAL : 45**

### TEXT BOOKS

1. Andrew N. Sloss Dominic Symes Chris Wright, "ARM System Developer's Guide Designing and Optimizing System Software", Elsevier Inc 2010.
2. Joseph Yu, "The Definitive Guide to the ARM Cortex-M", Elsevier- Newness, 2014.

### REFERENCE BOOKS

1. Peter Barry Patrick Crowley "Modern Embedded Computing Designing Connected, Pervasive, Media- Rich Systems", Elsevier, 2012.
2. Steve Furber, "ARM system on Chip Architecture", Addison Wesley Professional, 2<sup>nd</sup> Edition, 2000.
3. Jonathan W Valvano, "Embedded systems : Introduction to ARM @ cortex TM - Micro controllers", 5<sup>th</sup> Edition, 2015.
4. Rajkamal, "Embedded system Architecture Programming and Design", Tata Mc Graw Hill, 2<sup>nd</sup> Edition, 2009.
5. Shibu K.V. "Introduction to Embedded Systems", Tata Mc Graw Hill, 1<sup>st</sup> Edition, 2009.

# 15ECOE03 - BROADBAND COMMUNICATION

L	T	P	C
3	0	0	3

## ASSESSMENT : THEORY

### COURSE OUTCOME

Upon completion of this course the students will be able to demonstrate an ability to

**CO1** : Describe the concepts and applications of Microwave and Millimeter wave communication

**CO2** : Comprehend and explain the operation of Satellite communication and navigation systems

**CO3** : Illustrate the operation of optical communication systems and high speed networks

**CO4** : Exemplify the features and functionalities of cellular communication from 2G to 4G and beyond

**CO5** : Distinguish and describe different wireless technologies based on its features and applications

### MICROWAVE AND MILLIMETER WAVE COMMUNICATION

Microwave concepts - devices and lines - waveguides and cavity resonators -Microwave semiconductor diodes-Microwave tubes - antennas - Microwave and millimeter applications (9)

### SATELLITE COMMUNICATION

Satellite orbits - Satellite Communication Systems - Satellite subsystems - Ground stations - Applications - Global Navigation satellite systems (9)

### OPTICAL COMMUNICATION

Optical principles - optical communication systems - fiber optics cables - optical transmitters and receivers - wavelength division multiplexing - passive optical networks -40/100Gbps networks and beyond (9)

### CELLPHONE TECHNOLOGIES

Cellular telephone systems - Cellular industry overview - 2G and 3G digital cell phone systems -Long term evolution and 4G cellular systems - Base stations and small (9)

### WIRELESS TECHNOLOGIES

Wireless LAN - PANs and Bluetooth - Zigbee and mesh wireless networks - Wi-Max and wireless Meteropolitan area networks - Infrared wireless - Radio frequency identification - Ultra wideband wireless-wireless applications (9)

**TOTAL : 45**

### TEXT BOOK

1. Louis E.Frenzel,"Principles of Electronic Communication Systems", Mc-Graw hill Education,4th edition,2016

### REFERENCE BOOKS

1. Kennedy G, "Electronic Communication Systems", Tata McGraw Hill, 4th Edition, 1999.
2. Rappaport,T.S, "Wireless communications", Pearson Education, 2nd Edition, 2010
3. William Stallings, "Wireless Communications and networks", Pearson Prentice Hall of India, 2nd Edition, 2009.
4. David Tse, Pramod Viswanath, "Fundamentals of Wireless Communication", Cambridge University Press, 1st Edition, 2005.
5. Aditya K.Jagannathan, "Principles of Modern Wireless Communication Systems: Theory and Practice", Mc-Graw hill Education, 2016.

# 15ECOE04 - ROBOTICS FOR INDUSTRIAL APPLICATIONS

L	T	P	C
3	0	0	3

## ASSESSMENT : THEORY

### COURSE OUTCOME

Upon completion of this course the students will be able to demonstrate an ability to

**CO1** : Comprehend and appreciate the significance and role of industrial robot in the present contemporary world

**CO2** : Exemplify the features and functionalities of the sensors in Robot

**CO3** : Develop different language programs to design and develop robotic based systems

**CO4** : Develop system for industrial automation and medical application

**CO5** : Illustrate the methodologies to provide automatic solution for replacing humans in life threatening area

### SCOPE OF ROBOTS

The scope of industrial Robots - Definition of an industrial robot - Need for industrial robots -Economic and Social Issues- applications. (4)

### ROBOT COMPONENTS

Fundamentals of Robot Technology - Automation and Robotics - Robot anatomy - Work volume -Precision of movement - End effectors - Sensors. (9)

### ROBOT PROGRAMMING

Robot Programming - Methods - interlocks textual languages. Characteristics of Robot level languages, characteristic of task level languages. (9)

### ROBOT WORK CELL

Robot Cell Design and Control - Remote Center compliance - Safety in Robotics. (9)

### FUTURE TRENDS

Telepresence robot, Autonomous mobile robots, Walker Robots, Solar-ball Robot, Underwater bots, Aerobots, Advanced robotics in Space - Specific features of space robotics systems - longterm technical developments, Next generation robots. (14)

**TOTAL : 45**

### TEXT BOOKS

1. Robert J. Schilling, "Fundamentals of Robotics- Analysis and Control", Pearson Education, 2006.
2. John M. Holland, "Designing Autonomous Mobile Robots-Inside the mind of an Intelligent Machine", Newnes Publication, 2004.

### REFERENCE BOOKS

1. Mikell P.Groover, Mitchell Weiss, Roger N.Nagel Nicholas G.Odrey, "Industrial Robotics Technology, Programming and Applications", McGraw Hill Book Company 1986.
2. John Iovine, "Robots, Android and Animatronics", Second Edition, McGraw-Hill, 2012.
3. Fu K.S. Gonzaleaz R.C. and Lee C.S.G., "Robotics Control Sensing, Vision and Intelligence", McGraw Hill, International Editions, 1987.
4. Bernard Hodges and Paul Hallam, "Industrial Robotics", British Library Cataloging in Publication 1990.
5. Deb, S.R., "Robotics Technology and flexible automation", Tata McGraw Hill, 1994.

# 15ECOE05 - SIGNAL PROCESSING AND ITS APPLICATIONS

L	T	P	C
3	0	0	3

## ASSESSMENT : THEORY

### COURSE OUTCOME

Upon completion of this course the students will be able to demonstrate an ability to

- CO1** : Compute the Discrete Fourier Transform (DFT) of a given discrete time sequence using Radix-2 Fast Fourier Transform algorithms and design FIR/IIR Filters
- CO2** : Apply source coding procedure to calculate coding efficiency based on entropy & mutual information and outline different pulse analog modulation techniques
- CO3** : Analyze various equalization techniques and compare its performance
- CO4** : Calculate channel capacity using Shannon's channel capacity theorem and develop channel error control codes
- CO5** : Analyze speech processing methods in time and frequency domain and design codec methods for speech compression techniques

### ORTHOGONAL TRANSFORMS AND DIGITAL FILTER STRUCTURES

DFT-DCT-Properties of DFT- Computation of DFT, FFT and structures-Decimation in time-Decimation in frequency - Linear convolution using DFT

Basic FIR/IIR filter structures-FIR/IIR Cascaded lattice structures-Parallel allpass realization of IIR transfer functions- Sine cosine generator - Computational complexity of filter structures (10)

### DATA COMPRESSION

Information entropy-Source coding-Huffman algorithm-Delta Modulation-Adaptive Delta Modulation- Continuously Variable Slope Delta Modulation-Differential Pulse Code Modulation - Adaptive Differential Pulse Code Modulation. (8)

### SIGNAL PROCESSING IN COMMUNICATION RECEIVER

Temporal Equalization-Space Time Equalization-Frequency Domain Equalization-Symbol Timing Recovery- Channel Quality Estimation- Automatic Frequency Control-Overall Receiver Block. (9)

### ERROR CORRECTING CODES & CHANNEL CODING

Error Correcting codes-Error Correction-Linear Blocks Codes-Cyclic Codes- Bose, Chaudhari and Hocquenghem Codes- Convolution Codes-Viterbi Decoding-Interleaving Codes-Concatenated Codes- Turbo Codes. (9)

### SPEECH CODING

Speech Coding-Adaptive Predictive Coding-Sub Band Coding,-Vocoders-Liner Predictive Coding- Image Coding-Joint Photo Graphic Expert Group(JPEG)-Moving Pictures Expert Group(MPEG), the layer-3 of MPEG-1 Algorithms(MP3),Lempel- ZIV Algorithms - Recognition techniques:Speech Recognition and Image recognition (9)

**TOTAL : 45**

### TEXT BOOKS

1. V. Oppenheim, R. W. Shafer and J.R.Buck, "Discrete-Time Signal Processing", Pearson Education, 4th Edition,2011
2. Simon Haykins, "Digital Communications Systems", 1st Edition, Wiley, 2013.

### REFERENCE BOOKS

1. Sanjit. K. Mitra and Sanjit Kumar Mitra, "Digital Signal Processing - A computer based approach", Tata McGraw Hill, 4th Edition, 2011.
2. Todd K Moon, "Error Correction Coding - Mathematical methods and Algorithms", John Wiley & Sons, 2005.
3. Roberto Togneri, Christopher J.S DeSilva, "Fundamentals of Information Theory and Coding Design", CRC press, 2003
4. L.R.Rabiner and R.W.Schaffer "Digital Processing of Speech signals" Prentice Hall 1978
5. Nirmal K. Bose, Calyampudi Radhakrishna Rao, "Signal Processing and Its Applications" North-Holland, 1993

# 15CSOE01 - FUNDAMENTALS OF SOFTWARE ENGINEERING

L	T	P	C
3	0	0	3

## ASSESSMENT : THEORY

### COURSE OUTCOME

- CO1** : Describe the various software life cycle models and choose an appropriate model for a given application.
- CO2** : Identify the functional requirements, prepare data flow, ER diagrams and Software Requirement Specifications.
- CO3** : Employ suitable architectural styles, software design methodologies, coding standards and practices in developing practical applications
- CO4** : Discuss various testing techniques and their application in defect removal.

### INTRODUCTION

The Software Engineering Discipline - Software Development Projects - Software Life Cycle Models: Use of Life Cycle Models - Classical Waterfall Model-Iterative Waterfall Model-Prototype model-Evolutionary Model-Spiral Model (9)

### SOFTWARE REQUIREMENTS AND ANALYSIS

Requirements Analysis and Specification - Requirements Gathering and Analysis- Value of good SRS - Requirement process- Requirement Specification - desirable characteristics, components and Structure of requirements document - Functional Specification with use cases - basics - developing Use Cases -DFDs - Data Dictionary - ER Diagrams. (8)

### SOFTWARE DESIGN

Design concepts - Cohesion and Coupling- The Open-Closed Principle - Function Oriented Software Design: Structured charts - Structured design methodology - Detailed Design: Logic / Algorithm design - State Modeling of Classes. (10)

### CODING

Programming principles and guidelines - Structured programming - Information hiding - some programming practices - Coding standards - Code inspection - Planning- Self review - Group review meeting. (7)

### TESTING

Testing Fundamentals -Black Box Testing: Equivalence Class Partitioning - Boundary Value Analysis - White box Testing: Control Flow based criteria - Data Flow based Testing - Levels of Testing: Unit Testing - Integration Testing - System Testing - Acceptance Testing. (11)

**TOTAL : 45**

### TEXT BOOKS

1. Pankaj Jalote, "Software Engineering A precise Approach", Wiley India, Third edition 2012.
2. Rajib Mall, "Fundamentals of Software Engineering", PHI Learning Private Limited, Third Edition 2013. ( Introduction only)

### REFERENCE BOOKS

1. Roger.S.Pressman "Software Engineering A Practitioner's Approach", McGraw Hill International Edition, Seventh Edition, 2014.
2. Ian Sommerville, "Software Engineering", Dorling Kindersley (India) Private Ltd., Eighth Edition, 2008.

# 15CSOE02 - INTRODUCTION TO DATA WAREHOUSING AND DATA MINING

L	T	P	C
3	0	0	3

## ASSESSMENT : THEORY

### COURSE OUTCOME

**CO1** : Describe the basic concepts, architecture, data models of database management systems and data warehouse.

**CO2** : Demonstrate the multidisciplinary fields of data mining and illustrate the techniques for data preprocessing.

**CO3** : Find frequent item set and generate association rules for the given transactions.

**CO4** : Analyze different types of data using classification and clustering techniques.

### BASIC CONCEPTS OF DATABASE SYSTEM

Purpose of DBMS - Applications - Views of data - Data Abstraction - Instances and Schemas - Data Models - Database Languages - Relational Databases - Database Architecture - Database users and administrators - History of Database systems  
(8)

### DATA MINING

Data Mining - On What Kind of Data-Data Mining Functionalities - Classification of Data Mining Systems - Data Mining Task Primitives - Integration of a Data Mining System with a Database or Data Warehouse System-Major Issues in Data Mining. (9)

### DATA WAREHOUSING

Data Warehouse - Introduction-Multidimensional Data Model-Data Warehouse Architecture -Data Warehouse Implementation - From Data Warehousing to Data Mining. (8)

### DATA PREPROCESSING AND ASSOCIATION RULES

Data Preprocessing: Needs Preprocessing the Data - Data Cleaning- Data Integration and Transformation-Data Reduction-Discretization and Concept Hierarchy Generation. Association Rules: Basic concepts - Apriori Algorithm - Generation of association rules from frequent item sets - FP Tree Algorithm - Pattern evaluation methods (10)

### CLUSTERING AND CLASSIFICATION

Cluster analysis - Partitioning Methods - K-Means and K-Medoid algorithm - CLARA - CLARANS - Hierarchical clustering - BIRCH - Density based clustering - DBSCAN - Decision tree induction. (10)

**TOTAL : 45**

### TEXT BOOKS

1. Abraham Silberschatz, Henry F. Korth, S. Sudharshan, "Database System Concepts", Tata McGraw Hill, Sixth Edition, 2013. (Basic Concepts of Database System only)
2. Jiawei Han & Micheline Kamber, "Data Mining-Concepts and Techniques" Morgan Kaufmann Publishers, Third Edition, 2012.

