DEPARTMENT OF COMPUTER SCIENCE &ENGINEERING

DELHI TECHNOLOGICAL UNIVERSITY

(Formerly Delhi College of Engineering)

Curriculum

B. Tech. (SOFTWARE ENGINEERING)

W.E.F. 2015-16

DEPARTMENT OF COMPUTER ENGINEERING

BACHELOR OF TECHNOLOGY (SOFTWARE ENGINEERING)

I Year: Odd Semester

Teaching Scheme					Contact Hours/Week			Exam Duration (h)		Relative Weights (%)				
S. No.	**Subject Code**	**Course Title**	**Subject Area**	**Credit**	**L**	**T**	**P**	**Theory**	**Practical**	**CWS**	**PRS**	**MTE**	**ETE**	**PRE**
Group A														
1	MA101	Mathematics - I	ASC	4	3	1	0	3	0	25	-	25	50	-
2	AP101	Physics – I	ASC	4	3	0	2	3	0	15	15	30	40	-
3	AC101	Chemistry	ASC	4	3	0	2	3	0	15	15	30	40	-
4	ME101	Basic Mechanical Engineering	AEC	4	4	0	0	3	0	25	-	25	50	-
5	ME103	Workshop Practice	AEC	2	0	0	3	0	3	-	50	-	-	50
6	HU101	Communication Skills	HMC	3	3	0	0	3	0	25	-	25	50	-
	Total			**21**	16	1	7							
Group B														
1	MA101	Mathematics - I	ASC	4	3	1	0	3	0	25	-	25	50	-
2	AP101	Physics – I	ASC	4	3	0	2	3	0	15	15	30	40	-
3	EE101	Basic Electrical Engineering	AEC	4	3	0	2	3	0	15	15	30	40	-
4	CO101	Programming Fundamentals	AEC	4	3	0	2	3	0	15	15	30	40	-
5	ME105	Engineering Graphics	AEC	2	0	0	3	0	3	-	50	-	-	50
6	EN101	Introduction to Environmental Science	AEC	3	3	0	0	3	0	25	-	25	50	-
	Total			**21**	15	1	9							

I Year: Even Semester

Teaching Scheme					Contact Hours/Week			Exam Duration		Relative Weights (%)				
S. No.	**Subject Code**	**Course Title**	**Subject Area**	**Credit**	**L**	**T**	**P**	**Theory**	**Practical**	**CWS**	**PRS**	**MTE**	**ETE**	**PRE**
Group A														
1	MA102	Mathematics – II	ASC	4	3	1	0	3	0	25	-	25	50	-
2	AP102	Physics – II	ASC	4	3	0	2	3	0	15	15	30	40	-
3	EE102	Basic Electrical Engineering	AEC	4	3	0	2	3	0	15	15	30	40	-
4	CO102	Programming Fundamentals	AEC	4	3	0	2	3	0	15	15	30	40	-
5	ME102	Engineering Graphics	AEC	2	0	0	3	0	3	-	50	-	-	50
6	EN102	Introduction to Environmental Science	AEC	3	3	0	0	3	0	25	-	25	50	-
	Total			**21**	15	1	9							
Group B														
1	MA102	Mathematics – II	ASC	4	3	1	0	3	0	25	-	25	50	-
2	AP102	Physics – II	ASC	4	3	0	2	3	0	15	15	30	40	-
3	AC102	Chemistry	ASC	4	3	0	2	3	0	15	15	30	40	-
4	ME104	Basic Mechanical Engineering	AEC	4	4	0	0	3	0	25	-	25	50	-
5	ME106	Workshop Practice	AEC	2	0	0	3	0	3	-	50	-	-	50
6	HU102	Communication Skills	HMC	3	3	0	0	3	0	25	-	25	50	-
	Total			**21**	16	1	7							

II Year: Odd Semester

S.No.	Code	Title	Area	Cr	L	T	P	TH	PH	CWS	PRS	MTE	ETE	PRE
1.	EC261	Analog Electronics	AEC	4	3	0	2	3	0	15	15	30	40	-
2.	SE201	Data Structures	DCC	4	3	0	2	3	0	15	15	30	40	-
3.	SE203	Object Oriented Programming	DCC	4	3	0	2	3	0	15	15	30	40	-
4.	SE205	Web Technology	DCC	4	3	0	0	3	0	25	-	25	50	-
5.	SE207	Engineering Analysis and Design (Modelling and Simulation)	DCC	4	3	1	0	3	0	25	-	25	50	-
6.	HU201	Engineering Economics	HMC	3	3	0	0	3	0	25	-	25	50	-
		Total		23										

II Year: Even Semester

S.No.	Code	Title	Area	Cr	L	T	P	TH	PH	CWS	PRS	MTE	ETE	PRE
1.	EC252	Digital Electronics	AEC	4	3	0	2	3	0	15	15	30	40	-
2.	SE202	Software Engineering	DCC	4	3	0	2	3	0	15	15	30	40	-
3.	SE204	Computer Organization & Architecture	DCC	4	3	1	0	3	0	25	-	25	50	-
4.	SE206	Database Management Systems	DCC	4	3	0	2	3	0	15	15	30	40	-
5.	SE208	Discrete Structures	DCC	4	3	1	0	3	0	25	-	25	50	-
6.	MG202	Fundamentals of Management	HMC	3	3	0	0	3	0	25	-	25	50	-
		Total		23										

III Year: Odd Semester

S.No.	Code	Title	Area	Cr	L	T	P	TH	PH	CWS	PRS	MTE	ETE	PRE
1.	SE301	Object Oriented Software Engineering	DCC	4	3	0	2	3	0	15	15	30	40	-
2.	SE303	Algorithm Design & Analysis	DCC	4	3	0		3	0	15	15	30	40	-
3.	SE3xx	Departmental Elective Course -1	DEC/GEC	4	3	0/1	2/0	3	0	15/25	15/-	30/25	40/50	-
4.	SE3xx	Departmental Elective Course -2	DEC/GEC	4	3	0/1	2/0	3	0	15/25	15/-	30/25	40/50	
5.		University Elective Course	UEC	3	3	0	0	3	0	25	-	25	50	-
6.	HU301	Professional Ethics & Values	HMC	2	2	0	0	3	0	25	-	25	50	-
		Total		21										

III Year: Even Semester

S.No.	Code	Title	Area	Cr	L	T	P	TH	PH	CWS	PRS	MTE	ETE	PRE
1.	SE302	Software Testing	DCC	4	3	0	2	3	0	15	15	30	40	-
2.	SE304	Operating System	DCC	4	3	0	2	3	0	15	15	30	40	-
3.	SE306	Compiler Design	DCC	4	3	1	0	3	0	25	-	25	50	-
4.	SE3xx	Departmental Elective Course	DEC/	4	3	0/	2/0	3	0	15/2	15/-	30	40/50	-

		-3	GEC			1				5		/25		
5.	SE3xx	Departmental Elective Course -4	DEC/ GEC	4	3	0/ 1	2/0	3	0	15/2 5	15/-	30 /25	40/50	-
6.	HU302	Technical Communication	HMC	2	2	0	0	3	0	25	-	25	50	--
		Total		22										

IV Year: Odd Semester

S.No.	Code	Title	Area	Cr	L	T	P	TH	PH	CWS	PRS	MTE	ETE	PRE
1.	SE401	B.Tech. Project-I	DCC	4										
2.	SE403	Training Seminar	DCC	2										
3.	SE405	Software Project Management	DCC	4	3	0	2	3	0	15	15	30	40	-
4.	SE407	Computer Networks	DCC	4	3	0	2	3	0	15	15	30	40	-
5.	SE4xx	Departmental Elective Course -5	DEC/GEC	4	3	0/1	2/0	3	0	15/25	15/-	30 /25	40/50	
6.	SE4xx	Departmental Elective Course- 6	DEC/GEC	4	3	0/1	2/0	3	0	15/25	15/-	30 /25	40/50	
			22											

IV Year: Even Semester

S.No.	Code	Title	Area	Cr	L	T	P	TH	PH	CWS	PRS	MTE	ETE	PRE
1.	SE402	B.Tech. Project-II	DCC	8										
2.	SE404	Empirical Software Engineering	DCC	4	3	0	2	3	0	15	15	30	40	-

3.	SE4xx	Departmental Elective Course-7	DEC/GEC	4	3	0/1	2/0	3	0	15/25	15/-	30 /25	40/50	
4.	SE4xx	Departmental Elective Course- 8	DEC/GEC	4	3	0/1	2/0	3	0	15/25	15/-	30 /25	40/50	
			20											

List of Departmental Elective Courses

S. No.	Subject Code	Subject	
1.	SE-305	Software Requirement Engineering	DEC-1, 2
2.	SE-307	Computer Graphics	
3	SE-309	Information Theory and coding	
4.	SE-311	Digital Signal Processing	
5.	SE-313	Advanced Data Structures	
6.	SE-315	Microprocessor & Interfacing	
7.	SE-317	Distributed Systems	
8.	SE-319	Soft Computing	
9.	SE-321	Artificial Intelligence	
10.	SE-323	Theory of Computation	
11.	SE-308	Software Reliability	DEC-3, 4
12.	SE-310	Multimedia Systems	
13.	SE-312	Parallel Computer Architecture	
14.	SE-314	Bio-Informatics	
15.	SE-316	Natural Language Processing	
16	SE-318	Advanced Database Management Systems	
17.	SE-320	Data Compression	
18.	SE-322	Real Time Systems	
19.	SE-324	Parallel Algorithms	
20.	SE-409	Software Maintenance	DEC-5, 6
21.	SE-411	Software Quality & Metrics	
22.	SE-413	Grid & Cluster Computing	

23.	SE-415	Pattern Recognition	
24.	SE-417	Data Warehousing & Data Mining	
25.	SE-419	Cyber-Forensics	
26.	SE-421	Robotics	
27.	SE-423	Machine Learning	
28.	SE-425	Intellectual Property Rights & Cyber Laws	
29.	SE-406	Advances in Software Engineering	DEC-7,8
30..	SE-408	Information & Network Security	
31.	SE-410	Swarm & Evolutionary Computing	
32.	SE-412	Semantic Web and Web Mining	
33.	SE-414	Cloud Computing	
34.	SE-416	Big Data Analytics	
35.	SE-418	Wireless and Mobile Computing	
36.	SE-420	Agile Software Process	

List of University Electives

S.No.	SUBJECT CODE	SUBJECTS
1.	CO351	Enterprise & Java Programming
2.	CO353	E-commerce & ERP
3.	CO355	Cryptography & Information Security
4.	CO357	Operating System
5.	CO359	Intellectual Property Rights & Cyber Laws
6.	CO361	Database Management System
7.	EC351	Mechatronics
8.	EC353	Computer Vision
9.	EC355	Embedded System
10.	EC 357	Digital Image Processing
11.	EC359	VLSI Design
12.	EE351	Power Electronics Systems
13.	EE353	Electrical Machines and Power Systems
14.	EE355	Instrumentation Systems
15.	EE357	Utilization of Electrical Energy
16.	EE359	Non-conventional Energy Systems
17.	EE361	Embedded Systems
18.	EN351	Environmental Pollution & E- Waste Management
19.	EN353	Occupational Health & Safety Management
20.	EN355	GIS & Remote Sensing
21.	EP351	Physics of Engineering Materials
22.	EP353	Nuclear Security
23.	HU351	Econometrics
24.	MA351	History Culture & Excitement of Mathematics
25.	ME351	Power Plant Engineering
26.	ME353	Renewable Sources of Energy
27.	ME355	Combustion Generated Pollution
28.	ME357	Thermal System
29.	ME359	Refrigeration & Air Conditioning
30.	ME361	Industrial Engineering
31.	ME363	Product Design & Simulation
32.	ME365	Computational fluid dynamics
33.	ME367	Finite Element Methods
34.	ME369	Total Life Cycle Management
35.	ME371	Value Engineering
36.	MG351	Fundamentals of Financial Accounting and Analysis
37.	MG353	Fundamentals of Marketing
38.	MG355	Human Resource Management
39.	MG357	Knowledge and Technology Management
40.	PE351	Advance Machining Process
41.	PE 353	Supply Chain Management
42.	PE355	Work Study Design
43.	PE357	Product Design & Simulation
44.	PE359	Total Life Cycle Management
45.	PE361	Total Quality Management
46.	PT361	High Performance Polymers
47.	PT363	Separation Technology
48.	PT365	Non-Conventional Energy
49.	PT367	Polymer Waste Management
50.	PT369	Nanotechnology in Polymers
51.	PT371	Applications of Polymer Blends and Composite
52.	IT 351	Artificial Intelligenceand Machine Learning

53.	IT 353	Data Structures and Algorithms
54.	IT 355	Communication and Computing Technology
55.	IT 357	Internet and Web Programming
56.	IT 359	Java Programming

1. Subject Code: **EC261** Course Title: **Analog Electronics**
2. Contact Hours: L: 3 T: 1 P: 0
3. Examination Duration (ETE) (Hrs.): Theory 3 Hrs Practical 0
4. Relative Weightage: CWS 25 PRS 0 MTE 25 ETE 50 PR 0
5. Credits: 4
6. Semester: III
7. Subject Area: AEC
8. Pre-requisite: NIL
9. Objective: To provide knowledge about the principles, concepts and applications of analog electronics.
10. Details of Course

S.No.	Contents	Contact Hours
1.	**Review of Semiconductors:** Energy band structure of Insulator, Semiconductor and Metal, Intrinsic and extrinsic semiconductor. **P-N Junction Diodes, and its application:** clipping and clamping circuits, Rectifiers and filters, Zener diode and regulators.	8
2.	**Bipolar Junction Transistor (BJT):** Introduction, Physical behavior, Ebers-Moll model, Common Base and Common Emitter characteristics, load line, operation point, active, saturation and cut off mode of operations. DC Model. **Bias stabilization:** Need for stabilization, fixed bias and self-bias circuits	8
3.	**BJT Amplifiers:** Transistor as an amplifier, BJT Low frequency small signal hybrid-π model, AC analysis of CB, CE, CC configurations.	8
4.	**Junction Field Effect Transistors (JFET)**: Introduction, Common source drain characteristics, operating point, biasing, MOSFETS (enhancement & depletion type). **FET Amplifier**: Low frequency small signal model, AC analysis of Common Source and Common Drain configurations.	8
5.	**Feedback Amplifiers and Oscillators**: Introduction, various feedback arrangements & stability, R-C phase shift oscillators.	4

6.	**Operational Amplifier (OPAMP):** Ideal OPAMP, Basic OPAMP circuitsstages, OPAMP Applications: Adders and Subtractor, Voltage follower, Current to Voltage Converter, Voltage to Current converter, Integrator, Differentiator, Logarithmic Amplifier, Square wave generator	6
	TOTAL	42

11. Suggested Books

S.No.	Name of Books / Authors/ Publishers	Year of Publication/ Reprint
	Text Books	
1	J. Millman and A Grabel, "Micro Electronics" TMH,	1999
2	J. Millman and Halkias, "Integrated Electronics, Analog & Digital Circuits & Systems" TMH.	1999
3.	I J Nagrath, " Electronics, Analog and digital, PHI	2009
	Reference Books	
4	B. Kumar and S B Jain, "Electronic Devices & Circuit" PHI	2010
5	Sedra& Smith, "Micro Electronic Circuits" Oxford University Press,	2000

1. Subject Code: **SE201** Course Title: **Data Structures**
2. Contact Hours: L: 3 T: 0 P: 2
3. Examination Duration (ETE) (Hrs.): Theory 3 Hrs Practical 0
4. Relative Weightage: CWS 15 PRS 15 MTE 30 ETE 40 PR 0
5. Credits: 4
6. Semester: III
7. Subject Area: DCC
8. Pre-requisite: Fundamentals of Programming
9. Objective: To study different kinds of data structures with their respective applications.
10. Details of Course

S.No.	Contents	Contact Hours
1.	**Introduction:** Introduction to Algorithmic, Complexity- Time-Space Trade off. Introduction to abstract data types, design, implementation and	8

	applications. Introduction to List data structure. **Arrays and Strings:** Representation of Arrays in Memory: one dimensional, Two dimensional and Multidimensional, Accessing of elements of array, performing operations like Insertion, Deletion and Searching. Sorting elements of arrays. Strings and String Operations. **Stacks and Queues:** Introduction to data structures like Stacks and Queues. Operations on Stacks and Queues, Array representation of Stacks , Applications of Stacks : recursion, Polish expression and their compilation conversion of infix expression to prefix and postfix expression, Operations of Queues, Representations of Queues Applications of Queues, Priority queues.	
2.	**Linked Lists:** Singly linked lists, Representation of linked list, Operations of Linked list such as Traversing, Insertion and Deletion, Searching, Applications of Linked List. Concepts of Circular linked list and Doubly linked list and their Applications. Stacks and Queues as linked list.	6
3.	**Trees:** Basic Terminology, Binary Trees and their representation, binary search trees, various operations on Binary search trees like traversing, searching, Insertion and Deletion , Applications of Binary search Trees , Complete Binary trees, Extended binary trees. General trees, AVL trees, Threaded trees, B- trees.	8
4.	**Searching and Sorting:** Linear Search, Binary search, Interpolation Search, Insertion Sort, Quick sort, Merge sort, Heap sort, sorting on different keys, External sorting.	7
5.	**Graphs:** Terminology and Representations, Graphs & Multi-graphs, Directed Graphs, Representation of graphs and their Transversal, Spanning trees, shortest path and Transitive Closure, Activity Networks, Topological Sort and Critical Paths.	7
6.	**File Structure:** File Organization, Indexing & Hashing, Hash Functions, Collision Resolution Techniques.	6
	TOTAL	42