### REFERENCE BOOKS

1. Ramez Elmasri, Shamkant B. Navathe, "Fundamentals of Database Systems", Pearson Education, Sixth Edition, 2013.
2. Arun K Pujari, "Data Mining Techniques" Universities Press India Ltd., Third Edition, 2012.
3. Dunham, "Data Mining- Introductory and Advanced Topics", Pearson Education, New Delhi, First Edition, 2006.
4. Pieter Adriaans, Dolf Zantinge, "Data Mining ", Pearson Education, Third Edition 2009, Delhi.
5. Sam Anahory, Dennis Murray, "Data Warehousing in the Real World ", Pearson Education, Seventh Indian Reprint New Delhi, 2003.
6. George M. Marakas, " Modern Data Warehousing, Mining, & Visualization Core concepts", Pearson Education, First Edition, 2003
7. Paulraj Ponnaiah, "Data Warehousing Fundamentals", Wiley Publishers, Singapore, First Edition, 2001.

# 15CSOE03 - INTRODUCTION TO EMBEDDED SYSTEMS

L	T	P	C
3	0	0	3

## ASSESSMENT : THEORY

### COURSE OUTCOME

**C01** : Examine the characteristics and challenges in embedded system development

**C02** : Identify the parameters affecting CPU performance and develop optimized code

**C03** : Demonstrate the scheduling of given set of real-time tasks using the appropriate scheduling algorithm

**C04** : Design embedded system for simple applications

### INTRODUCTION

Characteristics of embedded computing applications- Challenges in embedded computing design - Performance in embedded computing.Embedded System Design Process - Computer Architecture Taxonomy - ARM Processor -Assembly Language Programming. (10)

### CPU PERFORMANCE

I/O Primitives - Busy -Wait I/O - Interrupts - Memory System Mechanisms: Cache, Memory Management Unit and Address Translation - Pipelining - CPU Power Consumption (8)

### DEVELOPMENT AND DEBUGGING

Development environments - Debugging Techniques - Debugging challenges - System Level Performance analysis - Program Level Performance analysis - Program Optimization (9)

### SCHEDULING

Scheduling states of a Process-Running Periodic Processes - Preemption - Priorities- Rate Monotonic Scheduling - Earliest Deadline First Scheduling - Priority Inversion - Data dependency. (10)

### NETWORKS

Bus Standards: I2C, CAN Bus, Field Bus. CASE STUDY: Alarm Clock, Elevator Controller. (8)

**TOTAL : 45**

### TEXT BOOK

1. Marilyn Wolf, "Computers as Components: Principles of Embedded Computing System Design", Morgan Kaufman, Third Edition, 2012

### REFERENCE BOOKS

1. Rajib Mall, "Real-Time Systems: Theory and Practice", Pearson Education, First Edition, 2009. (For Scheduling)
2. David. E. Simon, "An Embedded Software Primer", Pearson Education, First Edition, 2012
3. Rajkamal, "Embedded Systems: Architecture, Programming and Design", McGraw Hill, Third Edition, 2014.



# 15CSOE04 - INTERNET PROGRAMMING

L	T	P	C
3	0	0	3

## ASSESSMENT : THEORY

### COURSE OUTCOME

- CO1 : Gain knowledge in overview of www and web based applications.*
- CO2 : Design and develop dynamic and Interactive web page using DHTML.*
- CO3 : Design and develop web applications using servlets.*
- CO4 : Gain knowledge on E-business models and E-marketing.*

### BASIC WEB CONCEPTS

Basic Web Concepts - Web based Client/Server model -Web Protocols- Working of web browser - Browser & Server Communication - Review of HTML: Markup Languages, Introduction to HTML- forms - frames - tables. (9)

### CLIENT SIDE PROGRAMMING

Client-side Programming (Review of JavaScript): Introduction, Writing Comments, Variables, Operators, Statements, Alert, Confirm, and Prompt Boxes, Functions, Event and Error Handling, Introduction to Built-in Classes, Form Validation, Cookies. (9)

### DYNAMIC HTML

Dynamic HTML :Introduction - cascading style sheets-object model and collections - event model - filters and transition - data binding - data control - ActiveX control - handling of multimedia data. (9)

### SERVER SIDE PROGRAMMING

Servlets - Deployment of simple servlets - web server (Java web server / Tomcat / Web logic) - HTTP GET and POST requests - session tracking - cookies - JDBC - simple web applications - Multi-tier applications. (9)

### WEB BASED APPLICATIONS AND ITS TECHNOLOGIES

Rails:Overview of Rails-Ajax:Overview of Ajax Rails with Ajax- e-Business Models-e-Marketing-online payments-Security. (9)  
**TOTAL : 45**

### TEXT BOOKS

1. Deital & Deital, "Internet and World Wide Web-How to Program", Pearson Education Fifth Edition, 2011.
2. Robert W.Sebesta, "Programming with World Wide Web", Pearson Education, Eighth Edition, 2015.

### REFERENCE BOOKS

1. Scot Johnson, Keith Ballinger,Davis Howard Chapman, "Special Edition Using Active Server Pages", Prentice Hall of India,paperback 1999.
2. Ravi Kalakota and Andrew B Whinston, "Frontiers of e-commerce", Addison Wesley, paperback 1999.
3. Jeffrey C. Jackson," Web Technologies: A Computer Science Perspective", Pearson Education, Reprint 2011.
4. Elliotte Rusty Harold, "Java Network Programming", O'Reilly Publishers, Fourth Edition 2013.



# 15CSOE05 - CUSTOMER RELATIONSHIP MANAGEMENT ESSENTIALS

L	T	P	C
3	0	0	3

## ASSESSMENT : THEORY

### COURSE OUTCOME

- CO1** : State the evolution of marketing and define CRM architecture explaining customer acquisition, retention and segmentation.
- CO2** : Describe the business value, its costs and deploying data mining for CRM with proper guidelines for privacy.
- CO3** : Demonstrate the scoring process and apply the various CRM optimization techniques to optimize CRM process in order to improve customer profitability.
- CO4** : Evaluate CRM tools using tool assessment and methodology to choose the appropriate tool for real time applications.

### INTRODUCTION

Most profitable Customer - CRM: Custom centered database, Managing campaigns, Evolution of marketing, Closed loop marketing, CRM architecture - Customer profitability - Customer acquisition - Cross selling - Customer retention - Customer segmentation. (9)

### BUILDING THE BUSINESS CASE

Introduction - Uncovering the needs for data mining - Defining the business value - The costs - Deploying Data mining for CRM: Introduction - Define the problem - Define the user - Define the data - Scope the project - Trial - Quality assurance - Education - Launch - Continuation. (10)

### COLLECTING CUSTOMER DATA

Introduction - Three types of customer data - Collecting customer data - Connecting customer - Customer data and privacy - Privacy and data mining - Guidelines for privacy - Legal issues associated with data mining. (8)

### SCORING YOUR CUSTOMER

Introduction - Process - Scoring architectures and configurations - Preparing the data - Integrating scoring with other applications - Optimizing the CRM process: Introduction - Improved customer profitability through optimization - Optimized CRM - Complete loop - Optimal CRM process - Optimization techniques. (8)

### OVERVIEW OF DATA MINING AND CRM TOOL MARKETS

Introduction - Data mining market place - Taxonomy of data mining tools - Tool assessment attributes and methodology - Tool evaluation - Other data mining tools - CRM tools - Next generation for CRM. (10)

**TOTAL : 45**

### TEXT BOOK

1. Alex Berson, Stephen Smith, Kurt Thearling, "Building Data mining Applications for CRM", Tata McGraw Hill, Fifteenth Reprint, 2008.

### REFERENCE BOOKS

1. Francis Buttle, Stan Maklan "Customer Relationship Management: Concepts and Technologies", Routledge, Third Edition, 2015.
2. Roger J. Baran, Robert J. Galka, "CRM: The Foundation of Contemporary Marketing Strategy", S.Chand (G/L) & Company Ltd, Second Edition, 2017.

# 15CSOE06 - E-COMMERCE

L	T	P	C
3	0	0	3

## ASSESSMENT : THEORY

### COURSE OUTCOME

**CO1** : Describe the features of e-commerce, various business models and marketing strategies used in e-commerce.

**CO2** : Use the knowledge on the mechanics of building a secure e-commerce website and payment systems.

**CO3** : Comprehensive online retailing, marketing and impact of social media.

**CO4** : Illustrate the procurement process and supply chain management in B2B e-commerce.

### INTRODUCTION

E-commerce: E-commerce and E-business - Features of E-commerce Technology - Types of E-commerce. Understanding E-commerce: Technology - Business and Society. E-commerce Business Models and Concepts: Eight Key Elements - Strategy, Structure and Process: Industry Structure - Industry Value Chains - Firm Value Chains - Firm Value Webs - Business Strategy. (7)

### BUILDING E-COMMERCE WEBSITE

Building an Ecommerce Presence: Systematic Approach - Choosing Software and Hardware: Web Server Software - Application Servers - Merchant Server Software Functionality and Packages - Web Services and Open Source Options - Other E-commerce Site Tools - Developing Mobile Website and Building Mobile Applications. (8)

### E-COMMERCE SECURITY AND PAYMENT SYSTEMS

Ecommerce Security Environment - Security Threats - Management Policies, Business Procedures and Public Laws - Payment Systems - E-commerce Payment Systems. (7)

### SOCIAL, MOBILE AND LOCAL MARKETING

Introduction to Social, Mobile and Local Marketing - Social Marketing: Social Marketing Players - The Social Marketing Process - Face book Marketing - Twitter Marketing - Pinterest Marketing - The Downside of Social Marketing - Mobile Marketing: Basic Mobile Marketing Features - Mobile Marketing Tools - Mobile Marketing Campaign - Local and Location Based Marketing: Location Based Marketing Platforms - The Technologies - Marketing Tools - Marketing Campaign - Marketing Results. (8)

### ONLINE RETAIL SERVICES, AUCTIONS AND PORTALS

E-commerce in Action: E-tailing Business Models: Virtual Merchants - Multi-channel Merchants - Catalog Merchants - Manufacturer Direct - Online Financial Services - Online Travel Services - Online Career Services. Online Auctions: Measuring Growth of Auctions and Dynamic Pricing - Benefits of Auctions - Risks and Costs of Auctions for Consumers and Businesses. E Commerce Portals: Types of Portals - Portal Business Models. (9)

### E-COMMERCE, SUPPLY CHAIN AND COLLABORATIVE MANAGEMENT

Defining and Measuring the Growth of B2B Commerce - Benefits and Challenges of B2B E-commerce - The Procurement Process and Supply Chain - Types of Procurement. Trends in Supply Chain Management and Collaborative Commerce: Just-in-Time and Lean Production - Supply Chain Simplification - Adaptive Supply Chains - Accountable Supply Chains - Sustainable Supply Chains - Electronic Data Interchange - Supply Chain Management Systems - Collaborative Commerce. (6)

**TOTAL : 45**

### TEXT BOOK

1. Kenneth C. Laudon, Carol Guercio Traver, "E-Commerce-Business, Technology, Society", Pearson India, Tenth edition, 2016.

## REFERENCE BOOKS

1. *Ravi Kalakota, Andrew Whinston, "Frontiers of Electronic Commerce", Pearson India, fourteenth Reprint 2007.*
2. *Dave Chaffey, "E - Business and E - Commerce Management: Strategy, Implementation, and Practice:" Pearson India, Sixth Edition, 2013.*
3. *Henry Chan, Raymond Lee, Tharam Dillon, Elizabeth Chang, "E-Commerce, Fundamentals and Applications", Wiley India Private Ltd Reprint 2008.*

# 15ITOE01 - DIGITAL COMPUTER BASICS

L	T	P	C
3	0	0	3

## ASSESSMENT : THEORY

### COURSE OUTCOME

- CO1** : Explain various schemes of number system representations, code conversions and perform arithmetic operations.
- CO2** : Describe Boolean Algebra, formulate and simplify Boolean expressions using K-Maps and illustrate the logic gates realization..
- CO3** : Describe the working of basic combinational circuits and sequential circuits.
- CO4** : Describe the structure and functioning of various memory schemes.

### NUMBER SYSTEMS

Binary Numbers, Number Base Conversions, Octal and Hexadecimal Numbers. Complements of Numbers - Signed Binary Numbers. Binary Codes : Binary-Coded Decimal (BCD) Code, Gray Code, ASCII Character Code, Error Detecting Code. BCD Addition - Decimal Arithmetic. Binary Storage and Registers. (9)

### BINARY LOGIC AND BOOLEAN ALGEBRA

Definition of Binary logic. Boolean Algebra - Basic Definitions - Theorems and Properties of Boolean Algebra - Canonical and Standard Forms. Digital Logic Gates : Integrated Circuits. Gate-Level Minimization: Map Method - Four Variable K-Map - Product of Sums Simplification. Realization of Boolean functions using Gates. (10)

### COMBINATIONAL CIRCUITS

Adder : Half Adder - Full Adder - Binary Parallel Adder - BCD Adder. Subtractor : Half Subtractor - Full Subtractor. Code Conversion. Decoders - De-Multiplexer - Encoders - Multiplexers. (9)

### SEQUENTIAL CIRCUITS

Storage Elements - Latches, Flip Flops - RS,D,JK and T flip - flops - Triggering of flip - flops - Characteristic Tables - Characteristic Equations. Registers - Shift Registers. Counters: Binary ripple counter - Updown binary counter. (9)

### MEMORY AND PROGRAMMABLE LOGIC

Random Access Memory - Memory Decoding - Read Only Memory - Types of ROMs, Programmable Logic Array, Programmable Array Logic. (8)

**TOTAL : 45**

### TEXT BOOK

1. M. Morris Mano and Michael D. Ciletti, "Digital Design with an Introduction to the Verilog HDL, Pearson Education, Fifth edition, 2013.

### REFERENCE BOOKS

1. M. Morris Mano, "Digital Logic and Computer Design", Pearson Education, First edition, 2008.
2. Thomas L.Floyd, "Digital Fundamentals", Pearson Education, Tenth edition, 2011.

# 15ITOE02 - PROGRAMMING IN JAVA

L	T	P	C
3	0	0	3

## ASSESSMENT : THEORY

### COURSE OUTCOME

**CO1** : Describe the fundamental aspects of object oriented programming paradigm.

**CO2** : Develop java programs using features like methods, classes, constructors, overloading and string handling.

**CO3** : Write exception handling routines for practical applications.

**CO4** : Describe multithreading, synchronization and networking features of Java.

**CO5** : Demonstrate use of applets and database connectivity in developing practical Applications.

## OBJECT ORIENTED PROGRAMMING

Introduction to object oriented languages - Evolution of object oriented languages - Object oriented programming paradigm - Basic concepts of object oriented programming - Procedural Vs object oriented programming. (6)

## INTRODUCTION TO JAVA

Java and Internet - Byte Code - Features of Java - Java Development Environment- Java Programming: Methods and Classes - Constructor - Garbage Collection - Overloading - Inheritance - Overriding - Packages and Interfaces - Java IO systems - String Handling : String and String Buffer. (12)

## EXCEPTION HANDLING

Exception Handling: Fundamentals of Exception handling and types - Built in Exceptions - user defined Exceptions. (5)

## MULTI THREADS

Multithreaded Programming : Thread Model - Thread properties - Thread priorities -Synchronization- Inter thread communication- Networking : Inet address - Datagrams - Sockets - URL connections. (11)

## APPLET AND DATABASE CONNECTIVITY

Introduction to Abstract Window Tool kit - Applet class - HTML applet tags - Parameter passing - Audio clip interface - Event class: Keyboard and Mouse events handling. (11)

**TOTAL : 45**

## TEXT BOOK

1. *Herbert Schilt : " Java 2 - Complete references ", Tata McGraw Hill, Ninth Edition, McGraw Hill Education, 2014.*

## REFERENCE BOOKS

1. *Deitel H.M and Deitel P.J, "Java - How to Program", Prentice Hall of India, Ninth Edition, 2012.*

# 15ITOE03 - FUNDAMENTALS OF DATABASE SYSTEMS

L	T	P	C
3	0	0	3

## ASSESSMENT : THEORY

### COURSE OUTCOME

**CO1** : Describe the database system concepts and explain the key features of Relational data models.

**CO2** : Describe the features of Entity Relationship diagram and draw Entity Relationship diagram for the given real world application

**CO3** : Design a normalized database system and carry out data retrieval using SQL.

**CO4** : Demonstrate various transaction concepts and various concurrency control mechanisms

### DATABASE SYSTEMS

Data Vs Information-Introducing the database and DBMS- Importance of Database Design- Files and File systems-Problems with File System Data Management, Database Systems.

Relational Database Model: Logical view of Data- Keys- Integrity Rules- Relational Set Operators- Data Dictionary and the system catalog -Codd's relational database rules. (10)

### RELATIONAL MODEL

Entity Relationship Model: Entities-Attributes-Relationship-Connectivity and cardinality-Existence Dependence-Relationship Strength-Weak Entities-Relationship participation-Relationship Degree-Recursive Relationship-Developing an ER Diagram. (8)

### STRUCTURED QUERY LANGUAGE

Introduction to SQL- Data Definition Commands- Data Manipulation Commands-Advanced Data Definition and SELECT Commands - Virtual Tables -Creating Views- Joining Database Tables. (8)

### DATABASE DESIGN

Database Tables and Normalization- Need for Normalization- Normalization Process-Improving the Design-Surrogate Key Considerations, High level Normal Forms, Normalization and Database Design-Denormalization. (10)

### TRANSACTION MANAGEMENT

Transaction Concepts: Transaction Properties- Transaction Concurrent Executions. Concurrency control with Locking Methods: Lock Granularity-Lock Types-Two-Phase Locking to Ensure Serializability-Deadlocks-Database Recovery Management-RAID. (9)

**TOTAL : 45**

### TEXT BOOK

1. Peter Rob, Corlos M. Coronel, "Database Systems: Design, Implementation and Management", Thompson Learning Course Technology, Tenth edition, 2012.

### REFERENCE BOOKS

1. Abraham Silberschatz, Henry F.Korth,S.Sudharshan,"Database System Concepts", McGraw-Hill, Sixth Edition, 2013.
2. Ramez Elmasri, Shamkant B. Navathe, "Fundamentals of Database Systems", Pearson Education, Sixth Edition, 2013.
3. Raghu Ramakrishnan, Johannes Gehrke, "Database Management Systems", McGraw Hill Education, Third Edition, 2014.
4. Thomas M.Connolly and Carolyn E.Begg, "A Practical Approach to Design, Implementation and Management", Pearson, 6th Edition, 2014.

# 15ITOE04 - CLOUD COMPUTING FUNDAMENTALS

L	T	P	C
3	0	0	3

## ASSESSMENT : THEORY

### COURSE OUTCOME

**CO1** : Understanding the client- server, distributed collaborative and cloud computing architecture along with cloud storage and services.

**CO2** : Classify the different virtualization environments and techniques.

**CO3** : Illustrate various services deployed from a cloud architecture supported by different providers.

**CO4** : Analyze the major security challenges and privacy problems in the cloud and virtual environment.

### INTRODUCTION

Understanding Cloud Computing- history of cloud computing: Client/Server computing, Peer to peer computing, Distributed computing and Collaborative computing.- Understanding cloud architecture, cloud storage and services-Pros and cons of cloud computing. (9)

### VIRTUALIZATION

Introduction-Characteristics of Virtualized Environments - Taxonomy of Virtualization Techniques - Virtualization and Cloud Computing - Pros and Cons of Virtualization - Technology Examples (9)

### CLOUD COMPUTING ARCHITECTURE

Cloud reference model: Architecture, Infrastructure / Hardware as a service, Platform as a service-Software as a service, Types of cloud: Public clouds, Private clouds, Hybrid Cloud, Community Clouds. (9)

### CLOUD SERVICES

Discovering Cloud services Development services and tools: Amazon, Google App Engine, IBM, Salesforce.com, Other Cloud Services development tools. (9)

### CLOUD SECURITY

Security Overview - Cloud Security Challenges - Software as a Service Security - Security Governance - Risk Management - Security Monitoring - Security Architecture Design - Data Security - Application Security - Virtual Machine Security. (9)

**TOTAL : 45**

### TEXT BOOKS

1. Michael Miller, "Cloud Computing: Web-Based Applications That Change the Way You Work and Collaborate Online", 1st Edition, Pearson Education, New Delhi, 2009.
2. Rajkumar Buyya, Christian Vecchiola, and Thamarai Selvi, "Mastering Cloud Computing", Tata McGraw Hill, 2013.(Virtualization, Cloud Computing Architecture)
3. John W.Rittinghouse and James F.Ransome, "Cloud Computing: Implementation, Management, and Security", CRC Press, 2010. (Cloud Security)

## REFERENCE BOOKS

1. *Toby Velt, Anthony Velt, Robert Elsenpeter, "Cloud Computing, A Practical Approach", McGraw-Hill Osborne Media, 2009.*
2. *Tom White, "Hadoop: The Definitive Guide", Yahoo Press, 2012.*
3. *Kai Hwang, Geoffrey C Fox, Jack G Dongarra, "Distributed and Cloud Computing, From Parallel Processing to the Internet of Things", Morgan Kaufmann Publishers, 2012.*



# 15ITOE05 - INFORMATION SECURITY FUNDAMENTALS

L	T	P	C
3	0	0	3

## ASSESSMENT : THEORY

### COURSE OUTCOME

**CO1** : Identify and analyze the security threats and attacks and apply device suitable security policies and standards.

**CO2** : Assess the risks and apply suitable risk control strategies.

**CO3** : Employ appropriate intrusion detection and prevention systems to ensure information security.

**CO4** : Discuss various national and international laws of information security and its framework.

### INTRODUCTION, NEED FOR SECURITY

Introduction to Information Security - The History of Information Security- Critical Characteristics of Information - NSTISSC Security Model - Components of an Information System - Securing Components - Balancing Information Security and Access - The Systems Development Life Cycle - The Security Systems Development Life Cycle. The Need for Security: Introduction - Business Needs First -Threats -Attacks. (5)

### RISK MANAGEMENT AND INFORMATION SECURITY

Introduction - An Overview of Risk Management - Risk Identification -Risk Assessment - Risk Control Strategies - Selecting a Risk Control Strategy - Risk Management Discussion Points - Recommended Practices in Controlling Risk. (6)

### POLICIES, STANDARDS, PRACTICES AND BUSINESS CONTINUITY

Introduction - Information Security Policy, Standards and Practices -The Information Security Blueprint: ISO 17799/BS 7799, ISO 27001and its controls, NIST Security Models, Design of Security Architecture - Security Education, Training and Awareness Program - Continuity Strategies. (6)

### SECURITY TECHNOLOGY

Introduction - Intrusion Detection and Prevention Systems: IDPS Terminology, Use of IDPS, Strengths and Limitations of IDPS - Honey Pots, Honey Nets, and Padded Cell Systems - Scanning and Analysis Tools, Access Control Devices - (8)

### BIOMETRIC CONTROLS

Biometrics - Nature of Biometrics Identification/Authentication Techniques - Biometric Techniques - Matching and Enrollment Process in Biometrics - Benefits Over Traditional Authentication Methods. (6)

### SECURITY OF WIRELESS NETWORKS

Attacks on Wireless Networks: Other Security Risks in Wireless Networks, Management and Mitigations for Wireless Networks Attacks. (7)

### LAWS AND LEGAL FRAMEWORK

Introduction - Information Security and the Law: The Rising Need -Understanding the Laws for Information Security: A Conceptual Framework - The Indian IT Act - Laws for Intellectual Property Rights (IPR) -Health Insurance Portability and Accountability Act (HIPAA) - Building Security into Software/System Development Life Cycle. (7)

**TOTAL : 45**

### TEXT BOOKS

1. Michael E Whitman and Herbert J Mattord, "Principles of Information Security", Course Technology, New Delhi, Fourth Edition, 2012 Reprint.
2. Nina Godbole, "Information Systems Security-Security Management, Metrics, Frameworks and Best Practices", Wiley India Pvt. Ltd., New Delhi, First Edition, 2009.(Biometric Controls, Security of Wireless Networks, Laws and Legal Framework)

## REFERENCE BOOKS

1. *Thomas R.Peltier, "Information Security Fundamentals", Auerbach Publications, Second Edition, 2013.*
2. *Micki Krause and Harold F.Tipton, "Information Security Management Handbook", Auerbach Publications, Sixth Edition,2008.*
3. *Mark Merkow and Jim Breithaupt," Information Security - Principles & Practices", Second Edition, Pearson Education, 2014.*

# 15ITOE06 - INTRODUCTION TO HUMAN COMPUTER INTERACTION

L	T	P	C
3	0	0	3

## ASSESSMENT : THEORY

### COURSE OUTCOME

- CO1** : Describe the importance and need for effective user friendly Graphical User Interfaces(GUI).
- CO2** : Choose suitable interactions devices/tools to meet application specific requirements.
- CO3** : Design Graphical User Interfaces(GUI) using apt components and apply the design guidelines for user-friendly navigation and presentation.
- CO4** : Asses graphical user interfaces for compliance against the screen design guidelines.

## INTRODUCTION

Importance of User Interface: Definition-Importance of good design-Benefits of good design-Human-centered development and Evaluation-Human Performance models-A Brief history of screen design. (9)

## THE GRAPHICAL USER INTERFACE & DESIGN PROCESS

GUI: Popularity of graphics - The concept of direct manipulation - Graphical system -Characteristics - Web user - Interface Popularity - Characteristics and Principles of User Interface.

Design process: Human Interaction with computers - Importance of Human Characteristics - Human Consideration - Human Interaction Speeds and Understanding Business Junctions. (9)

## SCREEN DESIGNING

Design Goals - Screen Planning and Purpose - Organizing Screen Elements - Ordering of Screen Data and Content - Screen Navigation and Flow - Visually Pleasing Composition - Amount of Information - Focus and Emphasis - Presenting Information Simply and Meaningfully - Information retrieval on web - Statistical Analysis - Technological considerations in Interface Design. (11)

## WINDOWS & COMPONENTS

Windows: New Navigation Schemes - Selection of Window - Selection of Devices Based on Screen Based Controls.

Components: Text and Messages - Icons and Increases - Multimedia - Colors - Uses -Problems - Choosing colors. (9)

## SOFTWARE TOOLS AND INTERACTION DEVICES

Specification Methods - Interface Building Tools - Keyboard and Function Keys - Pointing Devices Speech Recognition. (7)

**TOTAL : 45**

## TEXT BOOKS

1. Wilbert O Galitz, "The Essential Guide to User Interface Design", Third Edition, Wiley India Pvt., Ltd., 2007.
2. Ben Shneidermann, "Designing the User Interface", Fifth edition, Pearson Education Asia, 2013. (Software Tools and Interaction Devices)

## REFERENCE BOOKS

1. Alan Dix, Janet Finlay, G D Abowd and Russel Beale, "Human Computer Interaction", Pearson Education, Third Edition, 2004.

# 15ITOE07 - ENTERPRISE RESOURCE PLANNING CONCEPTS

L	T	P	C
3	0	0	3

## ASSESSMENT : THEORY

### COURSE OUTCOME

- CO1** : Describe the operational aspects of ERP system and its related technologies.
- CO2** : Demonstrate the steps required for ERP Project management and implementation process by choosing the right vendors/consultants, employee training and monitoring.
- CO3** : Categorize the business modules of an ERP package in order to define the functionality of various departments in a company.
- CO4** : Analyze the ERP marketplace and its vendors, and assess how Enterprise Application Integration (EAI), e-business help the company use ERP to its utmost benefit.