11. Suggested Books

S.No.	Name of Books / Authors/ Publishers	Year of Publication/ Reprint
Text Books:		
1.	Horowitz and Sahni, "Fundamentals of Data structures", Galgotia publications	1983
2.	Tannenbaum, "Data Structures", PHI	2007(Fifth Impression)
3.	An introduction to data structures and application by Jean Paul Tremblay & Pal G. Sorenson (McGraw Hill).	1984
	Reference Books	
4.	R.L. Kruse, B.P. Leary, C.L. Tondo, "Data structure and program design in C", PHI	2009(Fourth Impression)

1. Subject Code: **SE203** Course Title: **Object Oriented Programming**
2. Contact Hours: L: 3 T: 0 P: 2
3. Examination Duration (ETE) (Hrs.): Theory 3 Hrs Practical 0
4. Relative Weightage: CWS 15 PRS 15 MTE 30 ETE 40 PR 0
5. Credits: 4
6. Semester: III
7. Subject Area: DCC
8. Pre-requisite: NIL
9. Objective: To provide knowledge of Object Oriented programming features.
10. Details of Course

S.No.	Contents	Contact Hours
1.	**Object oriented paradigm & C++ at a glance:** Evolution of programming paradigm, structured versus object-oriented development, elements of object-oriented programming, Objects, classes, methods, popular OOP languages, software reuse. **Classes and objects:** Introduction, Class revisited, constant objects and	8

	constructor, static data members with constructors and destructors, constructor overloading, nested classes, objects as arguments, returning objects , friend functions and friend classes, constant parameters and member functions, static data and member functions.	
2.	**Dynamic objects:** Introduction, pointers to objects, array of objects, pointers to object members, this pointer, self-referential classes **Operator overloading and Inheritance:** overloading of new and delete operators, conversion between objects and basic types, conversion between objects of different classes, overloading with friend functions, abstract classes, inheritance types , virtual base classes, virtual functions, pointer to derived class objects, and base class objects, pure virtual functions, virtual destructors. **Generic programming with templates:** Introduction, function templates, overloaded function templates, class templates, inheritance of class template, class template containership, class template with overloaded operators.	7
3.	Introduction to byte code, security and portability, Data Types, variables, operators, arrays, type conversion and casting, type promotion, Control statements, standard input-output, Designing Classes, constructors, methods, access specifiers : public, private, protected, inheritance, packages and interfaces, Math, String, Vectors, and Array List classes, polymorphism: function and operator overloading, function overriding, abstract classes.	6
4.	**Exception Handling:** exception types, nested try-catch, throw, throws and finally statements, Multithread Programming: thread creation, synchronization and priorities.	6
5.	**Input-output and file operations:** Java.io, stream classes, Byte streams, character streams, serialization. Networking concepts: Client server and socket programming, TCP/IP client and server sockets.	7
6	**Applets and Java Swing:** Applet design, AWT packages, Applet event handling, parameters to applets, AWT controls, layout manager, Frames, container classes, Introduction to Java Beans, Swing and Servlets.	8
	TOTAL	42

11. Suggested Books

S.No.	Name of Books / Authors/ Publishers	Year of Publication/ Reprint

Text Books		
1	Patrick Naughton, Herbert Schildt: "The Complete Reference: Java 2", TMH.ISBN-13 9780070495432	1999
2	C Thomas Wu : "An Introduction to OO programming with Java", TMH,ISBN-10: 0073523305	2009
3.	Balaguruswami, "Object oriented with C++", TMH. ISBN 0070669074, 9780070669079	2008
4	Budd, "Object Oriented Programming", Addison Wesley	1997
Reference Books		
5	Mastering C++ K.R Venugopal Rajkumar, TMH.	2013
6	C++ Primer, "Lip man and Lajole", Addison Wesley.	1986
7	Maria litvin, Gary litvin,"Programming in C++", VPH.	2001
8	D Samantha, "Object oriented Programming in C++ and Java ", PHI.	2007

1. Subject Code: **SE205** Course Title: **Web Technology**
2. Contact Hours: L: 3 T: 0 P: 2
3. Examination Duration (ETE) (Hrs.): Theory 3 Hrs Practical 0
4. Relative Weightage: CWS 15 PRS 15 MTE 30 ETE 40 PR 0
5. Credits: 4
6. Semester: III
7. Subject Area: DCC
8. Pre-requisite: Fundamentals of Programming
9. Objective: To understand the Internet & the Web phenomena. Comprehend the evolution, development and research in the area of Web.
10. Details of Course

S.No.	Contents	Contact Hours
1.	**Inter-Networking:** Internet, Growth of Internet, Owners of the Internet, Anatomy of Internet, APRANET and Internet history of the World Web, Basic Internet Terminology, Net etiquette. Working of Internet: Packet switching technology, Internet Protocols: TCP/IP, Router. Internet Addressing Scheme: Machine Addressing (IP address), E-mail Address,	6

	Resource Addresses.	
2.	**Internet Applications:** E-mail, file transfer (FTP), telnet, usenet, Internet chat, Web.	4
3.	**Evolution of Web:**Web 1.0: Hypertext & linking documents, HTTP, Client-Server, peer-to-peer; Web Browser (Lynx, Mosiac, Netscape, Internet Explorer, Firefox, and Safari, the mobile web); Impact: Opportunities & Challenges. Web 2.0: From 1.0 to 2.0; Framework; Technologies: Client-side & server-side; Web 2.0 development technologies; Examples: social networking sites, blogs, wikis, video sharing sites, hosted services(web services, location-based services), web applications, mashups & folksonomies; Practical Usage. Web 3.0: From 2.0 to 3.0; Semantic Web: What, How, Why; From Web 3.0 to Web 4.0	10
4.	**Web Development:** Phases; Web Page, Website, and Web Application: Example, Technology Framework for development. Client-side technology: HTML (HTML 5).Client-side scripting: JavaScript. Server-side technology: PHP. Server-side scripting: Server-side JavaScript. Web application development frameworks: Django & Ruby on Rails. Web Database: Database Connectivity: JDBC, ODBC; Database-to-web connectivity.	14
6.	**Web Search and Mining:** Web IR System: Search Engines, Web Crawling, Search Engine Optimization, Web Analytics, Web Mining Taxonomy; Web Mining Framework; Social Web Mining. Text Mining: Opinion Mining, Recommendation System, Topic Detection and Tracking.	8
	TOTAL	42

11. Suggested Books

S.No.	Name of Books / Authors/ Publishers	Year of Publication/ Reprint

	Text Books	
1.	Internet and Web Technologies by Raj Kamal, Tata McGraw Hill edition. (ISBN: 9780070472969)	2002
2.	An Introduction to Search Engines and Web Navigation, Mark Levene, Pearson Education. (ISBN: 978047052684)	2010
3.	Modeling the Internet and the Web, Pierre Baldi, Paolo Frasconi, Padhraic Smyth, John Wiley and Sons Ltd. (ISBN: 978-0-470-84906-4)	2003
	Reference Books	
4.	HTML: A Beginner's Guide by Wendy Willard, Tata McGraw-Hill (ISBN: 9780070677234)	2009
5.	PHP and MySQL for Dynamic Web Sites, Ullman, Larry, Peachpit Press.1 (ISBN: 978-0-321-78407-0)	2012

1. Subject Code: **SE207** Course Title: **Simulation and Modeling**
2. Contact Hours: L: 3 T: 1 P: 0
3. Examination Duration (ETE) (Hrs.): Theory 3 Hrs Practical 0
4. Relative Weightage: CWS 25 PRS 0 MTE 25 ETE 50 PR 0
5. Credits: 4
6. Semester: III
7. Subject Area: DCC
8. Pre-requisite: Nil
9. Objective: To introduce different types of Simulation models, discrete event simulation modeling with example, uses of different simulation modeling software like GPSS, SIMSCRIPT, SLAM, GASP, and SIMULA and different evaluation methods for the simulation software output.
10. Details of Course

S.No.	Contents	Contact Hours
1.	Definition of System, types of system: continuous and discrete, modelling process and definition of a model.The nature of simulation: simulation model - static, dynamic, deterministic stochastic continuous, discrete models.	8
2.	Discrete event simulation: Time Advance Mechanism, Components and Organization of a Discrete Event Simulation Model, Selected Illustrative Examples of	11

	Simulation Application Models	
3.	Simulation software: Modelling of Complex Systems, Use of a Simulation Language such as GPSS, SIMSCRIPT, SLAM, GASP, and SIMULA.	12
4.	Evaluation of simulation output :Random Variables and their properties Estimation Methods, Goodness of Fit, Confidence Intervals, Variance Reduction Techniques, Validation of Simulation Models.	11
	TOTAL	42

11. Suggested Books

S.No.	Name of Books / Authors/ Publishers	Year of Publication/ Reprint
	Text Books	
1.	Simulation Modeling and Analysis, Kelton W.D. and Law A.M, II Edition, McGraw Hill	1982
2.	Interactive Dynamic System Simulation, G. A. Korn, McGraw Hill	1988
	Reference Books	
3.	Theory of Modeling and Simulation: Integrating Discrete Event and Continuous Complex Dynamic Systems, Bernard P. Zeigler, Herbert Praehofer, Tag Gon Kim, Academic Press, 2000	2000
4.	Modelling and simulation : Exploring dynamic system behavior, Birta, publisher : Yesdee, ISBN13 : 9788184893656	2012

1. Subject Code: **HU201** Course Title: **Engineering Economics**
2. Contact Hours: L: 3 T: 0 P: 0
3. Examination Duration (ETE)(Hrs.): Theory 3 Hrs Practical 0
4. Relative Weightage: CWS 25 PRS 0 MTE 25 ETE 50 PR 0
5. Credits: 3
6. Semester: III
7. Subject Area: HMC
8. Pre-requisite: NIL
9. Objective:
10. Details of Course

S.No.	Contents	Contact Hours
1.	Introduction: Nature and significance of economics, Goods and Utility, Basic Concept of Demand and Supply, Elasticity of Demand- Price elasticity of Demand, Cross elasticity of Demand, Production - Production Function, Production Process and Factors of Production, Market – Introduction to Monopoly, Perfect Competition, Oligopoly and Monopolistic Competition, Cost Concepts- Opportunity Cost, Total Cost, Average Cost; Marginal Cost; Life Cycle cost, Sunk Cost; Preparation of Cost Sheet Profit Maximisation-numerical problem.	10
2.	Money- its evaluation and function, Bank- Commercial Bank and Central Bank and brief idea about function of banking system:. Tax and Subsidy, Type of Tax- Direct and Indirect, Monetary and fiscal policy, Inflation and Business cycle, International trade, terms of Trade, Gain from International Trade, Free Trade vs. Protection, Dumping, Balance of Payment.	10
3.	Role of Science, Engineering and Technology in Economic Development: Seven salient Feature of the Indian Economy; Inclusive Growth; relevance for the Indian Economy; Globalisation& opening up of the Indian Economy; GDP-definition and Its measurement; How knowledge of engineering and ology may	12

	be used to improve life at slum; Green Revolution and White revolution. Reasons for their success and can we replicate them. Appropriate Technology & Sustainable Development. Entrepreneurship: Macro environment for promotion of entrepreneurship: How environment has changed after advent of IT and Globalisation.	
4.	Elementary Economic Analysis: Interest formulas and their Applications; Calculations of economic equivalence, Bases for Comparison of Alternatives: Present Worth Method, Future worth method, Annual equivalent, Internal Rate of Return; Business Risk; Factors which should be taken care while deciding price of the product in the market.	10
	TOTAL	42

11. Suggested books

S.No.	Name of Books / Authors/ Publishers/Year of Publication/Reprint
1.	Engineering Economy, Engi G.J. Thuesen, & W.J. Fabrycky, Prentice-Hall of India Private Limited,(2007)
2.	Engineering Economy, William G. Sullivan, James A. Bontadelli& Elin M. Wicks, Pearson Education Asia,(First Indian reprint),2009
3.	Engineering Economic Analysis, Donald G. Newman, Jerome P. Lavelle & Ted G. Eschenbach, , Engineering Press,2001
4.	Economics for Engineering Students, Seema Singh, , IK International Publishing House Pvt. Ltd,2014

1. Subject Code: **EC252** Course Title: **Digital Electronics**
2. Contact Hours: L: 3 T: 0 P: 2
3. Examination Duration (ETE) (Hrs.): Theory 3 Hrs Practical 0
4. Relative Weightage: CWS 15 PRS 15 MTE 30 ETE 40 PR 0
5. Credits: 4
6. Semester: IV
7. Subject Area: AEC
8. Pre-requisite: None
9. Objective: To introduce the concepts of digital logic, functioning and design of digital devices, logic families, electronic memory and related devices.
10. Details of Course

S.No.	Contents	Contact Hours
1.	Boolean Algebra, Venn diagram, switching function and minimization, switching functions with don't care terms etc. (Karnaugh's Map Method & Tabulation Techniques)	6
2.	Introduction Logic Gates, Logic Families TTL, Tristate Logic, ECL, CMOS	8

	and T^2L Logic, Logic parameters, Bistable, Monostable, Astable and Schmitt trigger circuit.	
3.	Gated memories, M/S flip flips, Shift Registers Serial & Parallel Counters, Ring counters, Up Down counters. Designing of combinational circuits like code converter, address decoders, comparators, etc.	8
4.	Introduction to semiconductor memories: ROM, PROM, EPROM, STATIC & DYNAMIC RAM. Introduction to Encoders, Decoders, Multiplexer, Demultiplexer, Designing Combinational circuits with multiplexers and other digital logic blocks, PROM. Concept of Digital to Analog Conversion Ladder Networks, and Concept of Analog to Digital conversion: Dual Slope method.	6
5.	V-F conversion, stair case Ramp-method/counter method successive approximation type of A/D converters etc.	6
6.	Introduction to design of synchronous & asynchronous sequential circuit flow table realization from verbal description, ASM charts, minimization of flow table and concept of state assignment.	8
	TOTAL	42

11. Suggested Books

S.No.	**Name of Books / Authors/ Publishers**	**Year of Publication/ Reprint**
Text Books		
1.	Thomas L. Floyd, Digital Fundamentals, 10thEdition, Pearson Education, ISBN-13: 9780132359238	2009
2.	M. Morris Mano, Digital Design, 4th Edition, Pearson EducationISBN-13: 9780131989245	2007
Reference Books		
3.	Donald P.Leach and Albert Paul Malvino, GoutamSaha, Digital Principles and Applications, 6th Edition, TMH, ISBN: 0070601755	2006
4.	John F.Wakerly, Digital Design: principles and practices, 4th Edition, Pearson Education, ISBN-10: 0131863894	2006

5.	John.M Yarbrough, Digital Logic Applications and Design, Thomson Learning, ISBN-10: 0314066756	2002

1. Subject Code: **SE202** Course Title: **Software Engineering**
2. Contact Hours: L: 3 T: 0 P: 2
3. Examination Duration (ETE) (Hrs.): Theory 3 Hrs Practical 0
4. Relative Weightage: CWS 15 PRS 15 MTE 30 ETE 40 PR 0
5. Credits: 4
6. Semester: IV
7. Subject Area: DCC
8. Pre-requisite: Nil
9. Objective: To introduce fundamentals of software engineering including requirement specifications, software design, testing and maintenance.
10. Details of Course

S.No.	Contents	Contact Hours
1.	Introduction: Introduction to software Engineering, Software characteristics, Software components, Software applications, Software Engineering Principles, Software metrics and measurement, monitoring and control. Software development life-cycle**,** Water fall model, prototyping model, Incremental model, Iterative enhancement Model, Spiral model.	8
2.	**Software Requirement Specification:** Requirements Elicitation Techniques, Requirements analysis, Models for Requirements analysis, requirements specification, requirements validation.	8
3.	**System Design:** Design Principles: Problem partitioning, abstraction. Top down and bottom up – design, structured approach. Functional versus	6

	object oriented approach of design, design specification, Cohesiveness and Coupling. Overview of SA/SD Methodology, structured analysis, data flow diagrams, extending DFD to structure chart.	
4.	**Software project Management:** Project planning and Project scheduling. Software Metrics**:** Size Metrics like LOC, Token Count, Function Count. Cost estimation using models like COCOMO. Risk management activities. **Software Reliability and Quality Assurance:** Reliability issues, Reliability metrics, reliability models, Software quality, ISO 9000 certification for software industry, SEI capability maturity model.	8
5.	**Testing:** Verification and validation, code inspection, test plan, test case specification. Level of testing: Unit, Integration Testing, Top down and bottom up integration testing, Alpha and Beta testing, System testing and debugging. functional testing, structural testing, Software testing strategies.	8
6.	**Software Maintenance**: Structured Vs unstructured maintenance, Maintenance Models, Configuration Management, Reverse Engineering, Software Re-engineering.	4
	TOTAL	42