## INTRODUCTION

Enterprise - An Overview - Introduction to ERP - Benefits Of ERP - ERP and Related Technologies - Business Process Reengineering (BPR) - Data Warehousing - Data Mining -OLAP - SCM. (9)

## ERP IMPLEMENTATION

ERP Implementation Lifecycle - Implementation Methodologies - ERP deployment methods - Package Selection - Process Definition - Vendors and Consultants - Contract with Vendors, Consultants and Employees - Training and education- Project Management and Monitoring. (10)

## THE ERP BUSINESS MODULES

Business modules of an ERP Package - Finance - Manufacturing - Human Resources - Plant Maintenance - Materials Management - Quality Management - Sales and Distribution. (9)

## THE ERP MARKET & ERP - Present and Future

ERP Marketplace and Marketplace Dynamics - ERP Vendors - SAP AG, Oracle Corporation, Microsoft Dynamics, EPICOR, QAD, RAMCO Systems - Enterprise Application Integration (EAI)- ERP and E-Business- Future Directions and Trends in ERP. (9)

## SAP

Gateway to SAP: Architecture of SAP R/3 -SAP Integrated-Three Tier Architecture - SAP Easy Access - Understanding ABAP Workbench (8)

**TOTAL : 45**

## TEXT BOOKS

1. Alexis Leon, "ERP Demystified", Tata McGraw Hill, New Delhi, Third Edition, 2014.
2. Dreamtech Press, "SAP R/3, Black Book", Dreamtech Software Team, 2006. (SAP)

## REFERENCE BOOKS

1. Ellen F.Monk, Bret Wagner, "Concepts in Enterprise Resource Planning", Course Technology Ptr, Fourth Edition, 2013.
2. Vinod Kumar Garg and Venkitakrishnan N.K., "Enterprise Resource Planning - Concepts and Practice", Prentice Hall of India, New Delhi, Second Edition, 2012.

# 15CHOE01 - INDUSTRIAL SAFETY ENGINEERING

L	T	P	C
3	0	0	3

## ASSESSMENT : THEORY

### COURSE OUTCOME

After completion of the course, students are able to

- C01** : Practice the safety norms and inspect turning machines, boring machines, milling machine, planning machine, grinding machines, CNC machines and wood working machinery to create risk free working environment.
- C02** : Assess the adequacy of machinery guarding to eliminate or reduce the hazards from the point operation, flying chips and sparks and moving parts.
- C03** : Apply the safety concepts in welding, gas cutting, storage and handling of gas cylinders, metal forming processes, etc.,
- C04** : Predict, identify and evaluate, hazardous conditions and practices safety rules in cold forming and hot working of metals
- C05** : Employ the safety rules in inspection and testing process and take plan the preventive measures in health and welfare of workers' aspects in engineering industry.

### SAFETY IN METAL WORKING MACHINERY AND WOOD WORKING MACHINES

General safety rules, principles, maintenance, Inspections of turning machines, boring machines, milling machine, planning machine and grinding machines, CNC machines, Wood working machinery, types, safety principles, electrical guards, work area, material handling, inspection, standards and codes- saws, types, hazards. (9)

### PRINCIPLES OF MACHINE GUARDING

Guarding during maintenance, Zero Mechanical State (ZMS), Definition, Policy for ZMS - guarding of hazards - point of operation protective devices, machine guarding, types, fixed guard, interlock guard, automatic guard, trip guard, electron eye, positional control guard, fixed guard fencing- guard construction- guard opening. Selection and suitability: lathe - drilling - boring - milling - grinding - shaping - sawing- shearing presses - forge hammer - flywheels - shafts - couplings -gears - sprockets wheels and chains pulleys and belts - authorized entry to hazardous installations-benefits of good guarding systems (9)

### SAFETY IN WELDING AND GAS CUTTING

Gas welding and oxygen cutting, resistance welding, arc welding and cutting, common hazards, personal protective equipment, training, safety precautions in brazing, soldering and metalizing - explosive welding, selection, care and maintenance of the associated equipment and instruments - safety in generation, distribution and handling of industrial gases-colour coding - flashback arrestor - leak detection-pipeline safety-storage and handling of gas cylinders. (9)

### SAFETY IN COLD FORMING AND HOT WORKING OF METALS

Cold working, power presses, point of operation safe guarding, auxiliary mechanisms, feeding and cutting mechanism, hand or foot-operated presses, power press electric controls, power press set up and die removal, inspection and maintenance-metal shears-press brakes. Hot working safety in forging, hot rolling mill operation, safe guards in hot rolling mills - hot bending of pipes, hazards and control measures. Safety in gas furnace operation, cupola, crucibles, ovens, foundry health hazards, work environment, material handling in foundries, foundry production cleaning and finishing foundry processes. (9)

### SAFETY IN FINISHING, INSPECTION AND TESTING

Heat treatment operations, electro plating, paint shops, sand and shotblasting, safety in inspection and testing, dynamic balancing, hydrotesting, valves, boiler drums and headers, pressure vessels, air leak test, steam testing, safety in radiography, personal monitoring devices, radiation hazards, engineering and administrative controls, Indian Boilers Regulation. Health and welfare measures in engineering industry-pollution control in engineering industry-industrial waste disposal (9)

**TOTAL : 45**

## TEXT BOOKS

1. Wells G.L., R.M.C. Seagrave-Flow sheeting for safety, Indian Institute of Chemical Engineering, London U.K, 1977.
2. TrevurKletz Butterworth, Learning from accidents, - London, 1988.
3. John Barton and Richard Rogers, Chemical reaction Hazards - A guide to safety, Institution of Chemical Engineering London, 1997.
4. Philip Hagan "Accident Prevention Manual for Business and Industry", N.S.C.Chicago, 13th edition 2009.

## REFERENCE BOOKS

1. Rohatgi A.K, Safety handling of Hazardous Chemicals Enterprises, Bombay, 1986.
2. Shukla S.K., Envirohazards and Techno Legal aspects, Shashi Publications, Jaipur India, 1993.
3. John V.Grimaldi and Rollin H.Simonds," Safety Management", Richard D Irwin, 1994.
4. Krishnan N.V. "Safety Management in Industry" Jaico Publishing House, Bombay, 1997.
5. "The Indian boilers act 1923 with amendments", Law Publishers (India) Pvt. Ltd., Allahabad.
6. "Health and Safety in welding and Allied processes", Welding Institute, UK, High Tech. Publishing Ltd., London, 1989.
7. "Safe use of wood working machinery", HSE, UK, 2005.

# 15CHOE02- RISK ANALYSIS AND HAZOP

L	T	P	C
3	0	0	3

## ASSESSMENT : THEORY

### COURSE OUTCOME

After completion of the course, students are able to

**CO1** : Identify individual hazards in a process and deduce the associated risks.

**CO2** : Identify radiation intensity and effects of explosion

**CO3** : Perform risk analysis of various types of problems

**CO4** : Evaluate effect about key hazard identification techniques

**CO5** : Apply risk analysis techniques and Hazop study

### INTRODUCTION AND DISPERSION MODELS

Risk analysis introduction, quantitative risk assessment, rapid risk analysis - Comprehensive risk analysis - Emission and dispersion - Leak rate calculation. Single and two-phase flow - Dispersion model for dense gas - Flash fire - Plume dispersion - Toxic dispersion model - Evaluation of risk. (9)

### RADIATION INTENSITY

Radiation - Tank on fire - Flame length - Radiation intensity calculation and its effect on plant, people and property radiation VCVCE - Explosion due to over pressure - Effects of explosion, risk contour -Effects, explosion, BLEVE - Jet fire - Fire ball. (9)

### RISK ANALYSIS

Overall risk analysis - Generation of meteorological data - Ignition data - Population data - Consequences analysis and total risk analysis - Overall risk contours for different failure scenarios - Disaster management plan - Emergency planning - On site and off site emergency planning, risk management ISO 14000, EMS models case studies - Marketing terminal, gas processing complex, refinery. (9)

### HAZARD ANALYSIS

Hazard identification safety audits, checklist, what if analysis, vulnerability models event tree analysis fault tree analysis, Hazan past accident analysis Fixborough - Mexico - Madras - Vizag - Bopal analysis (9)

### CASE STUDIES

Hazop - Guide words, parameters, derivation - Causes - Consequences - Recommendation - Coarse Hazop study - Case studies - Pumping system - Reactor - Mass transfer system. (9)

**TOTAL : 45**

### TEXT BOOKS

1. Ragavan K.V., Khan A.A., *Methodologies in Hazard identification and assessment -Manual, CLRI publication, 1990.*
2. Marcel.V.C., *Major Chemical Hazard, Ellis Hawood Ltd., Chi Chester, UK, 1987.*
3. Skeleton B., *Process Safety Analysis, Institution of chemical Engineers, U.K., 1997.*

### REFERENCE BOOKS

1. Daniel A Crowl., Louvar J.F., *Chemical Process Safety: Fundamentals with Applications, Prentice Hall, New Jersey, 2002.*

# 15CHOE03 - GREEN TECHNOLOGY

L	T	P	C
3	0	0	3

## ASSESSMENT : THEORY

### COURSE OUTCOME

After completion of the course, students are able to

**CO1** : Outline the green technology concepts and relevance in twenty first century requirements.

**CO2** : Defend the environmental and sustainability issues, role of CSR and CER and Indian corporate structure and environment.

**CO3** : Recall the indicators of sustainability and their use and can also find the alternate theories.

**CO4** : Criticize the environmental reporting, ISO 14001, ISO 14064, financial initiative by UNEP, etc.

**CO5** : Analyze the green tax incentives and rebates, business redesign and its models.

### INTRODUCTION

The concept of green technology; evolution; nature, scope, importance and types; developing a theory; green technology in India; relevance in twenty first century. (9)

### SUSTAINABILITY & ENVIRONMENT

Organizational environment; internal and external environment; Indian corporate structure and environment; how to go green; spreading the concept in organization; environmental and sustainability issues for the production of high-tech components and materials, life cycle analysis of materials, sustainable production and its role in corporate social responsibility (CSR) and corporate environmental responsibility (CER). (9)

### ECOSYSTEM APPROACHES

Approaches from ecological economics; indicators of sustainability; ecosystem services and their sustainable use; bio-diversity; Indian perspective; alternate theories (9)

### ACTS OF GREEN TECHNOLOGY

Environmental reporting and ISO 14001; climate change business and ISO 14064; green financing; financial initiative by UNEP; green energy technology; green product technology. (9)

### GREEN ECONOMICS

Definition; green techniques and methods; green tax incentives and rebates (to green projects and companies); green project technology in action; business redesign; eco-commerce models. (9)

**TOTAL : 45**

### REFERENCE BOOKS

1. *Green Technology and Green Technologies: Exploring the Causal Relationship* by Jazmin Seijas Nogarida, 2008.
2. *Green Marketing and Technology: A global Perspective* by John F. Whaik, 2005.
3. *The Green Energy Technology Book* by Leo A. Meyer.
4. *Green Project Technology* by Richard Maltzman and David Shiden.
5. *Green Marketing* by JacquelinOttman.
6. *Green and World* by Andrew S. Winston.



# 15CHOE04 - CORROSION SCIENCE AND ENGINEERING

L	T	P	C
3	0	0	3

## ASSESSMENT : THEORY

### COURSE OUTCOME

After successful completion of this course, the students will be able to

- CO1** : Classify the types of corrosion and theories and also relate the various controlled corrosion process.
- CO2** : Examine the factors involved in the corrosion and control methods of various corrosion.
- CO3** : Analyze the mechanism of corrosion and evaluate the effects like pH, temperature, flow rate on corrosion.
- CO4** : Design and develop the corrosion control methods like cathodic protection, sacrificial anode and impressed current anodes and anodic protection.
- CO5** : Predict the different corrosion testing, monitoring and inspection tests by surface analytical studies.

### INTRODUCTION

Introduction, classification, economics and cost of corrosion. emf series, galvanic series, corrosion theories derivation of potential - Current relations of activities controlled and diffusion controlled corrosion process. Potential - pH diagram, Fe-H<sub>2</sub>O system, application and limitation. Passivation - Definition, anodic passivation theory of passivation, oxidation laws, effects of oxygen and alloying on oxidation rates. (9)

### CORROSION CONTROL METHODS

Forms of corrosion - Definition, factors and control methods of various forms of corrosion such as pitting, inter granular, crevice, dezincification, stress corrosion, corrosion fatigue, fretting corrosion, hydrogen embitterment, corrosion processes and control methods in fertilizers, petrochemical, chemical building industries (9)

### MECHANISM OF CORROSION

Environmental aspects, atmospheric corrosion - Classification, factors influencing atmospheric corrosion, temporary corrosion preventive methods, corrosion in immersed condition, effect of dissolved gases, salts, pH, temperature, and flows rates on corrosion, marine corrosion, underground corrosion. Biological corrosion, definition, mechanism of corrosion, control of bio-corrosion. (9)

### CORROSION PREVENTION

Corrosion control aspects, electrochemical methods of protection-theory of cathodic protection design of cathodic protection, sacrificial anodes, impressed current anodes, anodic protection. Corrosion inhibitors for acidic, neutral and alkaline media, cooling water system - Boiler water system. Organic coating, surface preparation, natural, synthetic resin, paint, formulation and application. Design aspects in corrosion prevention, corrosion resistant materials. (9)

### CORROSION TEST

Corrosion testing, monitoring and inspection, laboratory corrosion tests, accelerated chemical tests for studying different forms of corrosion. Electrochemical methods of corrosion rate measurements by DC and AC methods, corrosion monitoring methods, chemical and electrochemical removal of corrosion products, newer techniques to study corrosion processes, inspection methods by NDT. Surface analytical techniques such as AES, ESCA, SEM. Evaluation of paints by conventional and electrochemical methods. (9)

**TOTAL : 45**

### TEXT BOOKS

1. Roberge P. R., *Corrosion Engineering*, McGraw Hill, New York, 2008.
2. Fontana M.G., Greene N.D., *Corrosion Engineering, Third Edition*, McGraw Hill, New York, 2005.
3. Uhling H. H., Revie R.W., *Corrosion and Corrosion Control*, John Wiley and Sons, Inc, 1985.

### REFERENCE BOOK

1. Banarjee.S.N., *An introduction to corrosion and corrosion inhibitors*, Oxonian Press Ltd., New Delhi, 1985.

# 15CHOE05 - INTRODUCTION TO CHEMICAL ENGINEERING

L	T	P	C
3	0	0	3

## ASSESSMENT : THEORY

### COURSE OUTCOME

After successful completion of this course, the students will be able to

**CO1** : Express the fundamentals of chemical engineering and to solve problems.

**CO2** : Ability to develop basic fluid concepts, transfer and separation operations.

**CO3** : Design equipments for transport and separation processes.

**CO4** : Apply material and Energy balance to precisely calculate material required for a process.

**CO5** : Apply steady state balances to develop process flow sheets.

### OVERVIEW OF CHEMICAL ENGINEERING

Concepts of unit operations and unit processes, and more recent developments, The Chemical Industry-scope, features & characteristics. Flow sheets, and symbols for various operations. (9)

### MATERIAL AND ENERGY BALANCE CALCULATIONS

Material balances in simple systems involving physical changes and chemical reactions; systems involving recycle, purge, and bypass, combustion reactions, Forms of energy, optimum utilization of energy, Energy balance calculations in simple systems. Introduction to Computer aided calculations-steady state material and energy balances, combustion reactions. (9)

### BASIC FLUID CONCEPTS

Dimensions and Units, Velocity and Stress Fields, Viscosity and surface tension, Non Newtonian viscosity, Dimensional Analysis (Buckingham PI theorem), Types of flows, Methods of Analysis, Fluid Statics. pipe flow, Pumps, Agitation and Mixing, Compressors. (9)

### HEAT TRANSFER OPERATIONS

Review of conduction, resistance concept, extended surfaces, lumped capacitance; Introduction to Convection, natural and forced convection, correlations; Radiation; Heat exchangers- Fundamental principles and classification of heat exchangers, Evaporators. (9)

### MASS TRANSFER OPERATIONS

Fundamental principles and classification of Distillations, Adsorption, Absorption, Drying, Extraction, Membrane Process. Energy and Mass Conservation in process systems and industries. Introduction to chemical reactors. (9)

**TOTAL : 45**

### REFERENCE BOOKS

1. G.T. Austin, R.N. Shreve, *Chemical Process Industries*, 5<sup>th</sup> Ed., McGraw Hill, 1984.
2. W.L. McCabe, J.C. Smith and P. Harriott, *Unit Operations of Chemical Engineering*, 6<sup>th</sup> Edition, McGraw Hill, 2001.
3. R. M. Felder and R.W. Rousseau, *Elementary Principles of Chemical Processes*, 3<sup>rd</sup> Ed., John Wiley, New York, 2004.
4. L.B. Anderson and L.A. Wenzel, *Introduction to Chemical Engineering*, McGraw Hill, 1961.
5. H.S. Fogler, *Elements of Chemical Reaction Engineering*, 4<sup>th</sup> Ed., Prentice-Hall, 2006.

# 15MOE01 - GRAPH THEORY AND ITS APPLICATIONS

L	T	P	C
3	0	0	3

## ASSESSMENT : THEORY

### COURSE OUTCOME

- CO1** : The students will be able to understand the idea of graph theory and to solve the real time problem.
- CO2** : To relate the Graph theory Algorithms' in their field of engineering and apply the same in their respective main stream.
- CO3** : To become familiar with Special graphs for modeling the networks.
- CO4** : Able to design and solve Coloring concepts for defined problems.
- CO5** : Model the networks using graph theory.

### GRAPHS AND SUBGRAPHS

Graph --Standard Concepts in Graphs - Subgraphs -Complete Graph - Bipartite Graph - Isomorphism - Adjacency Matrix and Incidence Matrix - Walk, Trail and Path -Bipartite Graph -Connectedness- The Shortest Path Problem- Disjkstra's Algorithm (9)

### TREES

Trees- Characterization- Blocks - Block Graphs - Cayley's Formula - Spanning Trees- Spanning Tree Algorithms - Kruskal's and Prim's Algorithm (9)

### EULERIAN AND HAMILTONIAN GRAPHS

Eulerian graphs - Euler's theorem -Hamiltonian graphs - Dirac's and Ore's theorems - Closure of a graph - Bondy-Chvatal theorem - Traveling salesman problem -The Chinese Postman Problem- Fleury's Algorithm. (9)

### COVERING AND COLORING

Covering - Independent Sets - Matching - Perfect Matching- Applications- The Personal Assignment Problem- Coloring - Chromatic Number - Four Color Problem - Chromatic Polynomials - Application. (9)

### DIRECTED GRAPHS

Digraph - orientation - strongly, weakly and unilaterally connected digraphs - directed acyclic graph - adjacency matrix and incidence matrix of graph - Network Flows- Transport Networks- Max-Flow Min- Cut Theorem- Activity Network (9)

**TOTAL : 45**

### TEXT BOOKS

1. Gary Chartrand and Ping Zhang, *Introduction to Graph Theory*, McGraw Hill Education (India), 2006.
2. Narsingh Deo, *"Graph Theory with Applications to Engineering and Computer Science"*, Prentice Hall of India Private Limited, 2004.

### REFERENCE BOOKS

1. Douglas B.West, *"Introduction to Graph Theory" II Edition*, Prentice Hall of India Private Limited, 2000.
2. Reinhard Diestel, *"Graph Theory"*, II Edition, Springer Publications, 2006.
3. Clark J. and Holton D.A, *"A First Look at Graph Theory"*, Allied Publishers, 1995.
4. Frank Harary, *Graph Theory*, 10th Edition, Narosa Publishing House, 2001.

# 15MOE02 - METHODS OF APPLIED MATHEMATICS

L	T	P	C
3	0	0	3

## ASSESSMENT : THEORY

### COURSE OUTCOME

- CO1 :** *The students will be able to understand the idea of integral equations and to solve the real time problems.*
- CO2 :** *To familiarize the students with basic concept of ordinary differential equations, special functions and solve problems associated with engineering applications.*
- CO3 :** *To achieve an understanding of the basic concepts of boundary value problems and characteristic function representations and method of solving them.*
- CO4 :** *Able to construct and solve a mathematical model for heat flow problems in real life situation*
- CO5 :** *Able to use the concepts of Calculus of variations and basic concepts for solving equations involving functional*

### INTEGRAL EQUATIONS

Relation between integral and differential equations - Green's function. Fredholm's equation with separable Kernels Hilbert Schmidt theory, interactive methods for solving equations of second kind. (9)

### SECOND ORDER ORDINARY DIFFERENTIAL EQUATIONS AND SPECIAL FUNCTIONS

Singular points, Series solutions and the methods of Frobenius, Bessel Equation, Bessel Functions, modified Bessel functions and their properties, Ber and Bei functions. (9)

### BOUNDARY PROBLEMS AND CHARACTERISTIC FUNCTION REPRESENTATIONS

Sturm - Liouville problems. Orthogonal functions and expansions in series of Orthogonal functions. Stodola and Vianello method for Sturm - Liouville problems Fourier, Fourier - Bessel and Legendre Series (9)

### PARTIAL DIFFERENTIAL EQUATIONS

Linear and quasi - linear equations of the first and second order. Characteristics of first and second order linear equations. Heat flow equations. Problems in one, two and three dimensions. Fourier method. (9)

### INTEGRAL TRANSFORM METHODS

Calculus of variations - Variational notation, Constraints and Lagrangian multipliers, variable and points, Rayleigh - Ritz method. (9)

**TOTAL : 45**

### TEXT BOOKS

1. *M.K.Venkatraman, Higher Mathematics for Engineering and Science, Third Edition, The National Publishing Company, (2014)*
2. *F.B. Hildebrand : Advanced Calculus for applications second Edn. (EEE). Prentice Hall of India P. Ltd., (2014)*

### REFERENCE BOOKS

1. *F.B. Hildebrand - Methods of Applied Mathematics, Second Edn. Prentice Hall of India P.Ltd., (2012)*
2. *C.Stephenson : An introduction to partial differential equation for Science students, ELBS.*
3. *E. D. Rainville : Special Functions.*
4. *Dettman : Mathematical methods in physics and Engineering.*

# 15MOE03 - LINEAR AND NON - LINEAR PROGRAMMING

L	T	P	C
3	0	0	3

## ASSESSMENT : THEORY

### COURSE OUTCOME

- CO1** : The students will be able to understand the idea of linear Programming problems and to solve the real time problems.
- CO2** : To familiarize the students with basic concept of Transportation models and solve problems associated with engineering applications.
- CO3** : To achieve an understanding of the basic concepts of Assignment problems and method of solving them.
- CO4** : Able to construct and solve a Game theory models in real life situation
- CO5** : Able to use the concepts of Non-linear Programming problems for solving Constrained and unconstrained equations.

### LINEAR PROGRAMMING

Formulation of LPP - Graphical methods for two variables - The Simplex method - Artificial Variables Techniques - Big M - method -The Two Phase method - Dual Simplex Method (9)

### TRANSPORTATION MODEL

Mathematical formulation of a Transportation problem -Methods for finding initial basic feasible solution - North West corner rule -Least cost method - Vogle's Approximation method -Modified distribution method - Degeneracy in Transportation problems. (9)

### ASSIGNMENT PROBLEM

Mathematical formulation of an Assignment problem - Hungarian Method - Unbalanced Assignment Models - Maximization case in Assignment Problems - Restrictions in Assignments -Travelling Salesman Problem. (9)

### GAME THEORY

Two person zero- sum Games -The Maxmini - Minimax Principle -Saddle Point and value of the game - Games without saddle points, Mixed Strategies-Matrix Oddment method for  $n \times n$  games -Dominance Property-Graphical Method of  $2 \times n$  or  $m \times 2$  games. (9)

### NON-LINEAR PROGRAMMING

Non-linear Programming Algorithm - Unconstrained Non-linear Algorithms - Constrained Non-linear Lagrange multipliers, Kuhn-Tucker optimality conditions. (9)

**TOTAL : 45**

### TEXT BOOKS

1. *Operations Research An Introduction, Eight Edition, Hamdy A. TAHA, Pearson Prentice Hall 2007, New Delhi*
2. *Resource management techniques by V.Sundaresan, Tenth Edition, 2016 A.R Publications, Chennai*

### REFERENCE BOOKS

1. *Andrews L.C. and Phillips R.L., "Mathematical Techniques for Engineers and Scientists", Prentice Hall of India Pvt.Ltd., New Delhi, 2005.*
2. *O'Neil, P.V., "Advanced Engineering Mathematics", Thomson Asia Pvt. Ltd., Singapore, 2003.*

# 15MOE04 - PROBABILITY AND RANDOM PROCESSES

L	T	P	C
3	0	0	3

## ASSESSMENT : THEORY

### COURSE OUTCOME

- CO1** : The students will be able to understand the idea probability problems and to solve the real time problems.
- CO2** : To familiarize the students with basic concept of probability distributions and solve problems associated with engineering applications.
- CO3** : To achieve an understanding of the basic concepts of Correlation and regression and method of solving them.
- CO4** : Able to solve a signal processing problems by using random process concepts.
- CO5** : Able to use the concepts of Correlation functions and Power spectral densities for solving Electrical and Electronics problem.

### THEORY OF PROBABILITY

Sample Space, Events, Axioms of probability, Conditional probability, Independent events, Theorem of total probability, Baye's Theorem. (9)

### PROBABILITY DISTRIBUTIONS

Definition of Discrete and Continuous random Variables

Discrete distributions: Binomial, Poisson and Geometric - Properties and Simple problems

Continuous distributions: Normal, Uniform Exponential - Properties and Simple problems. (9)

### CORRELATION AND REGRESSION

Correlation - Meaning and scope of Correlation - Scatter diagram, Karl Pearson's co-efficient of Correlation, Spearman's Rank Correlation, Multiple Correlation and partial correlation - simple problems.

Regression Analysis - Meaning and Scope of regression- Regression in two variables - Uses of Regression. (9)

### RANDOM PROCESSES

Classification - Stationary process - Markov process - Poisson process - Random telegraph process. (9)

### CORRELATION FUNCTIONS AND POWER SPECTRAL DENSITIES

Auto Correlation functions -Cross Correlation functions -Properties -Power spectral density - Cross spectral density -Properties. (9)

**TOTAL : 45**

### TEXT BOOKS

1. S.C.Gupta and V.K. Kapoor, *Fundamental of Mathematical Statistics, Tenth revised edition*, 2002.
2. T.Veerarajan, *Probability, Statistics and Random Processes, Second Edition, TataMcGraw-Hill* 2007

### REFERENCE BOOKS

1. Rohatgi V.K. (2002) : *Introduction to Mathematical Statistics, Wiley*. 2. Bhat, B. R. (2005) : *Modern Probability Theory - An Introductory Text Book, Third Edition, New Age International*.
2. Cochran, W.G.(2007): *Sampling Techniques, Wiley Eastern Private Limited*

3. *Sukhatme, P.V. and Sukhatme, B.V.(1977): Sampling Theory of Survey with Applications, Asia publishing House.*
4. *Venkataraman M.K, "Higher mathematics for Engineering and Science" National Publishing Company ,2000*
5. *Ibe , O.C., "Fundamentals of Applied Probability and Random processes", 1st Indian Reprint , Elsevier , 2007.*
6. *Peebles , P.Z., "Probability, Random Variables and Random Signal Principles", Tata McGraw Hill , 4th Edition , New Delhi, 2002.*

# 15POE01 - INTRODUCTION TO NANOSCIENCE AND NANOTECHNOLOGY

L	T	P	C
3	0	0	3

## ASSESSMENT : THEORY

### COURSE OUTCOME

- CO1** : Demonstrate the understanding of length scales concepts, nanostructures and nanotechnology.
- CO2** : Understand the different classes of nanomaterials.
- CO3** : Identify the principles of processing, manufacturing and characterization of nanomaterials and nanostructures.
- CO4** : Outline the applications of nanotechnology and develop an ability to critically evaluate the promise of a nanotechnology device.