11. Suggested Books

S.No.	Name of Books / Authors/ Publishers	Year of Publication/ Reprint
	Text Books	
1.	R. S. Pressman, "Software Engineering – A practitioner's approach", 3rd ed., McGraw Hill Int. Ed..	1992
	Reference Books	
2.	K. K. Aggarwal & Yogesh Singh, "Software Engineering", 2nd Ed., New Age International.	2005
3.	Sommerville, "Software Engineering", Addison Wesley.	2001

1. Subject Code: **SE204** Course Title: **Computer Organization and Architecture**
2. Contact Hours: L: 3 T: 1 P: 0
3. Examination Duration (ETE) (Hrs.): Theory 3 Hrs Practical 0

4. Relative Weightage: CWS 25 PRS 0 MTE 25 ETE 50 PR 0
5. Credits: 4
6. Semester: IV
7. Subject Area: DCC
8. Pre-requisite: Digital electronics
9. Objective: To provide knowledge about the principles, concepts and applications of Computer Organization and Architecture.
10. Details of Course

S.No.	Contents	Contact Hours
1.	**Introduction:** Digital computer generation, computer types and classifications, functional units and their interconnections, bus architecture, types of buses and bus arbitration. Register, bus and memory transfer. REGISTER TRANSFER LANGUAGE: Data movement around registers. Data movement from/to memory, arithmetic and logic micro operations. Concept of bus and timing in register transfer.	8
2.	**Control Unit:** Instruction types, formats, instruction cycles and sub-cycles (fetch and execute etc.), micro-operations, execution of a complete instruction. Hardwired and microprogrammed control: microprogrammed sequencing, wide branch addressing, and micro-instruction with next address field, pre-fetching microinstructions, concept of horizontal and vertical microprogramming.	8
3.	**Central Processing Unit:** Addition and subtraction of signed numbers look ahead carry adders. Multiplication: Signed operand multiplication, Booths algorithm and array multiplier. Division and logic operations. Floating point arithmetic operation, Processor organization, general register organization, stack organization and addressing modes.	9
4.	**Input/Output organization:** Peripheral devices, I/O interface, I/O ports, Interrupts: interrupt hardware, types of interrupts and exceptions.	4
5	Modes of Data Transfer: Programmed I/O, interrupt initiated I/O and Direct Memory Access. I/O channels and processors. Serial Communication: Synchronous & asynchronous communication, standard communication interfaces.	5
6.	**Memory: Basic** concept and hierarchy, Main memory, Auxiliary memory, Associative memory, Cache memories: concept and design issues, associative mapping, direct mapping, set-associative mapping, cache writing and initialization.	8

	TOTAL	42

11. Suggested Books

S.No.	Name of Books / Authors/ Publishers	Year of Publication/ Reprint
Text Books		
1	Patterson, Computer Organization and Design, Elsevier Pub.	2009
2	Morris Mano, Computer System Architecture, PHI	1992
3.	William Stalling, Computer Organization, PHI	2012
Reference Books		
4	Vravice,Hamacher&Zaky, Computer Organization, TMH	2009
5	Tannenbaum, Structured Computer Organization, PHI	2006

1. Subject Code: **SE206** Course Title: **Database Management Systems**
2. Contact Hours: L: 3 T: 0 P: 2
3. Examination Duration (ETE) (Hrs.): Theory 3 Hrs Practical 0
4. Relative Weightage: CWS 15 PRS 15 MTE 30 ETE 40 PR 0
5. Credits: 4
6. Semester: IV

7. Subject Area: DCC
8. Pre-requisite: Data Structures
9. Objective: To provide knowledge about the principles, concepts and applications of Database Management Systems.
10. Details of Course

S.No.	Contents	Contact Hours
1.	**Introduction:** Database system concepts and its architecture, Data models schema and instances, Data independence and database language and interface, Data definition languages, DML. Overall database structure. **Data modeling using Entity Relationship Model:** E.R. model concept, notation for ER diagrams mapping constraints, Keys, Concept of super key, candidate key, primary key generalizations, Aggregation, reducing ER diagrams to tables, extended ER model.	7
2.	**Relational Data Model and Language:** Relational data model concepts, integrity constraints, Keys domain constraints, referential integrity, assertions, triggers, foreign key relational algebra, relational calculus, domain and tuple calculus, SQL data definition queries and updates in SQL.	7
3.	**Data Base Design:** Functional dependencies, normal forms, 1NF, 2NF, 3NF and BCNF, multi-valued dependencies fourth normal form, join dependencies and fifth normal form. Inclusion dependencies, lossless join decompositions, normalization using FD, MVD and JDs, alternatives approaches to database design.	6
4.	**File Organization, Indexing and Hashing** Overview of file organization techniques, Indexing and Hashing- Basic concepts, Static Hashing, Dynamic Hashing, Ordered indices, Multi-level indexes, B-Tree index files, B+-Tree index files, Buffer management **Transaction processing concepts:** Transaction processing system, schedule and recoverability, Testing of serializability, Serializability of schedules, conflict & view serializable schedule, recovery from transaction failures, deadlock handling.	8
5.	**Concurrency Control Techniques:** Locking Techniques for concurrency control, time stamping protocols for concurrency control, concurrency control in distributed systems. multiple granularities and multi-version schemes.	8
6	**Case Studies:** Commercial databases, Oracle, Postgress, MySQL	6

	TOTAL	42

11. Suggested Books

S.No.	Name of Books / Authors/ Publishers	Year of Publication/ Reprint
	Text Books	
1	Elmasri, Navathe,"Fundamentals of Database systems", Addision Wesley	2006
2	Korth, Silbertz, Sudarshan,"Data base concepts", McGraw-Hill.	2001
	Reference Books	
3.	Ramakrishna, Gehkre, "Database Management System", McGraw-Hill	2002
4	Date C.J.,"An Introduction to Database systems"	2004

1. Subject Code: **SE208** Course Title: **Discrete Structures**
2. Contact Hours: L: 3 T: 1 P: 0
3. Examination Duration (ETE) (Hrs.): Theory 3 Hrs Practical 0
4. Relative Weightage: CWS 25 PRS 0 MTE 25 ETE 50 PR 0
5. Credits: 4
6. Semester: IV
7. Subject Area: DCC
8. Pre-requisite: Nil
9. Objective: To give basic knowledge of combinatorial problems, algebraic structures and graph theory.
10. Details of Course

S.No.	Contents	Contact Hours
1.	**Formal Logic:** Statement, Symbolic Representation and Tautologies, Quantifiers, Predicator and validity, Normal form, Prepositional Logic, Predicate Logic, Logic Programming and Proof of correctors	3

2.	**Proof, Relation and Analysis of Algorithm**: Technique for theorem proving : Direct Proof, Proof by Contra position, proof by exhausting cares and proof by contradiction, Principle of mathematical induction, principle of complete induction, recursive definition, solution methods for linear, first-order recurrence relations with constant coefficients, analysis of algorithms involving recurrence rotations-recursive selection sort, binary search, quick sort, solution method for a divide-and-conquer recurrence relation.	7
3.	**Sets and Combinations**: Sets, Subtracts, powersets, binary and unary operations on a set, set operations/set identities, fundamental country principles, principle of inclusion, exclusion and pigeonhole, permutation and combination, pascal's triangles, binomial theorem, representation of discrete structures.	8
4.	**Relation/function and matrices**: Rotation, properties of binary rotation, operation on binary rotation, closures, partial ordering, equivalence relation, properties of function, composition of function, inverse, binary and n-ary operations, characteristics for, permutation function, composition of cycles, Boolean matrices, Boolean matrices multiplication.	7
5.	**Lattices & Boolean Algebra**: Lattices: definition, sublattices, direct product, homomorphism Boolean algebra: Definition, properties, isomorphic structures (in particulars, structures with binary operations) subs algebra, direct product and homo-morphism, Boolean function, Boolean expression, representation & minimization of Boolean function.	7
6.	**Graph Theory**:Terminology, isomorphic graphs, Euler's formula (Proof) four color problem and the chromatic number of a graph, five color theorem. Trees terminology, directed graphs, Computer representation of graphs, Warshall's algorithms, Decision Trees, Euler path & Hamiltonian circuits, Shortest path & minimal spanning trees, Depth-first and breadth first searches, analysis of research algorithm, trees associated with DFS & BFS Connected components, in order, preorder & post order trees traversal algorithms.	8
	TOTAL	42

11. Suggested Books

S.No.	Name of Books / Authors/ Publishers	Year of Publication/ Reprint
	Text Books	
1.	Kenneth H. Rosen, "Discrete Mathematics and Its Applications", TMH (ISBN**:** 9780070681880)	1999
2.	C.L. Liu, "Elements of Discrete Mathematics", TMH (ISBN: 9780007043477)	2000
3.	Kolman, Busby & Ross, "Discrete Mathematical Structures", PHI (ISBN- 978-0132297516)	1996
	Reference Books	
4.	Narsingh Deo, "Graph Theory With Application to Engineering and Computer Science", PHI (ISBN: 9788120301450)	2004
5.	J. P. Trembly & P. Manohar, "Discrete Mathematical Structures with Applications to Computer Science", McGraw Hill (ISBN: 0070651426)	1997

1. Subject Code: **MG202** Course Title:**Fundamental Of Management**
2. Contact Hours: L: 3 T: 0 P: 0
3. Examination Duration (ETE) (Hrs.): Theory 3 Hrs Practical 0
4. Relative Weightage: CWS 25 PRS 0 MTE 25 ETE 50 PR 0
5. Credits: 3
6. Semester: IV
7. Subject Area: HMC
8. Pre-requisite: NIL
9. Objective: The basic objective of this paper is to acquaint the students with the basic concepts of management necessary to deal with emerging business environment besides sensitizing them about societal challenges
10. Details of Course

S.No.	Detail Contents	Contact Hours
1	Definition of management, importance of management, management principals, managerial roles, managerial ethos, management vs administration, managerial functions, task and responsibilities, organizational structure, motivation: meaning, theories and techniques.	8

2	Concept of business environment, corporate social responsibility and corporate governance, managerial values and ethics.	8
3	Objectives and importance of financial management, basics of capital budgeting, cost of capital, emerging sources of funds for new projects, introduction to stock market.	9
4	Functions of marketing, marketing Vssales, interface of marketing with other departments, customer life time value, new product development, unethical issues in marketing.	8
5	Introduction to knowledge management, knowledge society, knowledge economy, building knowledge assets, sources of knowledge, technology innovation process, E-governance: definition, objectives and significance; challenges in Indian context, Digital India programme.	9
	Total	**42**

11. Suggested Books

S. No.	**Name of Books / Authors/ Publishers/ Year of Publication/ Reprint**
1	Fundamental of Management, Stephen P. Robbins, David A. De Cenzo and Mary Coulter, Pearson Education,(ISBN:9780273755869),2011
2	Financial Accounting, 4 ed, S.N. Maheshwari and S.K. Maheshwari, VikasPulication,(ISBN:8125918523), 2005
3.	Management, James A F Stonner, Pearson Education,(ISBN: 9788131707043),2010
4.	Marketing Management, 14th ed., Philip Kotler , Kevin Lane Keller, Abraham Koshy and MithileswarJha, Pearson Education, (ISBN: 9788131767160), 2013
5	Knowledge Management in Organizations: A Critical Introduction, Donald Hislop, Oxford University Press, ISBN: 9780199691937,2013

1. Subject Code: **SE301** Course Title: **Object Oriented Software Engineering**
2. Contact Hours: L: 3 T: 0 P: 2
3. Examination Duration (ETE) (Hrs.): Theory 3 Hrs Practical 0
4. Relative Weightage: CWS 15 PRS 15 MTE 30 ETE 40 PR 0
5. Credits: 4
6. Semester: V
7. Subject Area: DCC
8. Pre-requisite: Software Engineering
9. Objective: To understand basic methodology of object oriented software engineering and learn to create UML diagrams at various phases of software development life cycle using case studies.
10. Details of Course

S.No.	Contents	Contact Hours
1.	**Introduction**: Object Oriented system concepts and Principles, Object Oriented system development, Component reuse, The common process framework for Object Oriented processes, System Development and Methodologies, object oriented software estimation.	6
2.	**System development:** System as model building, model architecture, The importance of modeling, principle of modeling, object oriented modeling,	8

	Introduction to Object-oriented Methodologies such as Unified Modeling Language, Overview of UML, conceptual model of UML, architecture, software development lifecycle using Rational Unified Process.	
3.	**Object Oriented Analysis**: requirement model, analysis model, Object oriented analysis using methods of Rumbaugh.	6
4.	**Software Design:** Software design Models, Object oriented methodologies of Booch, design model, System development using various UML Diagrams.	6
5.	**UML Methodology**: Detailed study of various UML Diagrams, System Analysis using UML Diagrams.	8
6.	**Object Oriented Testing and metrics:** Path Testing, State based testing, Class Testing, object oriented metrics. **Applications & Tools:** A complete case study of Software development using above Methodologies, Concepts of Computer-Aided Software Engineering and knowledge about current CASE tools use in the industry.	8
	TOTAL	42

11. Suggested Books

S.No.	Name of Books / Authors/ Publishers	Year of Publication/ Reprint
	Text Books	
1.	I. Jacobson, M. Christerson, P. Jonsson, G. Overgaard, "Object Oriented Software Engineering", 2nd Edition, Pearson Education.	2007
2.	Yogesh Singh & Ruchika Malhotra, "Object Oriented Software Engineering", 1st Ed., PHI Learning.	2012
	Reference Books	
3.	Sommerville, "Software Engineering", Addison Wesley.	2001

1. Subject Code: **SE303** Course Title: **Algorithm Design and Analysis**
2. Contact Hours: L: 3 T: 1 P: 0
3. Examination Duration (ETE) (Hrs): Theory 3 Hrs Practical 0
4. Relative Weightage: CWS 25 PRS 00 MTE 25 ETE 50 PR 0

5. Credits: 4
6. Semester: V
7. Subject Area: DCC
8. Pre-requisite: Data Structure
9. Objective: To introduce the concept of algorithmic efficiency by analyzing various algorithms such as Searching, Sorting, Divide-and-Conquer algorithms and to know detail about Greedy Paradigm, Principle of Dynamic Programming, Back Tracking, Branch and Bound, and Computational Complexity.
10. Details of Course

S.No.	Contents	Contact Hours
1.	**Introduction:** Concept of algorithmic efficiency, run time analysis of algorithms, Asymptotic Notations. Growth of Functions, Master's Theorem	6
2.	**Searching and Sorting:** Structure of divide-and-conquer algorithms; examples: binary search, quick sort, Stassen Multiplication; merge sort, heap sort and Analysis of divide and conquer run time recurrence relations.	7
3.	**Greedy Method**: Overview of the greedy paradigm examples of exact optimization solution: minimum cost spanning tree, approximate solutions: Knapsack problem, Kruskal's algorithm and Prim's algorithm for finding Minimum cost Spanning Trees, Dijkstra's and Bellman Ford Algorithm for finding Single source shortest paths, Huffman coding, Activity Selection Problem.	8
4.	**Dynamic programming**: Principles of dynamic programming. Applications: Rod cutting problem, Floyd-Warshall algorithm for all pair shortest paths. Matrix multiplication, Travelling salesman Problem, Longest Common sequence, **Back tracking:** Overview, 8-queen problem, and Knapsack problem, Traveling Salesman problem	7
5.	**Branch and bound**: LC searching Bounding, FIFO branch and bound, LC branch and bound application: 0/1 Knapsack problem	6
6.	**Computational Complexity**: Complexity measures, Polynomial Vs non-polynomial time complexity; NP-hard and NP-complete classes, examples: Circuit Satisfiablity, Vertex cover, Subset Sum problem, Randomized Algorithms, String Matching, NP-Hard and NP-Completeness, Approximation Algorithms, Sorting Network, Matrix Operations,	8

	Polynomials and FFT, Number Theoretic Algorithms.	
	TOTAL	42

11. Suggested Books

S.No.	Name of Books / Authors/ Publishers	Year of Publication/ Reprint
	Text Books:	
1.	T .H . Cormen, C . E . Leiserson, R .L . Rivest "Introduction to Algorithms", 3rd Ed., PHI.	2011 (reprint)
2.	E. Horowitz, S. Sahni, and S. Rajsekaran, "Fundamentals of Computer Algorithms," Galgotia Publication	1978
	Reference Books	
3	Sara Basse, A. V. Gelder, " Computer Algorithms," Addison Wesley	1988
4	Aho ,Ullman "Principles of Algorithms "	1974

1. Subject Code: **HU301** Course Title: **Professional Ethics and Human Values**
2. Contact Hours: L: 2 T: 0 P: 0
3. Examination Duration (ETE)(Hrs.): Theory 3 Hrs Practical 0
4. Relative Weightage: CWS 25 PRS 0 MTE 25 ETE 50 PR 0
5. Credits: 2