### BASICS OF NANOTECHNOLOGY

Introduction - Time and length scale in structures -Definition of a nanosystem -Dimensionality and size dependent phenomena -Surface to volume ratio -Fraction of surface atoms - Surface energy and surface stress- surface defects-Effect of nanoscale on various properties - Structural,thermal, mechanical,magnetic, optical and electronic properties. (9)

### DIFFERENT CLASSES OF NANOMATERIALS

Classification based on dimensionality-Quantum Dots,Wells and Wires- Carbon based nano materials (buckyballs, nanotubes, graphene)- Metal based nanomaterials (nanogold, nanosilver and metal oxides) - Nanocomposites-Nanopolymers - Nano ceramics -Biological nanomaterials. (9)

### SYNTHESIS OF NANOMATERIALS

Chemical Methods:Metal Nanocrystals by Reduction -Sol - gel processing -Solvothelmal Synthesis-Photochemical Synthesis - Chemical Vapor Deposition(CVD) - Metal Oxide - Chemical Vapor Deposition (MOCVD).Physical Methods:Ball Milling - Electrodeposition - Spray Pyrolysis - DC/RF Magnetron Sputtering - Molecular Beam Epitaxy (MBE). (9)

### CHARACTERIZATION OF NANOSTRUCTURES

Introduction, structural characterization, X-ray diffraction (XRD-Powder/Single crystal), Small angle X-ray scattering (SAXS), Scanning Electron Microscopy (SEM) - Energy Dispersive X-ray analysis (EDAX)- Transmission Electron Microscope (TEM) - Scanning Tunneling Microscope (STM)-Atomic Force Microscopy (AFM), UV-vis spectroscopy (liquid and solid state) - Raman Spectroscopy -X-ray Photoelectron Spectroscopy (XPS) - Auger Electron spectroscopy (AES). (9)

### APPLICATIONS

Solar energy conversion and catalysis - Molecular electronics and printed electronics -Nanoelectronics -Polymers with a special architecture - Liquid crystalline systems - Applications in displays and other devices -Nanomaterials for data storage -Photonics, Plasmonics- Chemical and biosensors -Nanomedicine and Nanobiotechnology. (9)

**TOTAL : 45**

### TEXT BOOKS

1. *Nano Technology: Basic Science and Emerging Technologies*, Mick Wilson, Kamali Kannargare., Geoff Smith Overseas Press (2005)
2. *A Textbook of Nanoscience and Nanotechnology*,Pradeep T., Tata McGrawHill Education Pvt. Ltd., 2012.
3. *Nanostructured Materials and Nanotechnology*,Hari Singh Nalwa,Academic Press, 2002.
4. *Introduction to Nanotechnology*, Charles P.Poole, FrankJ.Owens, Wiley Interscience (2003)
5. *Textbook of Nanoscience and Nanotechnology*, B.S. Murty, P. Shankar, Baldev Raj, B BRath, James Murday, Springer Science & Business Media, 2013.



## REFERENCE BOOKS

1. *Nanotechnology: A gentle introduction to the next Big idea*, Mark A.Ratner, Daniel Ratner, Mark Ratne, Prentice Hall P7R:1st Edition (2002)
2. *Fundamental properties of nanostructured materials* Ed D. Fioran, G.Sberveglier, World Scientific 1994
3. *Nanoscience: Nanotechnologies and Nanophysics*, Dupas C., Houdy P., Lahmani M., Springer-Verlag Berlin Heidelberg, 2007

# 15POE02 - PHYSICS AND TECHNOLOGY OF THIN FILMS

L	T	P	C
3	0	0	3

## ASSESSMENT : THEORY

### COURSE OUTCOME

**CO1** : Recognize the fundamental growth and material parameters of thin films.

**CO2** : Evaluate and use models for nucleation and growth of thin films.

**CO3** : Asses the relation between deposition technique, film structure, and film properties.

**CO4** : Identify modern techniques for the characterization of thin films

**CO5** : Demonstrate the applications of thin films

### PREPARATION OF THIN FILMS

Preparation methods: electrolytic deposition, cathodic and anodic films, thermal evaporation, cathodic sputtering, chemical vapour deposition. Molecular beam epitaxy and laser ablation methods. Thickness measurement and monitoring: electrical, mechanical, optical interference, microbalance, quartz crystal methods. (9)

### GROWTH KINETICS OF THIN FILMS

General features.- nucleation theories - energy formation of a nucleus - critical nucleation parameters; spherical and non spherical (cap, disc and cubic shaped) - Effect of electron bombardment on film structure. Post- nucleation growth, epitaxial films and growth. (9)

### ANALYTICAL TECHNIQUES OF CHARACTERIZATION

X-ray diffraction - photoluminescence - UV-Vis-IR spectrophotometer - Atomic Force Microscope - Scanning Electron Microscope - Hall effect - Vibrational Sample Magnetometer - Secondary Ion Mass Spectrometry - X-ray Photoemission Spectroscopy - Auger emission spectroscopy. (9)

### PROPERTIES OF THIN FILMS

Dielectric properties - experimental technique for the determination of dielectric properties - optical properties - experimental technique for the determination of optical constants - mechanical properties - experimental technique for the determination of mechanical properties of thin films - magnetic and superconducting properties. (9)

### APPLICATIONS

Optoelectronic devices : LED, LASER and Solar cell - Micro Electromechanical Systems (MEMS) - Fabrication of thin film capacitor - application of ferromagnetic thin films; data storage, Giant Magnetoresistance (GMR) - sensors - fabrication and characterization of thin film transistor and FET. (9)

**TOTAL : 45**

### TEXT BOOKS

1. A. Goswami, *Thin Film Fundamentals*, New Age international (P) Ltd. Publishers, New Delhi, 2006.
2. L.I. Maissel and Glang (Eds.), *Handbook of Thin film Technology*, McGraw- Hill, 1970.
3. K.L. Chopra, *Thin Film Phenomena*, McGraw-Hill (1983)

### REFERENCE BOOKS

1. *Thin-Film Deposition : Principles and Practice*, Smith Donald Donald L Smith Smith, McGraw-Hill Professional Pub, 1995
2. J.C. Anderson, *The Use of Thin Films in Physical Investigation*, Academic Press 1966.
3. J.J. Coutts, *Active and Passive Thin Film Devices*, Academic Press 1978.
4. George Hass, *Physics of Thin Films: Volumes 1.:12*, Academic Press 1963.
5. KiyotakaWasa, Makoto Kitabatake, Hideaki Adachi, *Thin Films Material Technology*, Springer-Verlag Berlin Heidelberg, 2004.

# 15POE03 - SOLAR CELL FUNDAMENTALS AND MATERIALS

L	T	P	C
3	0	0	3

## ASSESSMENT : THEORY

### COURSE OUTCOME

**CO1** : Demonstrate the knowledge about photovoltaics.

**CO2** : Gain knowledge about principle of operation of solar cells

**CO3** : Realization about semiconducting materials used in the manufacture of PV cells

**CO4** : Outline the various advanced solar cell technologies, their current status and future technological challenges

### EVOLUTION OF SOLAR CELLS

Historical development; present and future global issues- commercialization/economic factors- basic components of PV systems- The solar spectrum - terrestrial and space spectra; air mass (AM0, AM1.5) -Introduction to 1st, 2nd and 3rd generation photovoltaics. (9)

### SOLAR CELL FUNDAMENTALS

Photovoltaic effect - Principle of direct solar energy conversion into electricity in a solar cell - light absorption- creating charge carriers forming the electric field - driving the charge carriers - solar cell parameters- electrical characteristics - the ideal solar cell, solar cell in practice, the quantum efficiency and spectral response, optical properties - basics of solar cell device design. (9)

### SEMICONDUCTOR PROPERTIES

Overview of semiconductor properties relevant to solar cell operations- semiconductor band structure, carrier statistics in semiconductors, the transport equations, carrier mobility, carrier generation by optical absorption-band to band transitions, free-carrier absorption, recombination- bulk recombination processes, surface recombination, minority carrier life time. (9)

### SILICON AND THIN FILM SOLAR CELLS

Si photovoltaics-single crystal silicon cells - semicrystalline and polycrystalline silicon cells - overview of various thin film solar cells:gallium arsenide solar cells - fabrication techniques, InP& cadmium telluride based solar cells - copper indium diselenide solar cells - multijunction cells -environmental and health aspects. (9)

### ADVANCED SOLAR CELLS

Advanced solar cell concepts -organic (polymer) photovoltaics -new concepts - quantum dots, wires, intermediate band, multiple exciton generation - Dye sensitized solar cells - perovskite solar cells - challenges in materials and device design -current and future research trends in PV. (9)

**TOTAL : 45**

### TEXT BOOKS

1. Fonash S. J., "Solar Cell Device Physics", Academic, 2010.
2. Goetzberger, J. Knobloch, and B. Voss "Crystalline Silicon Solar Cells" Wiley,1998.
3. Green M. A. "Third Generation Photovoltaics: Advanced Solar Energy Conversion", Springer, 2006.

### REFERENCE BOOKS

1. Chetan Singh Solanki., Solar Photovoltaic: "Fundamentals, Technologies and Application", PHI Learning Pvt., Ltd., 2009.
2. Jha A.R., "Solar Cell Technology and Applications", CRC Press,2010.

# 15POE04 - ADVANCED MATERIAL PROCESSING TECHNOLOGIES

L	T	P	C
3	0	0	3

## ASSESSMENT : THEORY

### COURSE OUTCOME

- CO1** : Recognize the criteria for material selection based on properties of materials and to choose the required material for a specified application.
- CO2** : Understand various metallurgical forming processes such as casting, rolling extrusion, drawing, development of grain structure and processing of different composite types.
- CO3** : Demonstrate knowledge about powder metallurgy, ceramic and polymer processing methods.
- CO4** : Identify and choose the required surface treatment technique for coating formation on account of enhancing the surface properties of the mechanical components for engineering applications.
- CO5** : Understand the applicable joining and machining techniques and their limitations

### SELECTION OF MATERIALS.

Motivation for selection - Selection for mechanical properties, strength, toughness, fatigue and creep - Selection for surface durability, corrosion and wear resistance - Relationship between materials selection and processing - Case studies - aero, auto, marine, machinery and nuclear applications. High and low temperature materials, superconductors, supermagnetic materials, high entropy alloys, nanomaterials and biomaterials. (9)

### METALLURGICAL FORMING AND PROCESSING OF COMPOSITES

Metallurgical forming: Casting, rolling extrusion, drawing, development of grain structure for specific properties. Processing of composites: lay up methods, press/ autoclave / resin transfer moulding, Reinforced reaction injection molding (RRIM), obtrusion and filament winding. (9)

### POWDER METALLURGY, CERAMIC AND POLYMER PROCESSING

Powder metallurgy and ceramic processing: green fabrication methods, sintering, hot pressing, Hot isostatic pressing (HIP), spark plasma sintering, development of microstructure in powder processed materials. Polymer processing: extrusion, injection moulding, blow moulding, rotational moulding, vacuum forming and related processes processing of cellular polymers. (9)

### COATING METHODS

Introduction to surface Engineering, Differences between surface and bulk, Properties of surfaces-wear, wettability. Chemical vapour deposition, physical vapour deposition, electro deposition, electroless deposition, thermal spray processes. Principle of various coating processes, process parameters, controlling the yield of coating and various surface properties of the coating. Criteria for selection of a surface coating technology. Product oriented surface coating technology. (9)

### JOINING AND MACHINING

Joining: fusion welding, solid state welding, adhesive bonding, mechanical joining and recent advancements in welding. Machining: Electromachining (electrochemical and electro-discharge), mechanical machining and recent advancements. (9)

**TOTAL : 45**

### TEXT BOOKS

1. Charles J.A., Crane, F.A.A and Furness, J.A.G., "Selection and use of Engineering Materials", 3rd Edition, Butterworth-Heinemann, 1977.
2. Betzalel Avitzu, "Metal Forming- Processes and Analysis", Tata McGraw Hill, 1977.
3. William F Hasford, Robert M Caddell "Metal Forming: Mechanics and Metallurgy" Cambridge University Press P.ltd, 2007.
4. Angelo P C and Subramanian R, "Powder Metallurgy Science, Technology and Applications", Prentice Hall of India, New Delhi, 2012.

## REFERENCE BOOKS

1. Michael Barsoum, *"Fundamentals of Ceramics"*, McGraw Hill Publishing Co., INC, 1997
2. Gowariker V R, Viswanathan N V, JayadevSreedhar, *"Polymer Science"*, New Age International P Ltd., 2005.
3. David S. Rickerby, Allan Matthews, *"Advanced surface coatings: a handbook of surface engineering"*, Blackie, 1991.
4. Parmar, R.S, *"Welding Engineering and Technology"*, Khanna Publishers, 2003.

# 15COE01 - MEDICAL NANO TECHNOLOGY

L	T	P	C
3	0	0	3

## ASSESSMENT : THEORY

### COURSE OUTCOME

The students will be able to

**CO1** : Understand the essential features of nanomedicine

**CO2** : Identify the medical based nanotools

**CO3** : Assess health effects due to nanoparticle exposure

### ASSESSING NANOTECHNOLOGY HEALTH

**Nanomaterials** : The Current State of Nanotechnology Application - Nanotechnology Risks - Risk Analysis - Hazard Identification - Exposure Assessment for Nanomaterials - Risk Characterization - Risk Management - Best Practices for Nanomaterials in the Workplace - Safety Research - Needs for Engineered Nanoscale Materials (9)

### RISK ASSESSMENT AND ENVIRONMENTAL PROTECTION

Context for Technological Risk - Need for Risk Assessment for Nanotechnology - Adaptive Risk Assessment for Nanomaterials - Origins and Development of Risk Assessment - Risk Assessment Used in Environmental Decision Making - Issues in Applying the Four Steps of Risk Assessment to Nanotechnology - Hazard Assessment - Exposure Assessment - Dose - Response Evaluation (9)

### SUSTAINABLE NANOTECHNOLOGY DEVELOPMENT

Necessity of Risk Assessment in Nanotechnology - The Pace of Nanotechnology Development and the Paucity of Information - Potential for Wide Dispersion in the Environment Amid Uncertainty - Few Standards or Guidelines - Environmental Risk Issues - Carbon Nanotubes - Defining the Toxic Dose - Environmentally Friendly Nanotechnology - Life Cycle Analysis for Sustainable Nanotechnology (9)

### HUMAN HEALTH, TOXICOLOGY, AND NANOTECHNOLOGY RISK

Mechanisms of Toxicity - Types of Toxicological Studies - Pulmonary Toxicity Studies - Gastro intestinal Toxicity - In Vitro Studies - Dermal - In Vitro Toxicity Studies (4)

### ENVIRONMENTAL RISKS

Antimicrobial Properties of Nanoscale Silver - Buckyballs, Titanium Dioxide - Short-term Toxicity Tests - Daphnia LC50 Assays - Studies of Nanomaterial Toxicity to Fish - Buckyballs and Bass-TiO<sub>2</sub> in Arsenic - Field Studies - Environmental Exposures - Nanoscale Zerovalent Iron (9)

### NANOELECTRONIC DEVICES

Resonant tunneling diodes - Field effect transistors - Single electron transfer devices - Potential effect transistors - Light emitting diodes and lasers - Nanoelectromechanical system devices - Quantum dot cellular automata (5)

**TOTAL : 45**

### TEXT BOOKS

1. Geroge W. Hanson, "Fundamentals of Nanoelectronics", Prentice Hall, 2007
2. Vladimir V. Mithin et.al, "Introduction to Nanoelectronics: Science, Nanotechnology, Engineering, and Applications" Cambridge University Press, 2012

### REFERENCE BOOKS

1. Mithin.V, Kochelap.V and Stroschio.M, "Introduction to Nanoelectronics", Cambridge University Press, 2008
2. Karl Gosar et.al, "Nanoelectronics and Nanosystems: From Transistors to Molecular and Quantum devices", Springer, 2005.