6. Semester: V

7. Subject Area: HMC

8. Pre-requisite: NIL

9. Objective To make students aware of the ethics and codes of conduct required by Engineers and Professionals.

10. Details of Course

S.No.	Name of Books, Authors, Publishers	Contact Hours
1.	Human Values and Ethics: Morals, Values, Ethics and Integrity, Need for Value Education for Engineers, Happiness, Prosperity, Harmony.	6
2.	Code of Ethics and Professionalism: Professionalism and the Code of Ethics, Technical Education, Human Values and Coexistence, Universal Human Order, Natural acceptance.	6
3.	Professional Ethics and Technology :Science, Technology and Professional EthicsEngineering Ethics, Environmental Ethics, Safety, Responsibility and Rights.	8
4.	Case Studies: Holistic Technologies, Eco-friendly production systems, The role of responsible engineers and technologists, Global Issues concerning Engineers.	8
	TOTAL	28

11. Suggested Books

S.No.	**Name of Books/ Authors/ Publishers/ Year of Publication/ Reprint**
1.	Professional Ethics, Subramanian, R, Oxford University Press, ISBN13: 978-0-19-808634-5,2011
2.	Professional Ethics and Human Values,Govindarajan, M. S. Natarajan, V.S. Senthilkumar PHI, **ISBN: 978-81-203-4816-5,2013**
3.	Constitution of India and Professional Ethics, Reddy, G.B. and Mohd. Suhaib, IK International Publishing House. ISBN: 81-89866-01-X, 2006
4.	Introduction to Engineering Ethics (2nd Ed.)Martin, Mike W. and Roland Schingzinger McGraw-Hill ISBN 978-0-07-248311-6, 2010

1. Subject Code: **SE302** Course Title: **Software Testing**
2. Contact Hours: L: 3 T: 0 P: 2
3. Examination Duration (ETE) (Hrs.): Theory 3 Hrs Practical 0
4. Relative Weightage: CWS 15 PRS 15 MTE 30 ETE 40 PR 0
5. Credits: 4
6. Semester: VI
7. Subject Area: DCC
8. Pre-requisite: Software engineering
9. Objective: To understand software testing concepts and applications.
10. Details of Course

S.No.	Contents	Contact Hours
1.	**Introductory concepts:** Verification &Validation Terminologies like Goals, Role, Objectives, Limitations, Approaches & Applicability.	4
2.	**Software Testing:** Testing Process, Limitations of Testing, Testing activities. Levels of Testing: Unit Testing, Integration Testing, System Testing, Debugging, Domain Testing, Regression Testing, Stress Testing, Slice based testing.	8
3.	**Verification Testing:** Verification Methods, SRS Verification, Software Design Document Verification, Code Reviews, User Documentation Verification, Software Project Audits. **Functional Testing techniques:** Boundary Value Analysis, Equivalence Class Testing, Decision Table Based Testing, Cause Effect Graphing Technique.	8
4.	**Structural Testing:** Path testing, DD-Paths, Cyclomatic Complexity, Graph Metrics, Data Flow Testing, Mutation testing. Object Oriented Testing: Class	8

	Testing, GUI Testing.	
5.	**Testing Activities:** Unit Testing, Levels of Testing, Integration Testing, System Testing, Debugging **Software Testing Tools Taxonomy:** Methodology to evaluate automated testing. Using tools: Load Runner, Win runner and Rational Testing Tools, Java Testing Tools, JMetra, JUNIT Cactus and other recent tools.	8
6.	**Advanced Topics on Testing:** Prioritizing the Test-cases, Testing Web Applications, Automated Test Data Generation.	6
	TOTAL	42

11. Suggested Books

S.No.	Name of Books / Authors/ Publishers	Year of Publication/ Reprint
	Text Books	
1.	Paul C. Jorgenson, Software Testing A Craftsman's approach, CRC Press.	1997
2.	Yogesh Singh, "Software Testing", 1st Ed., Cambridge University Press.	2012
	Reference Books	
3.	Louise Tamres, "Software Testing", Pearson Education Asia.	2002

1. Subject Code: **SE304** Course Title: **Operating System**
2. Contact Hours: L: 3 T: 0 P: 2
3. Examination Duration (ETE) (Hrs.): Theory 3 Hrs Practical 0
4. Relative Weightage: CWS 15 PRS 15 MTE 30 ETE 40 PR 0
5. Credits: 4
6. Semester: VI
7. Subject Area: DCC
8. Pre-requisite: Data Structures
9. Objective: To familiar with the fundamental principles of the operating system, its services and functionalities, the concepts of processes, synchronization and scheduling, memory management and need for protection in computer systems.
10. Details of Course

S.No.	Contents	Contact Hours
1.	**Introduction:** Operating system and function, Evolution of operating system, Batch, Interactive, Time Sharing and Real Time System, System protection. **Operating System Structure:** System Components, System structure, Operating System Services.	4
2.	**Concurrent Processes:** Process concept, Principle of Concurrency, Producer Consumer Problem, Critical Section problem, Semaphores, Classical problems in Concurrency, Inter Process Communication, Process Generation, Process Scheduling. **CPU Scheduling:** Scheduling Concept, Performance Criteria Scheduling Algorithm, Evolution, Multiprocessor Scheduling.	9
3.	**Deadlock:** System Model, Deadlock Characterization, Prevention, Avoidance and Detection, Recovery from deadlock combined approach.	8
4.	**Memory Management:** Base machine, Resident monitor, Multiprogramming with fixed partition, Multiprogramming with variable partition, Multiple base register, Paging, Segmentation, Virtual memory concept, Demand paging, Performance, Paged replaced algorithm, Allocation	9

	of frames, Thrashing, Cache memory, Organization, Impact on performance.	
5.	**I/O Management & Disk Scheduling:** I/O devices and organization of I/O function, I/O Buffering, DISK I/O, Operating System Design Issues. **File System:** File Concept, File Organization and Access Mechanism, File Directories, File Sharing, Implementation Issues	9
6.	**Case Studies:** Windows, Linux and Unix	3
	TOTAL	42

11. Suggested Books

S.No.	Name of Books / Authors/ Publishers	Year of Publication/ Reprint
	Text Books	
1.	Silbersachatz , Galvin, Gagne "Operating System Concepts", Wiley, 9th Ed	2013
2.	Tannenbaum, "Operating Systems", PHI, 4th Edition	2000
	Reference Books	
3.	Milenekovic, "Operating System Concepts", McGraw Hill	1992
4.	Harvey M Dietel, " An Introduction to Operating System", Pearson Education	2004

1. Subject Code: **SE306** Course Title: **Compiler Design**
2. Contact Hours: L: 3 T: 0 P: 2
3. Examination Duration (ETE) (Hrs.): Theory 3 Hrs Practical 0
4. Relative Weightage: CWS 15 PRS 15 MTE 30 ETE 40 PR 0
5. Credits: 4
6. Semester: VI
7. Subject Area: DCC
8. Pre-requisite: Theory of Computation
9. Objective: To study the design of all the phases of compiler in detail.

10. Details of Course

S.No.	Contents	Contact Hours
1.	**Introduction:** Definition, Phases and Passes, FSM & RE's and their application to Lexical Analysis, Implementation of Lexical Analyzers, Lexical- Analyzer Generator, Lex – Compiler.	6
2.	**Syntax Analysis:** Formal Grammar and their application to Syntax Analysis, BNF Notation,. The Syntactic specification of Languages: CFG, Derivation and Parse Trees, Shift Reduce Parsing, Operator precedence parsing, top down Parsing, Predictive Parsers. LR Parsers, the canonical collection of LR(0)items, constructing SLR Parsing Tables, Constructing canonical LR Parsing tables and LALR parsing tables , An Automatic Parser Generator, YACC.	12
3.	**Syntax Directed Translation:** Syntax directed Translation Schemes, Implementation of Syntax directed translators, Intermediate Code, Postfix notation, Parse Trees and Syntax Trees, Three address Code, Quadruple & Triples, Translation of Assignment Statements, Boolean expressions, Control Statements, Array references in Arithmetic expressions , Procedure Calls , Declarations and Case statements Translations.	10
4.	**Symbol Tables:** Data Structure for Symbol Tables, representing scope information. Run Time Administration: Implementation of simple Stack allocation scheme, storage allocation in block structured language.	4
5.	**Error detection and Recovery:** Lexical phase errors, syntax phase errors, semantic errors and Error recovery techniques.	4
6.	**Code Optimization**: Loop optimization, the DAG representation of basic blocks, value numbers and Algebraic Laws, Global Data – Flow Analysis and Code generation.	6
	TOTAL	42

11. Suggested Books

S.No.	Name of Books / Authors/ Publishers	Year of Publication/ Reprint
	Text Books	

1.	Aho,Ullman & Sethi, "Compiler Design", Addison Wesley. ISBN 81-7808-046-X	2004
	Reference Books	
2.	D.M.Dhamdhere, "Compiler Construction – Principles & Practice", Macmillan India ISBN 0333904060	2000

1. Subject Code: **HU302** Course Title: **Technical Communication**
2. Contact Hours: L: 2 T: 0 P: 0
3. Examination Duration (Hrs.): Theory: 3 Practical: 0
4. Relative Weight**:** CWS: 25 PRS: 0 MTE: 25 ETE: 50 PRE: 0
5. Credits: 2 6. Semester: VI 7. Subject Area: HMC
8. Pre-requisite: NIL
9. Objective: To train students for business communication to enhance employability skills with special emphasis on placement interviews and public speaking.
10. Details of Course:

Sl. No.	**Contents**	**Contact Hours**
1.	**English for Professional Purposes:** **A.** Technical Communication- Methods, Strategies and Skills **B.** Communication in Global Contexts- Social, Cultural, Political and Technical, especially in formal set up	 1 2
2.	**Communication at the Workplace: Oral and Written:** **A. Written Communication**- Letters, Orders (Sale/Purchase) Report Writing, Technical proposals Resume, SOP, Memo, Notice, Agenda, Minutes, Note Taking/Making, **B. Oral Communication**: Seminars, Conferences, Meetings, Office Etiquettes/ Netiquettes, Presenting Written Material Negotiation, Demonstration, Group Discussion, Interview	 6 6
3.	**Group Discussion** and **Report Writing:** i) Group Discussion (Continous assessment through the semester) ii) Minor Report Writing(to be submitted before Mid- Semester Examination) iii) Major Report writing (To be submitted before End Semester Examination)	 13
	Total	28

11.Suggested References:

Sl.No.	**Name of Books, Authors, Publishers**

1	Technical Communication: Principles and Practice Raman, Meenakshi and Sangeeta Sharma, Oxford University Press, 2014, ISBN-13: 978-0-19-806529-6
2	Writing to Get Results, (3rd Ed) Blicq, Ron S., Lisa A. Moretto, John Wiley and Sons, Inc.,2001, ISBN 0-7803-6020-6
3	Effective Technical Communication: A Guide for Scientists and Engineers , Mitra, Barun K. OUP: Delhi, 2006, ISBN-13: 978-0-19-568291-5
4	Personality Development and Soft Skills, Mitra, Barun K. New Delhi: Oxford University Press.,2014, ISBN-9780198060017
5	The Essence of Effective Communication**,** Ludlow, Ron and Fergus Panton. Prentice Hall: PHI.,1996, ISBN-81-203-0909-X
6	Advanced Technical Communication, Gupta, Ruby. Foundation Books,2011, CUP. ISBN 978-81-7596-733-5
8	Soft Skills: Enhancing Employability, Rao, M.S. Connecting Campus with Corporate, 2011, ISBN: 978-93-80578-38-5
9	Developing Communication Skills (2nd Ed), Mohan, Krishna and Meera Banerji, Macmillan Publishers India Ltd.,2009 ISBN 13: 978=0230-63843-3

1. Subject Code: **SE-401** Course Title: **B.Tech Project-I**

2. Contact Hours: L:0 T:0 P:0

3. Examination Duration (Hrs.): Theory: 0 Practical: 0

4. Relative Weight**:** CWS: 0 PRS: 0 MTE: 0 ETE: 0 PRE: 0

5. Credits: 4

6. Semester: VII

7. Subject Area: DCC

8. Pre-requisite: NIL

9. **Objectives**: To familiarize the students to work in group and develop an independent understanding of engineering and analysis of engineering systems. He should also be able to write and present the work done during the course.

1. Subject Code: **SE-403** Course Title: **Training Seminar**

2. Contact Hours: L: 0 T:0 P:0

3. Examination Duration (Hrs.): Theory: 0 Practical: 0

4. Relative Weight**:** CWS: 0 PRS: 0 MTE: 0 ETE: 0 PRE: 0

5. Credits: 2

6. Semester: VII ‘

7. Subject Area: DCC

8. Pre-requisite: NIL

9. **Objectives**: To familiarize the students to work in industry and working culture of the industrial system. He should also be able to write and present the work done during the course.

1. Subject Code: **SE-405** Course Title: **Software Project Management**
2. Contact Hours: L: 3 T: 0 P: 2
3. Examination Duration (ETE) (Hrs.): Theory 3 Hrs Practical 0
4. Relative Weightage: CWS 15 PRS 15 MTE 30 ETE 40 PR 0
5. Credits: 4
6. Semester: VII
7. Subject Area: DCC
8. Pre-requisite: NIL
9. Objective: To introduce concepts of software planning, estimation and time scheduling.
10. Details of Course

S.No.	Contents	Contact Hours
1.	**Introduction:** Project Management concepts, Process Framework, Project Planning Software Life Cycle Models, Artifacts of the Project Management Process.	6
2.	**Cost and Scheduling Estimation Models:** Various Levels of COCOMO for Cost ,Effort, Schedule and Productivity Estimation. Approaches to	8

	Effort, Cost Estimation, and Schedule Estimation factors through COCOMO II, Putnam Estimation Model, Algorithmic models.	
3.	**Project Management Techniques**: Project Organizations and Responsibilities, Establishing Project Environment, Risk Management Process, Project Tracking and Control Defect Tracking Concepts such as Process monitoring and audit, Reviews, Inspections and Walkthroughs.	8
4.	**Project Closure:** Project Closure Analysis, Role of Closure Analysis in a project, Performing Closure Analysis, Closure Analysis Report.	6
5.	**Software Project Management Renaissance:** Conventional Software Management, Evolution of Software Economics, Improving Software Economics, The old way and the new way.	6
6.	**Advance Topics in Software Project Management:** Discussion on future Software Project Management Practices & Modern Project Profiles, Next Generation Software Economics, Modern Process Transitions.	8
	TOTAL	42

11. Suggested Books

S.No.	Name of Books / Authors/ Publishers	Year of Publication/ Reprint
	Text Books	
1.	Managing the Software Process, Watts S. Humphrey, Pearson Education.	1989
2.	Software Project Management, Bob Hughes, Tata McGraw Hill.	2009
	Reference Books	
3.	Sommerville, "Software Engineering", Addison Wesley.	2001

1. Subject Code: **SE407** Course Title: **Computer Networks**
2. Contact Hours: L: 3 T: 0 P: 2
3. Examination Duration (ETE) (Hrs.): Theory 3 Hrs Practical 0
4. Relative Weightage: CWS 15 PRS 15 MTE 30 ETE 40 PR 0
5. Credits: 4

6. Semester: VII
7. Subject Area: DCC
8. Pre-requisite: Operating systems, Algorithm Design and Analysis.
9. Objective: To introduce the layered concept of Computer network and protocols associated with TCP/IP.
10. Details of Course

S.No.	Contents	Contact Hours
1.	Introduction Concepts: Goals and Applications of Networks, Network structure and architecture, The OSI reference model, services, Network Topology Design - Delay Analysis, Physical Layer Transmission Media, Switching methods, ISDN.	8
2.	Medium Access sub layer: Medium Access sub layer - Channel Allocations, LAN protocols -ALOHA protocols - Overview of IEEE standards - FDDI. Data Link Layer - Elementary Data Link Protocols, Sliding Window protocols, Error Handling.	8
3.	Network Layer: Network Layer - Point - to Pont Networks, routing, Congestion control, Internetworking -TCP / IP, IP packet, IP address, IPv6.	6
4.	Transport Layer: Transport Layer - Design issues, connection management, session Layer-Design issues, remote procedure call.	6
5.	Presentation Layer- Data compression techniques, cryptography.	6
6.	Application Layer: Application Layer: File Transfer, Access and Management, Electronic mail, Virtual Terminals, Internet and Public Networks.	6
	TOTAL	40

11. Suggested Books

S.No.	Name of Books / Authors/ Publishers	Year of Publication/ Reprint
	Text Books	
1.	S. Tananbaum, “Computer Networks”, 3rd Ed, PHI	1999

2.	U. Black, “Computer Networks-Protocols, Standards and Interfaces”, PHI	1996
	Reference Books	
3.	Laura Chappell (ed), “Introduction to Cisco Router Configuration”, Techmedia	1999
4	W. Stallings, “Computer Communication Networks”, PHI	1999
5	William A. Shay, “Understanding Data Communications & Networks”, Vikas Publication	1999
6	A. Miller, “Data & Network Communications”, Vikas Publication	1998

1. Subject Code: **SE-402** Course Title: **B.Tech project-II**
2. Contact Hours: L:0 T:0 P:0
3. Examination Duration (Hrs.): Theory:0 Practical: 0
4. Relative Weight**:** CWS: 0 PRS: 0 MTE: 0 ETE:0 PRE: 0
5. Credits: 8
6. Semester: VIII
7. Subject Area: DCC
8. Pre-requisite: NIL
9. Objective: To familiarize the students to work in group and develop an independent understanding of engineering and analysis of engineering systems. He should also be able to write and present the work done during the course.

1. Subject Code: SE404 Course Title: Empirical Software Engineering
2. Contact Hours: L: 3 T: 0 P: 2
3. Examination Duration (ETE) (Hrs.): Theory 3 Hrs Practical 0 Hrs
4. Relative Weightage: CWS 15 PRS 15 MTE 30 ETE 40 PR 0
5. Credits: 4
6. Semester: VIII
7. Subject Area: DEC
8. Pre-requisite: Empirical Software Engineering

9. Objective: The objective is to study the collection and analysis of data and experience that can be used to characterize, evaluate and reveal relationships between software development deliverables, practices, and technologies.

10. Details of Course

S. No.	Contents	Contact Hours
1.	**Introduction:** What Is Empirical Software Engineering?; Overview of Empirical Studies; Types of Empirical Studies; Empirical Study Process; Ethics of Empirical Research; Importance of Empirical Research; Basic Elements of Empirical Research; Some Terminologies. **Systematic Literature Reviews:** Basic Concepts; Case Study; Planning the Review; Methods for Presenting Results; Conducting the Review; Reporting the Review.	6
2.	**Software Metrics**: Introduction; Measurement Basics; Measuring Size; Measuring Software Quality; Object-Oriented Metrics; Dynamic Software Metrics; System Evolution and Evolutionary Metrics; Validation of Metrics; Practical Relevance and Use of Software Metrics in Research; Industrial Relevance of Software Metrics **Experimental Design:** Overview of Experimental Design; Case Study: Fault Prediction Systems; Research Questions; Reviewing the Literature; Research Variables; Terminology Used in Study Types; Hypothesis Formulation; Data Collection; Selection of Data Analysis Methods.	8
3.	**Mining Data from Software Repositories:** Configuration Management Systems; Importance of Mining Software Repositories; Common Types of Software Repositories; Version Control Systems; Bug Tracking Systems; Extracting Data from Software Repositories; Static Source Code Analysis; Software Historical Analysis; Software Engineering Repositories and Open Research Data Sets; Case Study: Defect Collection and Reporting System for Git Repository.	6
4.	**Data Analysis and Statistical Testing:** Analyzing the Metric Data; Attribute Reduction Methods; Hypothesis Testing; Statistical Testing; Example—Univariate Analysis Results for Fault Prediction System.	6

	Model Development and Interpretation: Model Development; Statistical Multiple Regression Techniques; Machine Learning Techniques; Concerns in Model Prediction; Performance Measures for Categorical Dependent Variable; Performance Measures for Continuous Dependent Variable; Cross-Validation; Model Comparison Tests; Interpreting the Results; Example—Comparing ML Techniques for Fault Prediction.	
5.	**Validity Threats:** Categories of Threats to Validity; Example—Threats to Validity in Fault Prediction System; Threats and Their Countermeasures. **Reporting Results:** Reporting and Presenting Results; Guidelines for Masters and Doctoral Students; Research Ethics and Misconduct.	8
6.	**Mining Unstructured Data: Introduction;** Steps in Text Mining; Applications of Text Mining in Software Engineering; Example—Automated Severity Assessment of Software Defect Reports **Case Study & Tools:** Demonstrating Empirical Procedures**;** WEKA; KEEL; SPSS; MATLAB; R; Comparison of Tools	8
	TOTAL	42

11. Suggested Books

S.No.	Name of Books / Authors/ Publishers	Year of Publication/ Reprint
	Text Books	
1.	R. Malhotra, *Empirical Research in Software Engineering: Concepts, Analysis, and Applications*. CRC Press, 2015.	2015
	Reference Books	
3.	C. Wohlin, P. Runeson, M. Host, M. C. Ohlsson, B. Regnell, and A. Wesslen, *Experimentation in Software Engineering*, Berlin, Germany: Springer-Verlag	2012

DEPARTMENTAL ELECTIVE COURSES

1. Subject Code: **SE305** Course Title: **Software Requirement Engineering**
2. Contact Hours: L: 3 T: 1 P: 0
3. Examination Duration (ETE) (Hrs.): Theory 3 Hrs Practical 0
4. Relative Weightage: CWS 25 PRS 0 MTE 25 ETE 50 PR 0
5. Credits: 4
6. Semester: V
7. Subject Area: DEC
8. Pre-requisite: Software Engineering
9. Objective: Understand the fundamentals of software requirement engineering, management, tools and latest trends.
10. Details of Course

S.No.	Contents	Contact Hours
1.	**Unit 1 Software Requirements:** Essential of Software requirements, Different Dimensions of Software Requirements, Good practices for requirements engineering, improving requirements processes, and risk management.	8
2.	**Unit 2 Software Requirements Engineering:** Review of various activities of Requirements Engineering like requirements elicitation, requirements analysis, documentation & review. Discussion on current trends in requirements elicitation, requirements analysis models and verifying requirements, requirements specification & requirements prioritization.	8
3.	**Unit 3 Software Requirements Management (RM):** Principles and practices of RM, Requirements attributes, Change Management Process, Requirements Traceability Matrix, Links in requirements chain.	8
4.	**Unit 4 RM Tools:** Rational Requisite pro, Caliber RM, benefits of using a RM tool.	5
5.	**Unit 5 Advances in Requirement Engineering:** Commercial requirements management techniques & tools, implementing requirements management automation.	7
6.	**Unit 6** Latest trends in requirements engineering such as aspect-oriented requirement engineering, agent-based requirement engineering.	6
	Total	42

11. Suggested Books

S.No.	Name of Books / Authors/ Publishers	Year of Publication/ Reprint
	Text Books	
1.	Rajesh Naik and Swapna Kishore, "Software Requirements and Estimation" Tata McGraw Hill.	2007
2	Karl E. Weigers, "Software Requirements" Microsoft Press, 1999.	1999
3	Ellen Gottesdiener, Requirements by Collaboration: Workshops for Defining Needs, Addison Wesley, 2002.	2002
	Reference books:	
5	Ian Graham, Requirements Engineering and Rapid Development, Addison Wesley, 1998.	1998
6	Ivy Hooks and Kristin Farry, Customer-Centered Products: Creating successful products through smart Requirements Management, Amacom, 2001.	2001
7	Dean Leffingwell and Don Widrig, Managing Software Requirements: A Unified Approach, Addison Wesley, 1999.	1999

1. Subject Code: **SE307** Course Title: **Computer Graphics**
2. Contact Hours: L: 3 T: 0 P: 2
3. Examination Duration (ETE) (Hrs.): Theory 3 Hrs Practical 0
4. Relative Weightage: CWS 15 PRS 15 MTE 30 ETE 40 PR 0
5. Credits: 4

6. Semester: V
7. Subject Area: DEC
8. Pre-requisite: NIL
9. Objective: The objective of the course is to help students learn broad introduction to the theory and practice of computer graphics.
10. Details of Course

S.No.	Contents	Contact Hours
1.	**Overview of Computer Graphics:** Usage of Graphics and their applications, Over view of Graphics systems: Refreshing display devices, Random and raster scan display devices, Colour Models: RGB, HSV etc., Tablets, Joysticks, Track balls, Mouse and light pens, plotters, printers, digitizers.	6
2.	**Output primitives::** DDA Line drawing algorithm, Bresenham's Line Drawing Algorithm, Mid-point circle algorithm, Mid-point Ellipse algorithms, filling algorithms, boundary fill and flood fill algorithms, scan-line filling, character generation, line attributes, fill styles, anti-aliasing.	8
3.	**Transformations:** Basic 2D Transformations, Matrix representations & Homogeneous Coordinates, Matrix Representations for basic 2D and 3D transformations, Composite Transformations, reflection and shear transformations, affine transformation, transformations between coordinate systems.	6
4.	**Two dimensional viewing**: The viewing Pipeline, Viewing Coordinate Reference Frame, Window-to-Viewport Coordinate Transformation, Two Dimensional Viewing Functions, Barky line clipping algorithm, Algorithm for polygon clipping, Sutherland-Hodgeman polygon clipping, Wailer-Atherton polygon clipping, curve clipping, Text clipping.	8
5	**Curves and Surfaces:** Representation of surfaces, polygon meshes, plane equations, parametric cubic curves, Hermite Curves, Bezier Curves, 4 point and 5 point Bezier curves using Bernstein Polynomials, Conditions for smoothly joining curve segments, Bezier bi-cubic surface patch, B-Spline Curves, Cubic B-Spline curves using uniform knot vectors, Testing for first and second order continuities	6
6	**Projection:** Parallel Projection, Oblique Projection on XY plane, Isometric Projection, Perspective Projection, One Vanishing Point (V.P.) projection, Generation of 2 V.P. Projection, planar geometric projections.	8

	Shading and Hidden Surface Removal: Shading, Illumination Model for diffused Reflection, Effect of ambient lighting, distances, Specular Reflection Model, Computing Reflection Vector, Curved Surfaces, Polygonal Approximations, Guard Shading, Phong Model, Hidden Surface Removal, Back Face Detection, Depth Buffer (Z-Buffer, A-Buffer) Method, Scan Line Method, Depth Sorting Method, Area Subdivision Method.	
	TOTAL	42

11. Suggested Books

S.No.	Name of Books / Authors/ Publishers	Year of Publication/ Reprint
	Text Books:	
1.	D. Hearn, P. Baker & W. Carithers, "Computer Graphics with OpenGL", Pearson	2015
2.	Z. Xiang & R. Plastock "Computer Graphics", Schaum's Series, McGraw Hill,	2007
3.	David F. Rogers, "Procedural Elements for Computer Graphics", Tata McGraw Hill Book Company	2002
	Reference Books:	
4.	D. Rogers and J. Adams, "Mathematical Elements for Computer Graphics", MacGraw- Hill International Edition	2002
5.	Foley et al., "Computer Graphics Principles & practice", Addison Wesley	1999

1. Subject Code: **SE309** Course Title: **Information Theory & Coding**
2. Contact Hours: L: 3 T: 1 P: 0
3. Examination Duration (ETE) (Hrs.): Theory 3 Hrs Practical 0
4. Relative Weightage: CWS 25 PRS 0 MTE 25 ETE 50 PR 0
5. Credits: 4
6. Semester: V
7. Subject Area: DEC

8. Pre-requisite: Nil

9. Objective: To introduce fundamentals of Coding and information Theory.

10. Details of Course

S.No.	Contents	Contact Hours
1	Introduction to Probability, Sample space and events, The axioms of probability Elementary theorems -Conditional Probability and Independence, Baye's theorem. Random variables, discrete probability distribution, discrete functions for random and discrete random variables, continuous random variables.	6
2.	Uncertainty and Information, Shannon Entropy, Joint and conditional Entropies Mutual Information, Uniquely decipherable and Instantaneous codes, Noiseless coding problem. Source coding Theorem, Block coding, construction of Optimal codes, Huffman's & Shannon – Fano methods.	8
3.	Discrete memory less channel, channel capacity BSC and other channels	6
4.	Information measure for continuous ensembles capacity of AWGN channel. Error control coding. The channel coding Theorem, Application to BSC , Source Coding with fidelity criteria. Types of codes, error and error control strategies, Linear block codes, syndrome and error detection, Minimum distance, Error detecting and correcting capabilities of a block code, Syndrome decoding , Hamming codes.	8
5.	Cyclic codes, Generator and parity – check matrices, encoding, syndrome computation and error detection and decoding .BCH codes, decoding, of the BCH codes Introduction to RS codes. Convolution codes, Maximum likelihood decoding The Viterbi algorithm. Introduction to Turbo codes.	8
6	It covers Latest Research: Blind Deconvolution Using Convex Programming, Asynchronous code-division random access using convex optimization.	6
	TOTAL	42

11. Suggested Books

S.No.	Name of Books / Authors/ Publishers	Year of Publication/ Reprint
	Text Books	
1.	Information Theory by R Ash, Dover Science Publications	1998
2.	Element of Information Theory by Cover and Thomas, John Wiley & Sons	1991
3.	Error Control coding: Fundamental & Application by Shulin & Daniel J. Costello Jr, Prentice Hall	1982
4	A Mathematical Theory of Communication. By C. E. SHANNON.	1948
	Reference Books	
5	Communications in the presence of noise – Shannon	1949
6	Communication Systems By Simon Haykin, Wiley Student Edition	2014

1. Subject Code: **SE311** Course Title: **Digital Signal Processing**
2. Contact Hours: L: 3 T: 1 P: 0
3. Examination Duration (ETE) (Hrs.): Theory 3 Hrs Practical 0
4. Relative Weightage: CWS 25 PRS 0 MTE 25 ETE 50 PR 0
5. Credits: 4
6. Semester: V
7. Subject Area: DEC
8. Pre-requisite: NIL
9. Objective: To understand the learn the basics of digital signal processing
10. Details of Course

S.No.	Contents	Contact Hours
1.	**INTRODUCTION:** Introduction to Signal-continuous time and Discrete time signals and systems, characteristics of discrete time sinusoidal signals. Discrete –time description of signals and systems: Representation of elementary sequences, signal classification, basic operations, classification of discrete time systems. linear convolution.	6

2.	**FREQUENCY DOMAIN REPRESENTATION OF DISCRETE –TIME SIGNAL ANDSYSTEMS**: Discrete time Fourier transform (DTFT). Different properties of DTFT .Frequency domain representation of linear time invariant system.	6
3.	**DISCRETE FOURIER TRANSFORM (DFT)**: Introduction,Fourier representation of periodic signal DFT, properties of DFT. Linear convolution using the DFT **FAST FOURIER TRANSFORM(FFT)**: Decimation- in- time and Decimation- in-frequencyFFTAlgorithms(Radix 2 only).	10
4	.**Z-TRANSFORM**: Introduction, region of convergence for the Z-transform. The Inverse Z-transform. The Inverse Z-transform. One sided Z-transform. Solution of difference equation using Z-transform. System function.	6
5	**REALIZATION OF DIGITAL SYSTEMS**: System describe by difference equation, recursive and non-recursive systems, linear constant coefficient difference equation, Finite Impulse Response(FIR) and Infine Impulse Response (IIR) systems, Direct, cascaded and parallel form structure for IIR system. Direct and cascadedform structure for FIR system	6
6.	**IIR FILTER DESIGN**: Impulse invariance, Bilinear transform method, Butterworth filter.**FIR FILTER DESIGN**: FIR versus IIR, Linear phase FIR filter, FIR filter design by Rectangular, Hanning and Hamming window.	8
	TOTAL	42

11. Suggested Books

S.No.	Name of Books / Authors/ Publishers	Year of Publication/ Reprint
Text Books:		
1.	John Proakis and Dimitric Manolakis, ”Digital Signal Processing”, Pearson	2009
2.	.A K Mitra, “Digital Signal Processing” PHI	2009
Reference Book:		

3.	Oppenheim A.V.-Digital Signal Processing, PHI.	1988
4.	Lathi-Signals and Linear System, Oxford	2005

1. Subject Code: **SE313** Course Title: **Advanced Data Structures**
2. Contact Hours: L: 3 T: 1 P: 0
3. Examination Duration (ETE) (Hrs.): Theory 3 Hrs Practical 0
4. Relative Weightage: CWS 25 PRS 0 MTE 25 ETE 50 PR 0
5. Credits: 4
6. Semester: V
7. Subject Area: DEC
8. Pre-requisite: NIL
9. Objective: To study concepts of some advanced data structures like advanced trees and heaps.
10. Details of Course

S.No.	Contents	Contact Hours
1.	**ADVANCED TREES**: Definitions Operations on Weight Balanced Trees (Huffman Trees), Height balanced trees- B trees, B+ trees, 2-3 Trees and Red-Black Trees. Augmenting Red-Black Trees to Dynamic Order Statics and Interval Tree and Applications. Operations on Disjoint sets and its union find problem Implementing Sets. Dictionaries, Priority Queues and Concatenable Queues using 2-3 Trees.	8
2.	**MERGEABLE HEAPS**: Mergeable Heap Operations, Binomial Trees Implementing Binomial Heaps and its Operations, 2-3-4. Trees and 2-3-4 Heaps. Structure and Potential Function of Fibonacci Heap Implementing Fibonacci Heap.	9
3.	**GRAPH THEORY DEFINITIONS**: Definitions of Isomorphism Components. Circuits, Fundamental Circuits, Cut-sets. Cut-Vertices Planer and Dual graphs, Spanning Trees, Kuratovski's two Graphs.	8
4.	**GRAPH THEORY ALGORITHMS**: Algorithms for Connectedness, Finding all Spanning Trees in a Weighted Graph and Planarity Testing, all pair shortest path algorithms. Min-Cut Max-Flow theorem of Network Flows. Ford-Fulkerson Max Flow Algorithms.	7

5	Tries/digital search trees, Multiway tries, Suffix trees and applications, Quadtrees and Octrees and R-trees	8
	TOTAL	42

11. Suggested Books

S.No.	Name of Books / Authors/ Publishers	Year of Publication/ Reprint
	Text Books:	
1.	Narsingh Deo-Graph Theory with Application to Engineering and Computer Science,Prentice Hall of India.	2004
2.	Baase-Computer Algorithms, Pearson Education.	1999
3.	Cormen-Introduction to Algorithms, Prentice Hall of India.	2000
	Reference Book:	
4.	Aho A.V.,Hopcrptt J.E. and Ullman J.D.-The Design and Analysis of Computer	1979
5.	Horowitz and Sawhni-Fundamentals of Data Structures Galgotia Book Source.	1976