# 15COE02 - ADVANCED DRUG DELIVERY SYSTEMS

L	T	P	C
3	0	0	3

## ASSESSMENT : THEORY

### COURSE OUTCOME

**CO1** : The students will be able to know the fundamentals of Nanoscience and their applications in pharamacological industries

**CO2** : The students will able to describe polymeric drug delivery systems and their encapsulation methodology to study targeted drug delivery with different polymeric systems

**CO3** : The students will able to identify lipids-nanocarriers and their application in biological system

**CO4** : The students will able to study site specific drug delivery for gene therapy

### THEORY OF ADVANCED DRUG DELIVERY

Fundamentals of Nanocarriers - Size, Surface, Magnetic and Optical Properties, Pharmacokinetics and Pharmacodynamics of Nano drug carriers. Critical Factors in drug delivery. Transport of Nanoparticles - In Vitro and Ex Vivo Models. (10)

POLYMERS Dendrimers- Synthesis -Nanoscale containers- Dendritic Nanoscaffold systems Biocompatibility of Dendrimers, Gene transfection. pH based targeted delivery- chitosan and alginate. Copolymers in targeted drug delivery- PCL,PLA, PLGA. (8)

### LIPID BASED NANOCARRIERS

Liposomes, niosomes and solid lipid nanoparticles. Ligand based delivery by liposomes. Cubosomes. (9)

### MICROBES AND ANTIBODY BASED NANOCARRIERS

Bacterial dependent delivery of vaccines. Drug delivery and subcellular targeting by virus, Drug packaging and drug loading. Delivery of therapeutics by antibodies and antibodybioconjugates. (9)

### SITE SPECIFIC DRUG DELIVERY

Concepts and mechanism of Site specific drug delivery- Microneedles, Micropumps, microvalves. Implantable microchips. (9)

**TOTAL : 45**

### REFERENCE BOOKS

1. *Drug Delivery: Engineering Principles for Drug Therapy*, M. Salzman, Oxford University Press, 2001.
2. *Drug Delivery and Targeting*, A.M. Hillery, CRC Press, 2002.
3. *Drug Delivery: Principles and Applications*, B. Wang, Wiley Interscience, 2005.
4. *Nanoparticle Technology for Drug Delivery*, Ram B. Gupta, Uday B. Kompella Taylor & Francis, 2006.

## 15COE03 - BIOSENSORS

L	T	P	C
3	0	0	3

### ASSESSMENT : THEORY

#### COURSE OUTCOME

**CO1** : The students will able to understand protein based biosensors and their enzyme reactivity, stability and their application in protein based nano crystalline thin film processing

**CO2** : The students will able to describe DNA based biosensors to study the presence of heavy metals in the food products

**CO3** : The students will able to understand fluorescence, UV-Vis and electrochemical applications of biosensors

**CO4** : The students will able to study about the fabrication of biosensors and its application as nanochip analyzer

#### PROTEIN BASED BIOSENSORS

Nano structure for enzyme stabilization - Single enzyme nano particles - Nanotubes microporus silica - Protein based nano crystalline Diamond thin film for processing (9)

#### DNA BASED BIOSENSOR

Heavy metal complexing with DNA and its determination water and food samples - DNA zymo biosensors (9)

#### ELECTRO CHEMICAL APPLICATION

Detection in biosensors - Fluorescence - Absorption - Electrochemical. Integration of various techniques - Fibre optic biosensors (9)

#### FABRICATION OF BIOSENSORS

Techniques used for microfabrication - Microfabrication of electrodes - On chip analysis (9)

#### BIOSENSORS IN RESEARCH

Future direction in biosensor research - Designed protein pores-as components of biosensors - Molecular design - Bionanotechnology for cellular biosensing - Biosensors for drug discovery - Nanoscale biosensors (9)

**TOTAL : 45**

#### REFERENCE BOOKS

1. *Biosensors: A Practical Approach*, J. Cooper & C. Tass, Oxford University Press, 2004
2. *Nanomaterials for Biosensors*, Cs. Kumar, Willey - VCH, 2007
3. *Smart Biosensor Technology*, G.K. Knoff, A.S. Bassi, CRC Press, 2006.



# 15COE04 - NANOCOMPOSITES

L	T	P	C
3	0	0	3

## ASSESSMENT : THEORY

### COURSE OUTCOME

The students will be able to

**CO1** : Study the different synthesis techniques of metal ceramic nanocomposites and their functionality

**CO2** : Describe the processing techniques for heterometallic nanocomposites and to study their electromagnetical property

**CO3** : Understand the design of super hard nanocomposites with improved mechanical properties

**CO4** : Study the polymer based carbon nanotube composites, to study their mechanical properties and their industrial applications

### NANO CERAMICS

Metal-Oxide or Metal-Ceramic composites, Different aspects of their preparation techniques and their final properties and functionality. (9)

### METAL BASED NANOCOMPOSITES

Metal-metal nanocomposites, some simple preparation techniques and their new electrical and magnetic properties. (9)

### DESIGN OF SUPER HARD MATERIALS

Super hard nanocomposites, its designing and improvements of mechanical properties. (9)

### NEW KIND OF NANOCOMPOSITES

Fractal based glass-metal nanocomposites, its designing and fractal dimension analysis. Electrical property of fractal based nanocomposites. Core-Shell structured nanocomposites. (9)

### POLYMER BASED NANOCOMPOSITES

Preparation and characterization of diblock Copolymer based nanocomposites; Polymercarbon nanotubes based composites, their mechanical properties, and industrial possibilities. (9)

**TOTAL : 45**

### REFERENCE BOOKS

1. *Nanocomposites Science and Technology* - P. M. Ajayan, L.S. Schadler, P. V. Braun 2006.
2. *Physical Properties of Carbon Nanotubes*- R. Saito 1998.
3. *Carbon Nanotubes (Carbon, Vol 33)* - M. Endo, S. Iijima, M.S. Dresselhaus 1997.
4. *The search for novel, superhard materials- Stan Veprek (Review Article) JVSTA, 1999*
5. *Electromagnetic and magnetic properties of multi component metal oxides, hetero*
6. *Nanometer versus micrometer-sized particles-Christian Brosseau, Jamal Ben, Youssef, Philippe Talbot, Anne-Marie Konn, (Review Article) J. Appl. Phys, Vol 93, 2003*
7. *Diblock Copolymer, - Aviram (Review Article), Nature, 2002*

# 15COE05 - BIOREFINERY

L	T	P	C
3	0	0	3

## ASSESSMENT : THEORY

### COURSE OUTCOME

The students will be able to

**CO1** : Understand various renewable feedstocks for biofuels production

**CO2** : Understand the broad concept of second and third generation biofuel products from biomass and other low-cost agri-residues and biowastes.

**CO3** : Analyze the design processes for biofuel production

### CHEMISTRY & BIOCHEMISTRY OF BIOMASS

Types of biomass (e.g. wood waste, forestry residues, agricultural residues, perennial annual crops, organic municipal solid waste). Composition of lignocellulose (lignin, hemicellulose, cellulose); energy crops; chemical pretreatment; enzymatic pretreatment; degradation of cellulose; trichoderma cellulases; bacterial cellulases; and comparison with degradation of high starch. (9)

### BIODIESEL

Sources and processing of biodiesel, nature of lipids, fatty acids and triglycerides. Sources and characteristics of lipids for use as biodiesel feedstock; and conversion of feedstock into biodiesel, (transesterification). Use of vegetable oil (SVO) and waste vegetable oil (WVO). Environmental issues of biodiesel; major policies and regulations pertaining to the production, distribution, and use of biodiesel. (9)

### BIOMETHANE OR BIOGAS

Hydrolysis; anaerobic digestion; methanogenesis (acetoclastic, hydrogenotrophic), rates of methane formation; and one and two stage fermentation. Thermal depolymerization. Use of exhaust gases (e.g. CO<sub>2</sub>, H<sub>2</sub>S and H<sub>2</sub>) from geothermal power plants and industrial operations (e.g. coal and oil refineries) as an energy sources (methane and hydrogen) (9)

### GASIFICATION & PYROLYSIS TECHNOLOGIES

Gasification processes and the main types of gasifier designs; production of electricity by combining a gasifier with a gas turbine or fuel cell. Combined- cycle electricity generation with gas and steam turbines, and generation of heat and steam for district heating systems or CHP, including kalina Cycle. Production of synthesis gas (i.e. CO, H<sub>2</sub>, H<sub>2</sub>O, CO<sub>2</sub>) tar vapor and ash particles) for subsequent conversion to hydrogen and transport fuels; advanced gas cleaning technologies for biomass. Biological conversion of syngas into liquid biofuels. Fast pyrolysis technology to produce a range of fuels, chemicals, and fertilizers; biorefineries, and new uses for glycerine in biorefineries. (9)

### POLICIES AND FUTURE R&D OF BIOFUELS & BIOENERGY

Analysis of both current and future EU regulations and directives on biofuels and bioenergy. Tax regulations. Evaluation of different production alternatives to produce bioenergy; competitiveness of bioenergy alternatives in agriculture compared to other energy sources. Evaluation of current and future R&D needs; legal framework to support sustainable development and increased use of biofuels; government policies and programs with regard to biofuels and investment opportunities worldwide. (9)

**TOTAL : 45**

### TEXT BOOKS

1. Robert C. Brown, "Biorenewable Resources: Engineering", New Products from Agriculture, Wiley- Blackwell Publishing, 2003
2. Samir K. Khanal, "Anaerobic Biotechnology for Bioenergy Production: Principles and Application", Wiley- Blackwell Publishing 2008

### REFERENCE BOOKS

1. Martin Kaltschmitt; Hermann Hofbauer. "Biomass Conversion and Biorefinery", Springer Publishing, 2008

# 15HOE01 - PRINCIPLES OF MANAGEMENT

L	T	P	C
3	0	0	3

## ASSESSMENT : THEORY

### COURSE OUTCOME

**CO1** : Design the Management function for a given organization

**CO2** : Design and develop a strategic approach for the completion of the project

**CO3** : Analyze the behavior of individuals and groups in organizations in terms of the key factors

**CO4** : Formulate the procedure for recruitment, selection, training of staff to establish an organization

### INTRODUCTION TO MANAGEMENT

Meaning, Definition and Significance of Management-Basic functions of Management-Development of Management Thought (9)

### MANAGEMENT CONCEPTS

Planning, Organizing, Staffing, Directing and Controlling- MBO-Six sigma (9)

### ORGANIZATIONAL BEHAVIOR

Significance of OB, Role of Leadership, Personality and Motivation, Stress, Attitudes, Values and Perceptions at work (9)

### BUSINESS PROCESS REENGINEERING

Need for BPR, Various phases of BPR, Production and Productivity-Factors influencing Productivity. (8)

### HUMAN RESOURCE MANAGEMENT

Evolution of Management- Development of Managerial skills-Human Resource Management - Objectives -Job analysis - Recruitment -Selection and Placement and Training Development (10)

**TOTAL : 45**

### TEXT BOOKS

1. Harold Koontz, Heinz Weihrich and Ramachandra Aryasri, "Principles of Management" Tata McGraw Hill, New Delhi, 2013
2. Mamoria, CB, "Personnel Management", Sultan Chand and Sons, New Delhi 2013

### REFERENCE BOOKS

1. Robbin Finchanm and Peter Rhodes, "Principles of Organizational Behavior" Oxford University Press, 2010
2. CB Gupta "Management Theory and Practice" Sultan Chand and Sons, New Delhi, 2009
3. VSP Rao " Management Text and Cases" Excel Books, New Delhi, 2009
4. Fred Luthans " Organizational Behavior" Mc-Graw hill, New York 2005
5. Knanna OP "Industrial Engineering and Management", Dhanpat Rai publications, New Delhi 2003

# 15HOE02 - CURRENT TRENDS IN INDIAN ECONOMY

L	T	P	C
3	0	0	3

## ASSESSMENT : THEORY

### COURSE OUTCOME

- CO1 : Outline the structure of our Indian Economic System*
- CO2 : Access the role of industrial sector in Indian economy*
- CO3 : Interpret the demographic trends for the current scenario*
- CO4 : Analyze the role of two tier for the achievement of common national goals*

### NATIONAL INCOME AND AGRICULTURE SECTOR

Economics Development-Meaning-National Income and Per capita Income in India- Indian Planning-Agricultural Development of India: Major crops- Production-Productivity-Contribution to GDP and Exports (8)

### INDUSTRIAL SECTOR

India's industrial development-Industrial policies of 1948, 1956 and 1991-Liberalisation-Public sector-Privatization-Disinvestment policy-Role and importance of large scale industries and small scale industries-Special economic zones-Contribution to GDP-Growth rate (8)