1. Subject Code: **SE315** Course Title: **Micro-Processor & Interfacing**
2. Contact Hours: L: 3 T: 1 P: 0
3. Examination Duration (ETE) (Hrs.): Theory 3 Hrs Practical 0
4. Relative Weightage: CWS 25 PRS 0 MTE 25 ETE 50 PR 0
5. Credits: 4
6. Semester: V
7. Subject Area: DEC
8. Pre-requisite: Nil
9. Objective: To introduce fundamentals of micro processing.
10. Details of Course

S.No.	Contents	Contact Hours
1.	**Introduction:** Microprocessor evolution and types, microprocessor architecture and operation of its components, addressing modes, interrupts, and data transfer schemes, instruction and data flow, timer and timing diagram. Interfacing devices. Architectural advancement of microprocessor	8
2.	**8-bit Microprocessors:** Pin diagram and internal architecture of 8085 microprocessor, registers, ALU, interrupt and machine cycle. Instruction sets. Addressing modes. Instruction formats Instruction Classification: data transfer, arithmetic operations, logical operations, branching operations, machine control and assembler directives. Counters and Time Delays.	8
3.	**16-bit Microprocessor:** Architecture of 8086 microprocessor: register organization, bus interface unit, execution unit, memory addressing, memory segmentation. Operating modes. Instruction sets, instruction format, Types of instructions. Interrupts: hardware and software interrupts.	8
4.	**Programming:** Assembly language programming based on Intel 8085/8086. Instructions, data transfer, arithmetic, logic, branch operations, looping, counting, indexing, programming techniques, counters and time delays, stacks and subroutines, conditional call and return instructions	8
5.	**Peripheral Interfacing:** Peripheral Devices: 8237/8257 DMA Controller, 8255 programmable peripheral interface, 8253/8254programmable timer/counter, 8259 programmable interrupt controller, 8251 USART and RS232C.	10
	TOTAL	42

11. Suggested Books

S.No.	Name of Books / Authors/ Publishers	Year of Publication/ Reprint
	Text Books:	
1.	Gaonkar Ramesh S, "Microprocessor Architecture, Programming and Applications with 8085", Penram International Publishing.	2002
2.	Ray A K , Bhurchandi K M , "Advanced Microprocessors and	2007

	Peripherals, TMH	
3.	Hall D V, "Microprocessor Interfacing", TMH.	1986
	Reference Books:	
4	Liu and Gibson G A , Microcomputer System: The 8086/8088 family ,PHI	1986
5	Aditya P Mathur, Introduction to Microprocessor, TMH	1989
6	Brey, Barry B, INTEL Microprocessors, PHI	2000
7	Renu Sigh & B.P.Sigh, Microprocessor, Interfacing and Application	2008

1. Subject Code: **SE317** Course Title: **Distributed Systems**
2. Contact Hours: L: 3 T: 0 P: 2
3. Examination Duration (ETE) (Hrs.): Theory 3 Hrs Practical 0
4. Relative Weightage: CWS 15 PRS 15 MTE 30 ETE 40 PR 0
5. Credits: 4
6. Semester: V
7. Subject Area: DEC
8. Pre-requisite: Computer Networks, Operating System
9. Objective: The objective of the course is to help students understand the fundamental goals of Distributed Systems and concepts communication, synchronization, resource allocation, file systems, fault tolerance and security.
10. Details of Course

S.No.	Contents	Contact Hours

1.	Introduction to Distributed Systems, Design Goals, Types of Distributed systems, system architectures and fundamental models, middleware, Threads, virtualization, client-Server Model, Code migration	7
2.	Communication fundamentals, Remote Procedure Call, message oriented communication, and stream oriented communication, multicast communication	7
3.	Synchronization: clock synchronization, logical clocks, mutual exclusion algorithms: centralized, decentralized, distributed and token ring algorithms, election algorithms.	6
4.	Replication management: need for replication, consistency models: data centric and client centric consistency models, replica management, consistency protocols: continuous, primary-based, replicated-write and cache-coherence protocols.	8
5.	Fault tolerance: basic concepts and failure models, process resilience, reliable client-server and group communication, distributed commit recovery mechanisms	6
6.	Security in distributed systems, secure channels, authentication, integrity and confidentiality, access control, security management. Naming: Flat naming approaches, structured naming, name space and resolution, attribute- based naming, directory services, LDAP, decentralized implementations.	8
	TOTAL	42

11. Suggested Books

S.No.	Name of Books / Authors/ Publishers	Year of Publication/ Reprint
	Text Books	
1.	Distributed Systems, Principles and Paradigms, 2nd edition by Andrew S. Tanenbaum and Maarteen Van Steen, Pearson Education, (ISBN-13: 978-0132392273)	2013
2.	Distributed System: Concepts and Design, 5th edition by Coulouris,	2013

	Dollimore, Kindberg,Pearson Ed, (ISBN-13: 978-0132143011)	
	Reference Books	
3.	Distributed Algorithms: Principles, Algorithms, and Systems by A. D. Kshemkalyani and M. Singhal, (ISBN-13: 978-0521189842)	2013

1. Subject Code: **SE319** Course Title: **Soft Computing**
2. Contact Hours: L: 3 T: 1 P: 0
3. Examination Duration (ETE) (Hrs.): Theory 3 Hrs Practical 0
4. Relative Weightage: CWS 25 PRS 0 MTE 25 ETE 50 PR 0
5. Credits: 4
6. Semester: V
7. Subject Area: DEC
8. Pre-requisite: Discrete Mathematics
9. Objective: The course integrates the concepts of fuzzy logic, neural networks and optimization techniques for understanding the complex nature of decisions taken by human beings which incorporates partial understanding of the truth with past experience. At the end of this course the student should be able to understand the basic techniques used in soft computing and apply them to solve real world problems.
10. Details of Course

S.No.	Contents	Contact Hours
1.	**Neural Networks:** History, overview of biological Neuro-system, Mathematical Models of Neurons, ANN architecture, Learning rules,	8

	Learning Paradigms-Supervised, Unsupervised and reinforcement Learning, ANN training Algorithms-perceptrons, Training rules, Delta, Back Propagation Algorithm, Multilayer Perceptron Model, Hopfield Networks, Associative Memories, Applications of Artificial Neural Networks.	
2.	**Fuzzy Logic:** Introduction to Fuzzy Logic, Classical and Fuzzy Sets: Overview of Classical Sets, Membership Function, Fuzzy rule generation.	7
3.	**Operations on Fuzzy Sets:** Compliment, Intersections, Unions, Combinations of Operations, Aggregation Operations. Nonspecificity of Fuzzy & Crisp Sets, Fuzziness of Fuzzy Sets	6
4.	**Fuzzy Arithmetic:** Fuzzy Numbers, Linguistic Variables, Arithmetic Operations on Intervals & Numbers, Lattice of Fuzzy Numbers, Fuzzy Equations.	6
5.	**Evolutionary Computing:**. Introduction, Evolutionary Techniques, Swarm Intelligence, Bacterial Foraging, Ant Colony Optimization, and Genetic Algorithm.	8
6.	**Introduction of Neuro-Fuzzy Systems:** Architecture of Neuro Fuzzy Networks.	7
	TOTAL	42

11. Suggested Books

S.No.	Name of Books / Authors/ Publishers	Year of Publication/ Reprint
	Text Books:	
1.	"An Introduction to Neural Networks", Anderson J.A., PHI.	1995
2.	"Introduction to the Theory of Neural Computation", Hertz J. Krogh, R.G. Palmer, Addison-Wesley, California.	1991
3.	"Fuzzy Sets & Fuzzy Logic", G.J. Klir & B. Yuan, PHI.	2009
4.	"An Introduction to Genetic Algorithm", Melanie Mitchell, PHI.	1997
	Reference Books:	
5.	"Understanding Neural Networks and Fuzzy Logic": Basic Concepts and Applications, by S. V. Kartalopoulos, IEEE Press – PHI	1997
6.	"Neural Networks, Fuzzy Logic and Genetic Algorithms", by S. Rajasekaran & G. A. Vijayalakshmi Pai,: Synthesis & Applications, PHI	2003

1. Subject Code: **SE321** Course Title: **Artificial Intelligence**
2. Contact Hours: L: 3 T: 0 P: 2
3. Examination Duration (ETE) (Hrs.): Theory 3 Hrs Practical 0
4. Relative Weightage: CWS 15 PRS 15 MTE 30 ETE 40 PR 0
5. Credits: 4
6. Semester: V
7. Subject Area: DEC
8. Pre-requisite: Discrete mathematics, Programming, Probability & Graph Theory
9. Objective: To introduce basic Knowledge representation, problem solving, and learning methods of Artificial Intelligence and understand the role of knowledge representation, problem solving, and learning in intelligent system engineering.
10. Details of Course

S.No.	Contents	Contact Hours
1.	**Introduction**: AI Problems, Task Domains of AI, AI Techniques: search knowledge, abstraction. Introduction to Intelligent program and Intelligent agents. Problem Solving: Basic Problem solving Method: state space search, problem characteristics, Production systems characteristics, issues in design of Intelligent search algorithm.	6
2.	**Heuristic search Techniques**: Hill climbing techniques, Best First search, A* Search, Problem Reduction: AO* Search, Constraint Satisfaction, Means-	7

	End Analysis. **Game Playing**: Game Tree, Searching procedure Minimax, alpha-beta pruning	
3.	**Knowledge Representation**: Knowledge Representation issues. Knowledge Representation using Predicate Logic: Unification, resolution. Rule based Systems: Forward versus backward reasoning, conflict resolution. **Structured Knowledge Representation**: Semantic Nets, Frames, conceptual dependency, scripts.	7
4.	**Programming Languages**: Fundamental and concepts of Programming languages like Prolog or Lisp. Relationship of languages with Knowledge representation and inferences	6
5.	**Reasoning**: Handling uncertainty Non-Monotonic Reasoning, Probabilistic reasoning, use of certainty factors, fuzzy logic. Learning Concept of learning, learning automation, genetic algorithm, learning by inductions, neural nets.	8
6.	**Applications:** Expert Systems: Architecture, Domain Knowledge, Knowledge Acquisition, Case Studies: MYCIN, RI, Natural language Processing: Syntactic, Semantic and Pragmatic Analysis, Robotics etc.	8
	TOTAL	42

11. Suggested Books

S.No.	Name of Books / Authors/ Publishers	Year of Publication/ Reprint
	Text Books	
1.	Artificial Intelligence, E. Rich and K. Knight, TMH, 2nd ed.(ISBN-978-0070522633)	1992
2.	Principles of AI, N.J. Nilsson, , Narosa Publ. House, (ISBN: 978-81-85198-29-3)	1990
	Reference Books	
3.	"Neural Networks in Computer Intelligence" by KM Fu, McGraw Hill (ISBN- 978-0136042594)	1992
4.	Artificial Intelligence: Structures and Strategies for Complex Problem	2005

	Solving (5th Edition), George F. Luger, 2005. Addison-Wesley. (ISBN: 978-8131723272)	
5.	Artificial Intelligence: A Guide to Intelligent Systems (2nd Edition).Michael Negnevitsky, 2005. Addison-Wesley. (ISBN: 978-8131720493)	2005
6	"Introduction to AI and Expert Systems", D.W. Patterson, , PHI, 1992(ISBN: 978-0134771007)	1992

1. Subject Code: **SE323** Course Title: **Theory of Computation**
2. Contact Hours: L: 3 T: 1 P: 0
3. Examination Duration (ETE) (Hrs.): Theory 3 Hrs Practical 0
4. Relative Weightage: CWS 25 PRS 0 MTE 25 ETE 50 PR 0
5. Credits: 4
6. Semester: V
7. Subject Area: DCC
8. Pre-requisite: Elementary set theory, Relations, Mappings, and some abstract algebra
9. Objective: To provide knowledge and skills in theoretical foundations of computing that are needed to study and practice computer science.
10. Details of Course

S.No.	Contents	Contact Hours
1.	**Introduction:** Alphabets, Strings and Languages; Automata and Grammars, Deterministic finite Automata (DFA)-Formal Definition, Simplified notation: State transition graph, Transition table, Language of DFA, Nondeterministic finite Automata (NFA), NFA with epsilon transition, Language of NFA, Equivalence of NFA and DFA, Minimization of Finite Automata, Distinguishing one string from other, Myhill-Nerode Theorem.	8
2.	**Regular expression (RE):** Definition, Operators of regular expression and their precedence, Algebraic laws for Regular expressions, Kleen's Theorem, Regular expression to FA, DFA to Regular expression, Arden Theorem, Non Regular Languages, Pumping Lemma for regular Languages. Application of Pumping Lemma, Closure properties of Regular Languages, Decision properties of Regular Languages, FA with output: Moore and Mealy machine, Equivalence of Moore and Mealy Machine, Applications and Limitation of FA.	8

3.	**Context free grammar (CFG):**Definition, Examples, Derivation , Derivation trees, Ambiguity in Grammar, Inherent ambiguity, Ambiguous to Unambiguous CFG, Useless symbols, Simplification of CFGs, Normal forms for CFGs: CNF and GNF,	6
4.	**Context Free Languages (CFL):** Closure properties of CFLs, Decision Properties of CFLs: Emptiness, Finiteness and Membership, Pumping lemma for CFLs.	6
5.	**Push Down Automata (PDA):** Description and definition, Instantaneous Description, Language of PDA, Acceptance by Final state, Acceptance by empty stack, Deterministic PDA, Equivalence of PDA and CFG, CFG to PDA and PDA to CFG, Two stack PDA.	6
6.	**Turing machines (TM):** Basic model, definition and representation, Instantaneous Description, Language acceptance by TM, Variants of Turing Machine, TM as Computer of Integer functions, Universal TM, Church's Thesis, Recursive and recursively enumerable languages, Halting problem, Introduction to Undecidability, Undecidable problems about TMs. Post correspondence problem (PCP), Modified PCP, Introduction to recursive function theory.	10
	TOTAL	42

11. Suggested Books

S.No.	Name of Books / Authors/ Publishers	Year of Publication/ Reprint
	Text Books	
1	Hopcroft, Ullman, "Introduction to Automata Theory, Languages and Computation", Pearson Education.ISBN-13: 978-0321455369	2006
2	K.L.P. Mishra and N.Chandrasekaran, "Theory of Computer Science Automata, Languages and Computation", PHI, ISBN-10: 8120329686	2007
	Reference Books	
3.	Martin J. C., "Introduction to Languages and Theory of Computations", TMH ,ISBN 978–0–07–319146–1	2010
4.	Papadimitrou, C. and Lewis, C.L., "Elements of the Theory of Computation", PHI , ISBN-13: 978-0132624787	1998
5.	Peter Linz, "An Introduction to Formal Language and Automata", Third Edition, Narosa Publishers, New Delhi , ISBN 0-7637-142	2001
6.	Kamala Krithivasan and Rama. R, "Introduction to Formal Languages, Automata Theory and Computation", Pearson Education, ISBN 978-81-317-2356-2	2009

1. Subject Code: **SE308** Course Title: **Software Reliability**
2. Contact Hours: L: 3 T: 1 P: 0
3. Examination Duration (ETE) (Hrs.): Theory 3 Hrs Practical 0
4. Relative Weightage: CWS 25 PRS 0 MTE 25 ETE 50 PR 0
5. Credits: 4
6. Semester: VI
7. Subject Area: DEC
8. Pre-requisite: Software Engineering
9. Objective: To appreciate and understand scientific concepts of Software and Hardware Reliability , to apply Software Reliability Growth Models in Software Development and to emphasize the Application of Software Reliability Models

10. Details of Course

S.No.	Contents	Contact Hours
1.	**UNIT I - INTRODUCTION TO SYSTEM RELIABILITY**: Review of Reliability Mathematics – Random Experiment, Probability distributions- Binomial, Poisson, Exponential, Weibull, and Generalized Exponential distributions; System Reliability -Reliability Block diagram — Repairable and Non Repairable systems; Maintainability and Availability — MTBF — MTTF, MDT – MTTR; Designing for higher reliability — Redundancy— k out of n systems	12
2.	**UNIT II-SYSTEM RELIABILITY CONCEPTS** : Software and hardware reliability; Basic Concepts – Errors, faults and Failures; Reliability Model classification – Operational Reliability, Testing Reliability; Introduction to Software Reliability Growth Models (SRGMs) - General Model Characteristic – Historical Development of models – Model Classification scheme –white box and black box models; Markovian models – Jelinski –Moranda model	12
3.	**UNIT III-NON-HOMOGENOUS POISSON PROCESS MODELS:** NHPP models- Musa models- Basic Execution time, Logarithmic Poisson Execution time models- Goel – Okumoto model, Yamada delayed S-shaped model, Imperfect debuggingmodels –Kapur- Garg model, Subburaj-Gopal model for the learning phenomenon, Subburaj-Gopap-Kapur versatile debugging model	12

4.	**UNIT IV-COMPARISON OF SOFTWARE RELIABILITY MODELS** Bayesian models- Littlewood –Verall model; Discrete models; Efforts based models; Execution time, Testing time and Calendar Time modeling; Comparison Criteria – Goodness of fit - Predictive Validity of Models – short term and long term	8
5.	**UNIT V-ADVANCED TOPICS IN SOFTWARE RELIABILITY** Engineering "just right reliability"- Test case generation-operational profile; setting system failure intensity objectives; preparing, executing and guiding test; Release Time determination – criteria – cost, failure intensity, reliability.	8
	TOTAL	42

11. Suggested Books

S.No.	Name of Books / Authors/ Publishers	Year of Publication/ Reprint
	Text Books:	
1.	John D. Musa, Anthony Iannino, Kazuhira Okumoto, "Software Reliability – Measurement, Prediction, Application, Series in Software Engineering and Technology", McGraw Hill, 1987. 2.	1987
2.	Michael Lyu, "Handbook of Software Reliability Engineering", IEEE Computer Society Press, ISBN: 0-07-039400-8, 1996.	1996
	Reference books:	1996
4.	John D. Musa, "Software Reliability Engineering", Tata McGraw Hill, 1999.	1999
5.	Patric D. T.O connor," Practical Reliability Engineering" , 4th Edition, John Wesley & sons, 2003.	2003
6.	Xie M, "Software Reliability Modelling", World Scientific, Singapore, 1991.	1991
7.	Research papers published in relevant international journals	

1. Subject Code: **SE310** Course Title: **Multimedia Systems**
2. Contact Hours: L: 3 T: 1 P: 0
3. Examination Duration (ETE) (Hrs.): Theory 3 Hrs Practical 0
4. Relative Weightage: CWS 25 PRS 0 MTE 25 ETE 50 PR 0
5. Credits: 4
6. Semester: VI

7. Subject Area: DEC
8. Pre-requisite: Nil
9. Objective: To study the concepts of multimedia data, algorithms and compression.
10. Details of Course

S.No.	Contents	Contact Hours
1.	Introduction to Multimedia, Multimedia Information, Multimedia Objects, Multimedia in business and work. Convergence of Computer, Communication and Entertainment Products ,Stages of Multimedia Projects: Multimedia hardware, Memory & storage devices, Communication devices, Multimedia software's, presentation tools, tools for object generations, video, sound, image capturing, authoring tools, card and page based authoring tools.	9
2.	Multimedia Building Blocks: Text, Sound MIDI, Digital Audio, audio file formats, MIDI under windows environment, Audio & Video Capture.	6
3.	Data Compression: Huffman Coding, Shannon Fano Algorithm, Huffman Algorithms, Adaptive Coding, Arithmetic Coding Higher Order Modeling. Finite Context Modeling, Dictionary based Compression, Sliding Window Compression, LZ77, LZW compression, Compression, Compression ratio loss less & lossy compression.	9
4.	Speech Compression & Synthesis : Digital Audio concepts, Sampling Variables, Loss less compression of sound, loss compression & silence compression.	6
5.	Images: Multiple monitors, bitmaps, Vector drawing, lossy graphic compression, image file formats, animations, Images standards, JPEG Compression, Zigzag Coding,	5
6.	Multimedia Database. Content based retrieval for text and images, Video**:** Video representation, Colors, Video Compression, MPEG standards, MHEG Standard Video Streaming on net, Video Conferencing, Multimedia Broadcast Services, Indexing and retrieval of Video Database, recent developments in Multimedia.	7
	TOTAL	42

11. Suggested Books

S.No.	Name of Books / Authors/ Publishers	Year of Publication/ Reprint
	Text Books:	
1.	Tay Vaughan "Multimedia, Making IT Work" Osborne McGraw Hill. (ISBN-10: 0072264527)	2014, 2010
2.	Buford "Multimedia Systems" Addison Wesley (ISBN-13: 9780201532586)	2000
3.	Agarwal & Tiwari "Multimedia Systems" Excel.	2002
	Reference books:	1996
4.	Mark Nelson "Data Compression Book" BPB. (ISBN-13: 9781558514348	2013
5.	David Hillman "Multimedia technology and Applications" Galgotia Publication	2008

1. Subject Code: **SE312** Course Title: **Parallel Computer Architecture**
2. Contact Hours: L: 3 T: 1 P: 0
3. Examination Duration (ETE) (Hrs.): Theory 3 Hrs Practical 0
4. Relative Weightage: CWS 25 PRS 0 MTE 25 ETE 50 PR 0
5. Credits: 4
6. Semester: VI
7. Subject Area: DEC
8. Pre-requisite: Computer Architecture
9. Objective: To introduce fundamentals of parallel, pipelines and superscalar architecture.
10. Details of Course

S.No.	Contents	Contact

		Hours
1.	**Introduction**: Introduction to parallel computing, need for parallel computing, parallel architectural classification schemes, Flynn's , Fang's classification, performance of parallel processors, distributed processing, processor and memory hierarchy, bus, cache & shared memory, introduction to super scalar architectures, quantitative evaluation of performance gain using memory, cache miss/hits.	6
2.	**Multi-core Architectures**: Introduction to multi-core architectures, issues involved into writing code for multi-core architectures, development of programs for these architectures, program optimizations techniques, building of some of these techniques in compilers, Open MP and other message passing libraries, threads, mutex etc.	6
3.	**Multi-threaded Architectures** Parallel computers, Instruction level parallelism (ILP) vs. thread level parallelism (TLP), Performance issues: Brief introduction to cache hierarchy and communication latency, Shared memory multiprocessors, General architectures and the problem of cache coherence, Synchronization primitives: Atomic primitives; locks: TTS, ticket, array; barriers: central and tree; performance implications in shared memory programs; Chip multiprocessors: Why CMP (Moore's law, wire delay); shared L2 vs. tiled CMP; core complexity; power/performance; Snoopy coherence: invalidate vs. update, MSI, MESI, MOESI, MOSI; performance trade-offs; pipelined snoopy bus design; Memory consistency models: SC, PC, TSO, PSO, WO/WC, RC; Chip multiprocessor case studies: Intel Montecito and dual-core, Pentium4, IBM Power4, Sun Niagara	10
4.	**Compiler Optimization** Issues Introduction to optimization, overview of parallelization; Shared memory programming, introduction to Open MP; Dataflow analysis, pointer analysis, alias analysis; Data dependence analysis, solving data dependence equations (integer linear programming problem); Loop optimizations; Memory hierarchy issues in code optimization.	8
5.	**Operating System** Issues Operating System issues for multiprocessing Need for pre-emptive OS; Scheduling Techniques, Usual OS scheduling techniques, Threads, Distributed scheduler, Multiprocessor scheduling, Gang scheduling; Communication between processes, Message boxes, Shared memory; Sharing issues and Synchronization, Sharing memory and other structures, Sharing I/O devices, Distributed Semaphores, monitors,	8

	spin-locks, Implementation techniques on multi-cores; Open MP, MPI and case studies	
6.	**Applications** Case studies from Applications: Digital Signal Processing, Image processing, Speech processing.	4
	TOTAL	42

11. Suggested Books

S.No.	Name of Books / Authors/ Publishers	Year of Publication/ Reprint
	Text Books	
1.	Kai Hwang, "Advanced computer architecture"; TMH	2000
2.	J .P.Hayes, "computer Architecture and organization", MGH	1998
3.	M.J Flynn, "Computer Architecture, Pipelined and Parallel Processor Design", Narosa Publishing	1998
	Reference Books	
4.	D.A.Patterson, J.L.Hennessy, "Computer Architecture :A quantitative approach", Morgan Kauffmann	2002
5.	Hwang and Briggs, " Computer Architecture and Parallel Processing"; MGH	2000

1. Subject Code: **SE314** Course Title: **Bioinformatics**
2. Contact Hours: L: 3 T: 1 P: 0
3. Examination Duration (ETE) (Hrs.): Theory 3 Hrs Practical 0
4. Relative Weightage: CWS 25 PRS 0 MTE 25 ETE 50 PR 0
5. Credits: 4
6. Semester: VI
7. Subject Area: DEC
8. Pre-requisite: Searching & Sorting, Statistics, Mathematics
9. Objective: To provide knowledge about the principles, concepts and applications of bioinformatics.
10. Details of Course

S.No.	Contents	Contact Hours
1.	The Biologist & Internet: Internet basics, FTP, World Wide Web, and Introduction to Primary & Secondary database, GenBank, GCG, and ACDEB. Structure Databases: Introduction to structures, PDB, MMDB, Structure file formats, Visualizing structural information, Database structure viewers, Introduction to the NCBI database, SeqIDS, Seq. Annot: Annotating the sequence, Seqdiscr: Describing the sequence.	10
2.	Information Retrieval from Biological Databases & submission of DNA Sequences to the Databases: Retrieving database entries, Integrated information retrieval: The ENTREZ system, sequence databases beyond NCBI, Medical Databases; Where to submit nucleotide sequences, How to submit on the World Wide Web, How to submit with sequin, Molecular modeling	8
3.	Sequence Alignment and Database Searching: Introduction, Evolutionary basis of sequence alignment, Optimal alignment methods, Substitution scores & gap penalties, Statistical significance of alignments, Database similarity searching, FASTA, BLAST, Low complexity regions, Repetitive elements.	8
4.	Multiple Sequence Alignment & Genome Mapping: Progressive alignment methods, Motifs and patterns, Probe, Presentation methods, Abscript; Different types of maps: physical, genetical, etc. Synteny, Human genome project, Application of genome mapping, Chromosome maps.	8
5.	Predictive Methods Using Nucleotide & protein Sequences: Framework, marking repetitive DNA, Database search, Codon bias detection, Detecting function sites in the DM, Protein identity based on composition.	8
	TOTAL	42

11. Suggested Books

S.No.	Name of Books / Authors/ Publishers	Year of Publication/ Reprint
	Text Books	
1	Bioinformatics: A practical guide to the analysis of genes and proteins A.D. Baxevanis and B.F.F. Ouellette (Eds). John Wiley and Sons. ISBN 0-471-38391-0	2001
2	Bioinformatics: Concepts, Skills &Applications. Rastogi, S.C., Mendiratta, N. and Rastogi, CBS Publishers &Distributors, New Delhi. ISBN 13: 9788120330627	2004
	Reference Books	
3	Bioinformatics: Sequence and Genome Analysis by D.W. Mount, Cold Spring Harbor Laboratory Press, ISBN 978-087969712-9	2004
4	Gautham.N, "Bioinformatics", Narosa Publishing Company. ISBN 978-81-8487-249-1	2006

1. Subject Code: **SE316** Course Title: **Natural Language Processing**
2. Contact Hours: L: 3 T: 1 P: 0
3. Examination Duration (ETE) (Hrs.): Theory 3 Hrs Practical 0
4. Relative Weightage: CWS 25 PRS 0 MTE 25 ETE 50PR - 0
5. Credits: 4
6. Semester: VI
7. Subject Area: DEC
8. Pre-requisite: Theory of Automata
9. Objective: The goal of natural language processing (NLP) is to design and build computer systems that are able to analyze natural languages like German or English, and that generate their outputs in a natural language.
10. Details of Course

S.No.	Contents	Contact Hours
1.	**Introduction:**The study of Language, Introduction to NLP, Regular Expression, Finite State Automata, Evaluating Language Understanding Systems, Different levels of Language Analysis, Representations and	6

	Understanding, Linguistic Background.	
2.	**Grammars and Parsing:**Top-Down and Bottom-Up Parsers, Transition Network Grammars, Top-Down Chart Parsing, Feature Systems and Augmented Grammars, Morphological Analysis and the Lexicon, Parsing with Features, Augmented Transition Networks.	7
3.	**Grammars for Natural Language:** Auxiliary Verbs and Verb Phrases, Movement Phenomenon in Language, Handling questions in Context-Free Grammars, Hold mechanisms in ATNs, Human preferences in Parsing, Encoding uncertainty, Deterministic Parser.	6
4.	**Ambiguity Resolution:** Statistical Methods, Probabilistic Language Processing, Estimating Probabilities, Part-of-Speech tagging, Obtaining Lexical Probabilities, Probabilistic Context-Free Grammars, Dependency Parsing, Best First Parsing, Semantics and Logical Form, Word senses and Ambiguity, Encoding Ambiguity in Logical Form.	7
5.	**Advanced Features and Syntax, Features and Unification:** Feature structures – Unification of feature structures – Features structures in the grammar – Implementing unification – Parsing with unification constraints – Types and Inheritance. Lexicalized and Probabilistic Parsing: Probabilistic context-free grammar – problems with PCFGs – Probabilistic lexicalized CFGs – Dependency Grammars – Human parsing.	8
6.	**Application of NLP:** Intelligent Work Processors, Machine Translation, User Interfaces, Man-Machine Interfaces, Natural language Querying Tutoring and Authoring Systems, Speech Recognition Commercial use of NLP, Semantic Interpretation, Information Retrieval.	8
	TOTAL	42

11. Suggested Books

S.No.	Name of Books / Authors/ Publishers	Year of Publication/ Reprint
	Text Books	

1.	James Allen, Natural Language Understanding, 2/e, Pearson Education (ISBN 13: 9788131708958)	2003
2.	Foundation of Statistical Natural Language Processing, Manning and Schutze, (**ISBN-13:** 978-0262133609)	1998
3.	D. Jurafsky, J. H. Martin, Speech and Language Processing, Pearson Education,(**ISBN-13:** 978-8131716724)	2008
	Reference books	
4.	Bharati, Chaitanya and Sangal: Natural Language Processing- a Paninian perspective(**ISBN-13:** 978-8120309210)	1995
5.	Leonard Bolc. (Ed.): Natural Language Parsing Systems, Springer Verlag, (**ISBN-13:** 978-0387175379)	1986

1. Subject Code: **SE318** Course Title: **Advanced Database Management Systems**
2. Contact Hours: L: 3 T: 1 P: 0
3. Examination Duration (ETE) (Hrs.): Theory 3 Hrs Practical 0
4. Relative Weightage: CWS 25 PRS 0 MTE 25 ETE 50 PR 0
5. Credits: 4
6. Semester: VI
7. Subject Area: DEC
8. Pre-requisite: Database Management Systems
9. Objective: To highlight the features of advanced SQL, parallel and distributed databases and architecture of modern database systems.
10. Details of Course

S.No.	Contents	Contact Hours
1.	**Advanced SQL**: SQL Data Types and Schemas, Integrity Constraints, Authorization, Embedded SQL, Dynamic SQL, Functions and Procedural Constructs, Recursive Queries, Advanced SQL Features. **Object-Based Databases and XML:** Complex Data Types, Structured Types and Inheritance in SQL, Table Inheritance, Array and Multiset Types in SQL, Object-Identity and Reference Types in SQL, Implementing O-R Features, Persistent Programming Languages, Object-Oriented versus Object-Relational, Structure of XML Data, XML Document Schema, Querying and Transformation, Application Program Interfaces to XML,	8

	Storage of XML Data, XML Applications.	
2.	**Query Processing and Query Optimization:** Measures of Query Cost, Selection Operation, Sorting, Join Operation, Other Operations, Evaluation of Expressions, Transformation of Relational Expressions, Estimating Statistics of Expression Results, Choice of Evaluation Plans, Materialized Views.	6
3.	**Recovery System:** Failure Classification, Storage Structure, Recovery and Atomicity, Log-Based Recovery, Recovery with Concurrent Transactions, Buffer Management, Failure with Loss of Nonvolatile Storage, Advanced Recovery Techniques, Remote Backup Systems.	6
4.	**Database-System Architectures:** Centralized and Client –Server Architectures, Server System Architectures, Parallel Systems, Distributed Systems, Network Types, Parallel Databases, I/O Parallelism, Interquery Parallelism, Intraquery Parallelism, Intraoperation Parallelism, Interoperation Parallelism, Design of Parallel Systems.	8
5.	**Distributed Databases:** Homogeneous and Heterogeneous Databases, Distributed Data Storage, Distributed Transactions, Commit Protocols, Concurrency Control in Distributed Databases, Availability, Distributed Query Processing, Heterogeneous Distributed Databases.	6
6.	**Advanced Data Types and New Applications**: Time in Databases, Spatial and Geographic Data, Multimedia Databases, Mobility and Personal Databases. **Advanced Transaction Processing**: Transaction-Processing Monitors, Transactional Workflows, E-Commerce, Main-Memory Databases, Real-Time Transaction Systems, Long-Duration Transactions, Transaction Management in Multi-databases.	8
	TOTAL	42

11. Suggested Books

S.No.	Name of Books / Authors/ Publishers	Year of Publication/ Reprint
	Text Books	
1.	Silberchatz, Korth, Sudershan,"Database System Concepts", Tata MC Graw Hills Publishing	5th Ed, 2005
	Reference Books	
2.	RamezElmasri&ShamkantNavathe, "Database Management Systems", Pearson Education Asia	6th Ed, 2010.
3.	Raghu Ramakrishnan, Johannes Gehrke, "Database Management Systems", McGraw Hill	3rd Ed, 2004.

4.	N.Tamer Ozsu, Patrick Valduriez, “Principles of Distributed Database Systems”, Prentice Hal International Inc.	1999.
5.	Carlo Zaniolo, Stefano Ceri, Christos Faloustsos, R.T.Snodgrass, V.S.Subrahmanian, “Advanced Database Systems”, Morgan Kaufman Series	1997.