### POPULATION

Growth and policy issues-Demographic trends-Vital statistics-India's population: size and growth rate-Demographic dividend-HDI-Population policy-Issues of Unemployment, Poverty and inequality in India (10)

### SERVICE SECTOR

Service sector in India-Banking-Insurance-Telecommunication-IT sector-Software exports-BPO-Contribution to GDP (9)

### FEDERAL SYSTEM AND FOREIGN TRADE

Federal setup in India-Taxes: Direct and Indirect Tax-Value added Tax-Foreign direct investment-Merits and Demerits-India's imports and exports: Composition and direction-Foreign exchange reserve position- MNC's in India (10)

**TOTAL : 45**

### TEXT BOOK

1. *Ruddar Datt and Sundaram, KPM, Indian Economy, S.Chand and company, New Delhi-2015 Ramesh Singh Indian Economy, McGraw hill Education 7<sup>th</sup> edition, 2015*

### REFERENCE

1. [www.jagranjosh.com](http://www.jagranjosh.com)

# 15HOE03 - MONETARY ECONOMICS

L	T	P	C
3	0	0	3

## ASSESSMENT : THEORY

### COURSE OUTCOME

**C01** : Evaluate the monetary measures formulated through static and dynamic role of money

**C02** : Design the driving force of circular flow of money

**C03** : Analyse how quantity theory of money fluctuate the price level

**C04** : Estimate the demand and supply of money based on the Interest rate

### NATURE AND SIGNIFICANCE OF MONEY

Definition of Money-Functions of Money-Static and Dynamic role of Money-Circular flow of Money-Monetary standards-Gold standard-Paper currency standard-Principles of Note issue-Measures of Money supply (9)

### QUANTITY THEORY OF MONEY

Fisher's quantity theory of Money-Assumptions-Cash Balance Approach (Cambridge Equations)- Equation of Marshall, Pigou and Keynes-Similarities and dissimilarities of cash balance and cash transaction approaches-Income and expenditure theory-Superiority of Income and expenditure theory-Demand for Money : Classical and Keynesian liquidity preference theory approach (9)

### INFLATION AND DEFLATION

Meaning-Types-Causes of Inflation-Demand Pull and Cost push inflation -Inflationary Gap-Phillips Curve-Effects of Inflation-Deflation-Causes-Measures to control Inflation and Deflation-Stagflation (9)

### COMMERCIAL BANKING AND FINANCIAL MARKETS

Functions of Commercial Banks-Credit Creation-Meaning and constitute of Money Markets-Capital Market-Institutional structure of Capital Market-Primary Market-Secondary Market-Indian capital Market-Non-Banking financial intermediaries (9)

### CENTRAL BANKING AND MONETARY POLICY

Central Banking-Functions-Organization-Instruments of Credit control-Monetary Policy: Meaning, Objectives, and Recent policy changes in RBI-Monetary Policy in a developing economy (9)

**TOTAL : 45**

### TEXT BOOK

1. *Jhinghan ML "Monetary Economics:" Vrinda Publications, New Delhi 2013*

### REFERENCE BOOKS

1. *Sethi TT, "Monetary Economic Theory", S Chand & Co, New Delhi 1996*
2. *Mithani DN, "Money Banking and International Trade", Himalaya, Mumbai 2013*

# 15HOE04 - ACCOUNTING FOR MANAGERIAL DECISIONS

L	T	P	C
3	0	0	3

## ASSESSMENT : THEORY

### **COURSE OUTCOME**

**CO1** : Differentiate Financial and Management Accounting

**CO2** : Analyze the profit and loss of the firm using the classifications of ratio analysis

**CO3** : Prepare a fund flow statement

**CO4** : Sketch the Break even chart and interpret the results for a given data

### **MANAGEMENT ACCOUNTING**

Introduction to Management Accounting - Nature and Scope of Management Accounting - Importance - Functions - Distinguish between Financial and Management Accounting - Tools in Management Accounting - Limitations - Disadvantages (9)

### **FINANCIAL STATEMENTS**

Ratio Analysis - Meaning - Significance - Classifications - Liquidity Ratios - Turnover Ratios - Profitability Ratios - Solvency Ratios (8)

### **FUND FLOW AND CASH FLOW STATEMENT**

Meaning and concept of flow of Funds-Meaning of fund Flow Statement - Difference between Fund flow statement and Income statement - Preparation and Interpretation of cash flow statement (9)

### **INVESTMENT DECISION**

Budgeting - Objectives - Features - Advantages - Disadvantages - Cash Budget - Flexible Budget (9)

### **MARGINAL COSTING AND WORKING CAPITAL MEASUREMENT**

Marginal Costing - Importance - Advantages - Breakeven Point - Breakeven Chart - Margin of Safety - Profit Volume Analysis - Working Capital - Importance - Factors Affecting Working Capital - Computation of Working Capital Requirements (10)

**TOTAL : 45**

### **TEXT BOOK**

1. R.K.Sharma and Sasi K.Gupta, "Management accounting", 2014

# 15HOE05 - ENTREPRENEURSHIP DEVELOPMENT

L	T	P	C
3	0	0	3

## ASSESSMENT : THEORY

### COURSE OUTCOME

- CO1** : Develop an entrepreneurial mindset by learning key skills such as creative thinking, innovations and funding for business
- CO2** : Formulate a business plan
- CO3** : Assess the strengths and weaknesses of business plan
- CO4** : Prepare a business plan for selecting a product

### LAUNCHING ENTREPRENEURIAL VENTURES

Creativity, Innovations, Methods to Initiate Ventures, Legal Challenges, Search for Entrepreneurial Capital (8)

### BUSINESS PLAN FOR NEW VENTURES

Meaning and Objectives of a Business Plan, Advantages and cost of preparing a Business Plan, Elements, Critical Assessment (9)

Strategic Perspectives - Strategic Growth, Need for Strategic Planning, Understanding the growth stage, Unique managerial Concerns of growing enterprise, Valuation Concerns (10)

Entrepreneurship - Indian Perspective: Historical Perspective, Global Indian Entrepreneurs, Institutions, Modern Entrepreneurs (9)

Project Work - Students have to prepare a detailed business plan selecting a product(s), Presentation of such business plans and submission after necessary corrections suggested by subject faculty. (9)

**TOTAL : 45**

### TEXT BOOK

1. Robert D Hisrich, Michael P Peters & Dean Shepherd, "Entrepreneurship", Tata McGraw Hill, 2013

### REFERENCE BOOKS

1. Thomas W.Zimmerer, Norman M.Scarborough, "Essentials of Entrepreneurship and Small Business Management", Prentice Hall of India, 2009
2. G.S.Sudha, "Management and Entrepreneurship Development", Indus Valley Publication, 2009

## 15HOE06 - EMPLOYABILITY SKILLS

L	T	P	C
3	0	0	3

### ASSESSMENT : THEORY

#### COURSE OUTCOME

**C01** : Set a goal and outline strategies to achieve it

**C02** : Prepare a job application letter with a resume for a position in a corporate sector

**C03** : Analyse the listening comprehension and answer the questions

**C04** : Find a solution for a problem in the corporate sector applying problem solving skills

#### GOAL SETTING AND TIME MANAGEMENT

Goal Setting - Immediate, Short Term and Long Term Goals - Smart Goals - Strategies to Achieve Goals - Confidence Building, Self-esteem, Motivation - Time Management - Identifying Time Wasters - Time Management Skills. (9)

#### SPEAKING

Ice-breakers - Self introduction - Role Play - Debate - Group Discussion: Purpose - Group Behavior - Analyzing Performance. Job Interviews: Identifying Job Openings - Interview Process - Types of Questions - Mock Interviews - Professional Grooming. (11)

#### READING AND WRITING

Reading Comprehension - Speed Reading Necessary for Reading Letters and Files - Vocabulary Development - Preparing Job Applications - Writing Covering Letter and Résumé - Applying for Jobs Online - Creative Writing - Article Writing - Book Review (9)

#### LISTENING

Listening to - Conversations, Long Speeches, Narrations, Descriptions, Famous Speeches. (8)

#### LEADERSHIP AND TEAM MANAGEMENT

Qualities of a Good Leader - Leadership Styles - Decision Making - Problem Solving - Etiquettes - Email, Professional, Dining & Telephone - Team Building - Team Work - Delegation. (8)

**TOTAL : 45**

#### TEXT BOOKS

1. Aruna Koneru. "Professional Communication". Tata MacGraw Hill Publishing Company Limited. New Delhi, 2008.
2. Jones, Leo and Richard Alexander. "New International Business English" Cambridge University Press, 2003.

#### REFERENCE BOOKS

1. Corneilssen, Joep. "How to Prepare for Group Discussion and Interview". New Delhi: Tata-McGraw-Hill, 2009.



# 15HOE07 - ENGLISH FOR ACADEMIC PURPOSES

L	T	P	C
3	0	0	3

## ASSESSMENT : THEORY

### COURSE OUTCOME

*CO1 : Write a description of a system.*

*CO2 : Formulate a research paper*

*CO3 : Listen to a lecture and prepare a summary.*

*CO4 : Construct dialogues using appropriate expressions.*

### FOCUS ON LANGUAGE

Sentence Construction- Types of Clauses- Sequence words - Co ordination- Subordination- Paragraphing Information - Describing a System & Procedure (8)

### READING

Understand a writer's purpose - Use strategies to ascertain meaning from unfamiliar vocabulary encountered in context - Recall and use vocabulary regarding urbanization and mega cities - To identify and outline main ideas in a passage - Skim a reading passage for main ideas - Summarize texts and images - Using a dictionary to obtain lexical, phonological and orthographical information - Identify and use target vocabulary words - Highlight important parts and texts. (8)

### WRITING

Achieving appropriate tone and style in Academic Writing - writing a Research Article - Types of Research Designs - Choosing a Research Problem- The Abstract - The Introduction - The Literature Review . The Methodology - The Results - The Discussion - The Conclusion - Citing Sources - Proof reading Your Paper (10)

### LISTENING

Listening to conversation - Lectures - Topics - Discussions - Listening comprehension on specific topics - Listening to recognize formal and Informal spoken English (8)

### SPEAKING

Seminar skills - Engage in verbal role playing in formal and informal situation. - Express advice and personal opinions with supporting information - Paraphrase stories and information - Expressing requests - Suggestions - Complaints - Apology - Giving and accepting compliments - Making invitations - Refusing invitations (11)

**TOTAL : 45**

### TEXT BOOK

1. *MLA Handbook 8th edition published 2016. ISBN : 9781603292627*

### REFERENCE BOOKS

1. *English for writing Research papers, Authors : Wall work, Adrian Published 2016, Spinger Publication.*

# 15HOE08 - ENGLISH FOR COMPETITIVE EXAMS

L	T	P	C
3	0	0	3

## ASSESSMENT : THEORY

### COURSE OUTCOME

**CO1** : Listen to TOEFL, IELTS and GRE exercises and formulate appropriate answers.

**CO2** : Speak using right grammar and appropriate pronunciation on general and academic topics.

**CO3** : Analyze the passage and answer the question.

**CO4** : Generate and organize ideas on a given topic

### LISTENING

Listening to conversation - Narration - Suggestion - Assumptions - Predictions - Implications - Problems - Academic Conversations  
- Discussions - Lectures (11)

### SPEAKING

Independent speaking - Integrated speaking - Speaking about a personal experience - Preferences - Report the speakers opinion - Explain a problem and solution give a summary of a academic lecture. (13)

### READING

Read and understand short passages - Integrated reading tasks - Read the passage and choose the right summary of the passage - Reading for main ideas - Scanning the passage for synonyms - Making inferences - Identifying exceptions - Locating references. (12)

### WRITING

Independent writing - Integrated writing - Writing short essays - Writing dialogues - Articles - Sentence construction (9)  
**TOTAL : 45**

### TEXT BOOK

1. Sharpe J.Pamela. *Barron's How to prepare for the TOEFL Test of English as a foreign Language. 11<sup>th</sup> Edition, Galgotia Publications Pvt.Ltd: New Delhi, 2004.*

### REFERENCE BOOKS

1. Sharpe J.Pamela. *Barron's TOEFL iBT Internet- Based Test. 12<sup>th</sup> Edition, Galgotia publications Pvt.Ltd: New Delhi, 2009.*
2. Longman *Introductory course for the TOEFL Test.*

# 15HOE09 - LIFE AND LITERATURE

L	T	P	C
3	0	0	3

## ASSESSMENT : THEORY

### COURSE OUTCOME

- CO1** : Compose an essay on the prose piece  
**CO2** : Analyse the poem and write a critical appreciation of it  
**CO3** : Read the story and find the moral values implied in the stories  
**CO4** : Write a review of the fiction

### PROSE

- The Postmaster by Rabindranath Tagore,  
Snapshot of a Dog by J G Thurber  
On the Rule of the Road by A.G. Gardiner  
The Village Schoolmaster by Oliver Goldsmith  
Incident of the French Camp by Robert Browning (13)

### POEMS

- Stopping By Woods on a Snowy Evening by Robert Frost  
The Ballad of Father Gilligan by W.B. Yeats (9)

### SHORT STORIES

- The Model Millionaire by Oscar Wilde  
The Ant and the Grasshopper by W. Somerset Maugham  
The Doll's House by Katherine Mansfield, Biography (10)  
Albert Einstein and Steve Jobs

### FICTION

- The Old Man and the Sea by Ernest Hemmingway  
The Scarlet Pimpernel by Baroness Emma Orczy  
Practice in creative writing, review writing (13)

**TOTAL : 45**

### TEXT BOOKS

1. Kumara Pillai. ed. *A Book of Modern Short Stories*. Macmillan: New Delhi, 2009
2. Colleen and Darius Krishnaraj. ed. *Convergence, A Book of Short Stories*. Macmillan: New Delhi, 2009
3. Ernest Hemmingway. *The Old Man and the Sea*. Arrow: Warwickshire, 2000.
4. Baroness Emma Orczy, *The Scarlet Pimpernel*. Hutchinson : 1995

### REFERENCE BOOKS

1. Xavier. ed. *An Anthology of Popular Essays and Poems*. Macmillan: New Delhi, 2009