1. Subject Code: **SE320** Course Title: **Data compression**
2. Contact Hours: L: 3 T: 1 P: 0
3. Examination Duration (ETE) (Hrs.): Theory 3 Hrs Practical 0
4. Relative Weightage: CWS 25 PRS 0 MTE 25 ETE 50 PR 0
5. Credits: 4
6. Semester: VI
7. Subject Area: DEC
8. Pre-requisite: NIL
9. Objective: To study various data/image compression techniques in detail.
10. Details of Course

S.No.	Contents	Contact Hours
1.	**Introduction:** Compression Techniques: Loss less compression, Lossy Compression, Measures of performance, Modeling and coding, Mathematical *Preliminaries* for Lossless compression: A brief introduction to information theory, Models: Physical models, Probability models, Markov models, composite source model, Coding: uniquely decodable codes, Prefix codes.	6
2.	**Huffman coding:** The Huffman coding algorithm: Minimum variance Huffman codes, Adaptive Huffman coding: Update procedure, encoding procedure, decoding procedure. Golomb codes, Rice codes, Tunstall codes, Applications of Hoffman coding: Loss less image compression, Text compression, Audio Compression.	8
3.	**Arithmetic Coding:** Coding a sequence, Generating a binary code, Comparison of Binary and Huffman coding, Applications: Bi-level image compression-The JBIG standard, JBIG2, Image compression. Dictionary	12

	Techniques: Introduction, Static Dictionary: Diagram Coding, Adaptive Dictionary. The LZ77 Approach, The LZ78 Approach, Applications: File Compression-UNIX compress.	
4.	Image Compression: The Graphics Interchange Format (GIF), Compression over Modems: V.42 bits, Predictive Coding: Prediction with Partial match (ppm): The basic algorithm, The ESCAPE SYMBOL, length of context, The Exclusion Principle, The Burrows- Wheeler Transform: Move-to-front coding, CALIC, JPEG-LS, Multi-resolution Approaches, Facsimile Encoding, Dynamic Markoy Compression.	8
5.	**Mathematical Preliminaries for Lossy Coding:** Distortion criteria, Models, Scalar Ouantization: The Quantization problem, Uniform Quantizer, Adaptive Quantization, Non uniform Quantization.	4
6.	**Vector Quantization:** Advantages of Vector Quantization *over* Scalar Quantization, The Linde-Buzo- Gray Algorithm, Tree structured Vector Quantizers. Structured *Vector* Quantizers.	4
	TOTAL	42

11. Suggested Books

S.No.	**Name of Books / Authors/ Publishers**	**Year of Publication/ Reprint**
	Text Book	
1.	Khalid Sayood, Introduction to Data Compression, Morgan Kaufmann Publishers. ISBN 1558605584	2000
	Reference Book	
2	Data Compression The Complete Reference, 4th ed. by David Salomon. ISBN-13: 978-1-84628-602-5.	2007

1. Subject Code: **SE322** Course Title: **Real Time Systems**
2. Contact Hours: L: 3 T: 1 P: 0
3. Examination Duration (ETE) (Hrs.): Theory 3 Hrs Practical 0
4. Relative Weightage: CWS 25 PRS 0 MTE 25 ETE 50 PR 0
5. Credits: 4
6. Semester: VI
7. Subject Area: DEC
8. Pre-requisite: Data Structures and Algorithms
9. Objective: The course addresses basic concepts of real-time systems, presents examples of real-time systems, covers real-time systems analysis and design, and gives an in-depth treatment of timing analysis and scheduling
10. Details of Course

S.No.	Contents	Contact Hours
1.	Introduction **:** Definition, Typical Real Time Applications; Digital Control, High Level Controls, Signal Processing etc., Release Times, Deadlines, and Timing Constraints, Hard Real Time Systems and Soft Real Time Systems, Reference Models for Real Time Systems: Processors and Resources, Temporal Parameters of Real Time Workload, Periodic Task Model, Precedence Constraints and Data Dependency.	8
2.	Real Time Scheduling: Common Approaches to Real Time Scheduling: Clock Driven Approach, Weighted Round Robin Approach, Priority Driven Approach, Dynamic Versus Static Systems, Optimality of Effective-Deadline-First (EDF) and Least-Slack-Time-First(LST) Algorithms, Offline Versus Online Scheduling, Scheduling A periodic and Sporadic jobs in Priority Driven and Clock Driven Systems.	10
3.	Resources Access Control: Effect of Resource Contention and Resource Access Control (RAC), Non preemptive Critical Sections, Basic Priority-Inheritance and Priority-Ceiling Protocols, Stack Based Priority-Ceiling Protocol, Use of Priority-Ceiling Protocol in Dynamic Priority Systems, Pre-emption Ceiling Protocol, Access Control in Multiple-Unit Resources, Controlling Concurrent Accesses to Data Objects	8
4.	Multiprocessor System Environment **:** Multiprocessor and Distributed System Model, Multiprocessor Priority-Ceiling Protocol, Schedulability of Fixed-Priority End-to-End Periodic Tasks, Scheduling Algorithms for End-to-End Periodic Tasks, End-to-End Tasks in Heterogeneous Systems,	8

	Predictability and Validation of Dynamic Multiprocessor Systems, Scheduling of Tasks with Temporal Distance Constraints.	
5.	Real Time Communication **:** Model of Real Time Communication, Priority-Based Service and Weighted Round-Robin Service Disciplines for Switched Networks, Medium Access Control Protocols for Broadcast Networks, Internet and Resource Reservation Protocols, Real Time Protocols, Communication in Multicomputer System, An Overview of Real Time Operating Systems.	8
	TOTAL	42

11. Suggested Books

S.No.	**Name of Books / Authors/ Publishers**	**Year of Publication/ Reprint**
	Text Books	
1.	Real Time Systems by Jane W. S. Liu, Pearson Education Publication, ISBN 9788177585759	2000
	Reference Books	
2.	H. Kopetz, "Real time systems for distributed embedded applications, Kluwer Academic ISBN-13: 978-1441982360	2011
3.	Douglass, Real Time UML: Advances in the UML for Real-Time Systems, *3/e,* Addison-Wesley ISBN-13: 978-03211607	2013

1. Subject Code: **SE324** Course Title: **Parallel Algorithms**
2. Contact Hours: L: 3 T: 1 P: 0

3. Examination Duration (ETE) (Hrs.): Theory 3 Hrs Practical 0
4. Relative Weightage: CWS 25 PRS 0 MTE 25 ETE 50 PR 0
5. Credits: 4
6. Semester: VI
7. Subject Area: DEC

8. Pre-requisite: Data Structures, Analysis and design of algorithms

9. Objective: To introduce parallel algorithms and compare it with its sequential equivalent.
10. Details of Course

S.No.	Contents	Contact Hours
1.	Introduction: Need for parallel computers ,Models of computation, Analyzing parallel algorithms, Expressing parallel algorithms	3
2.	Dense Matrix algorithms: Matrix vector Multiplication, Matrix matrix multiplication	4
3.	Decomposition & Mapping techniques: Database query processing, 15 puzzle problem, Parallel discrete event simulation, Image dithering, Dense LU factorization	5
4.	Sorting : Hyper quick sort, Merge sort, Bitonic merge sort, odd even transposition, Enumeration sort(sorting on the CRCW model, CREW model and EREW model)	10
5.	Searching and selection: Searching on a sorted sequence (EREW,CREW,CRCW), Searching on a random sequence (EREW, CREW, CRCW, Tree and Mesh), Sequential selection algorithm, Parallel selection algorithm(EREW parallel solution)	10
6.	Graph Algorithm: Graph coloring ,Minimal spanning tree , Shortest path algorithm	10
	TOTAL	42

11. Suggested Books

S.No.	Name of Books / Authors/ Publishers	Year of Publication/ Reprint
1.	Ananth Grama, Anshul Gupta, George Karypis, Vipin Kumar "Introduction to Parallel Computing", Second Edition, Addison	2003

	Wesley, ISBN: 0-201-64865.	
2.	S.G. Akl, "The Design and Analysis of Parallel Algorithms", PHI. ISBN-10: 0132000563	1989
3.	F.T. Leighton, "Introduction to Parallel Algorithms and Architectures: Arrays, Trees, Hypercubes", MK Publishers, San Mateo California.ISBN:1-55860-117-1	1992
4.	Wilkinson, M. Allen, "Parallel Programming Techniques and Applications using networked workstations and parallel computers", Prentice Hall,ISBN-10: 0131405632.	1999
5.	Michael J. Quinn, "Parallel computer theory and practice", McGraw Hill, Second Edition, 1994. ISBN 10: 0070512949	1994

1. Subject Code: **SE409** Course Title: **Software Maintenance**
2. Contact Hours: L: 3 T: 1 P: 0
3. Examination Duration (ETE) (Hrs.): Theory 3 Hrs Practical 0
4. Relative Weightage: CWS 25 PRS 0 MTE 25 ETE 50 PR 0
5. Credits: 4
6. Semester: VII

7. Subject Area: DEC

8. Pre-requisite: Software Engineering

9. Objective: To study about reverse engineering , configuration management , software maintenance tools, software administration and performance

10. Details of Course

S.No.	Contents	Contact Hours
1.	**UNIT I–FUNDAMENTALS OF SOFTWARE MAINTENANCE:** Meaning of software maintenance, software change, ongoing support, economic implications of modifying software, the nomenclature and image problem, software maintenance framework, potential solutions to maintenance problem. Maintenance process models: Definition of critical appraisal of traditional process models, maintenance process models. Program understanding: Aims of program comprehension, maintainers and their information needs comprehension process models, mental models, program comprehension strategies, factors that affect understanding, implications of comprehension theories and studies	9
2.	**UNIT II-REVERSE ENGINEERING**: Definition, purposes and objectives, levels of reverse Engineering, supports techniques, benefits. Reuse and reusability: Definitions, objective and benefit of reuse, approach to reuse, domain Analysis, COMPONENTS engineering, reuse process model, factors that impact upon reuse. Maintenance measures, Definitions, objectives of software measurement, example measures, guidelines for selecting maintenance measures.	9
3.	**UNIT III-CONFIGURATION MANAGEMENT**: Definition for configuration management, change control, documentation. Management and organizational issues, Management responsibilities, enhancing maintenance productivity, maintenance teams, personnel Education and Training, organization modes.	8
4.	**UNIT IV-BUILDING AND SUSTAINING MAINTAINABILITY**: Quality Assurance, fourth generation languages, object oriented paradigms. Maintenance tools: Criteria for selecting tools, taxonomy of tools, program understanding and reverse engineering testing, configuration management, and other tasks. Past, present and future of software maintenance.	8

5.	**UNIT V-SOFTWARE ADMINISTRATION**: Analyzing system logs, operating system updates, patches, and configuration changes, Performing backups. Installing and configuring new hardware and software. Adding, removing, or updating user account information, resetting passwords, System performance tuning. Performing routine audits of systems and software.	8
	TOTAL	42

11. Suggested Books

S.No.	Name of Books / Authors/ Publishers	Year of Publication/ Reprint
	Text Books:	
1.	Armstrong A Takang and Penny A.Grubb, "Software Maintenance: concepts and Practice", International Thomson Computer press, London.	
	Reference books:	1996
4.	Roger S Pressman, "Software Engineering", 6th edition, Tata McGraw-Hill, 2004.	2004

1. Subject Code: **SE411** Course Title: **Software Quality & Metrics**

2. Contact Hours: L: 3 T: 1 P: 0

3. Examination Duration (ETE)(Hrs.): Theory 3Hrs Practical 0

4. Relative Weightage: CWS 25 PRS 0 MTE 25 ETE 50 PR 0

5. Credits: 4

6. Semester: VII

7. Subject Area: DEC

8. Pre-requisite: Nil

9. Objective: To understand software quality concepts, models and learn basics of metrics, their types and applications.

10. Details of Course

S.No.	Contents	Contact Hours
1.	**Software Quality Assurance Framework:** What is Quality? Software Quality Assurance, Components of Software Quality Assurance, Software Quality Assurance Plan. Steps to develop and implement a Software Quality Assurance Plan.	7
2.	**Quality Standards:** ISO 9000 and Comparison ISO Standards, CMM, CMMI, PCMM, Malcolm Balridge, 3 Sigma, 6 Sigma, Software Quality Models.	8
3.	**Measurement in Software Engineering:** scope of software metrics, Basics of Measurement: Measuring External Product Attributes: Modeling Software Quality, Measuring aspects of quality, Framework for Software Measurement, Measuring Internal Product Attributes, Size and Structure: Aspects of Software Size, Length, Reuse, Functionality, Complexity, Types of Structural Measures, Modularity and information flow attributes.	8
4.	**Software Quality Assurance Metrics and Measurement:** Software Quality Metrics**,** Product Quality metrics, Process Quality Metrics, Metrics for Software Maintenance, Software Quality metrics methodology, Object Oriented Metrics in quality.	8
5.	**Software Quality Estimation Tools:** Desirable features in software Quality estimation tools, Study of some existing Tools for quality estimation.	7
6.	Computer Aided Quality Engineering (CAQE) Concepts, Design Techniques for CAQE.	4
	TOTAL	42

11. Suggested Books

S.No.	Name of Books / Authors/ Publishers	Year of Publication/ Reprint
Text Books		
1.	Software Metrics, Fenton, CRC press	2014
2.	Yogesh Singh & Ruchika Malhotra, "Object Oriented Software Engineering", 1st Ed., PHI Learning.	2012

	Referencce Books	
3.	Software Quality: Theory and Management, Allan C. Gillies, Thomson Learning.	2003

1. Subject Code: **SE413** Course Title: **Grid and Cluster Computing**
2. . Contact Hours: L: 3 T: 1 P: 0
3. Examination Duration (ETE) (Hrs.): Theory 3 Hrs Practical 0
4. Relative Weightage: CWS 25 PRS 0 MTE 25 ETE 50 PR 0
5. Credits: 4
6. Semester: VII
7. Subject Area: DEC
8. Pre-requisite: Operating Systems, Data Structures and Algorithms
9. Objective: The course will provide an insight for achieving cost efficient high performance system and how to deal with design and architecture of grid and cluster computing.
10. Details of Course

S.No.	Contents	Contact Hours
	Cluster Computing Introduction to concepts in Cluster based distributed	

1.	computing Hardware technologies for cluster computing and software for cluster computing, and different Software Architecture for Cluster Computing.	5
2.	**Programming;** Programming Models and Paradigms, features and performance of standard MPI variants, Derived data types, communicators.	8
3.	**Resource management and scheduling** Managing, cluster resources: single system images, system level middleware, distributed task scheduling, monitoring and administering system resources Parallel I/O and Parallel Virtual File System. Scheduling: Condor, Maui Scheduler, Portable Batch System (PBS).	7
4.	**Grid Computing:** Grids and Grid Technologies, Programming models and Parallelization Techniques, Grid Security Infrastructure, Setting up Grid, deployment of Grid software and tools, and application execution.	9
5.	Standard application development tools and paradigms Performance evaluation tools, HINT, netperf, netpipe, ttcp, Iperf.message	8
6.	**Data Management** Application Case Study: Molecular Modeling for Drug Design and Brain Activity Analysis, Resource management and scheduling. .	4
	TOTAL	42

11. Suggested Books

S.No.	Name of Books / Authors/ Publishers	Year of Publication/ Reprint
	Text Books	
1.	Grid and Cluster Computing by C.S.R. Prabhu, PHI	2008
2.	Introduction to grid computing - Bart Jacob, Michael Brown	2005
3.	B. Wilkinson, Grid Computing: Techniques and Applications, CRC	2009

	Press.	
	Reference Books	
4.	R. Buyya, High Performance Cluster Computing: Architectures and Systems, Volume 1, Pearson Education.	2008
5.	D. Janakiram, Grid Computing, Tata McGraw-Hill.	2005

1. Subject Code: **SE415** Course Title: **Pattern Recognition**
2. Contact Hours: L: 3 T: 1 P: 0
3. Examination Duration (ETE) (Hrs.): Theory 3 Hrs Practical 0
4. Relative Weightage: CWS 25 PRS 0 MTE 25 ETE 50 PR 0
5. Credits: 4
6. Semester: VII
7. Subject Area: DEC
8. Pre-requisite: Linear Algebra, Probability Theory
9. Objective: To equip with basic mathematical and statistical techniques commonly used in pattern recognition. Also provide with an adequate background on probability theory, statistics, and optimization theory to tackle a wide spectrum of engineering problems.
10. Details of Course

S.No.	**Contents**	**Contact Hours**
1.	Pattern recognition fundamentals: Basic concepts of pattern recognition, fundamental problems in pattern recognition system, design concepts and methodologies, example of automatic pattern recognition systems, a simple	6

	automatic pattern recognition model.	
2.	Bayesian decision theory: Minimum-error-rate classification, Classifiers, Discriminant functions, Decision surfaces, Normal density and Discriminant functions, Discrete features, Missing and noisy features.	6
3.	Maximum-likelihood and Bayesian parameter estimation: Maximum-Likelihood estimation: Gaussian case, Maximum a Posteriori estimation, Bayesian estimation: Gaussian case, Problems of dimensionality, Dimensionality reduction: Principle component analysis.	6
4.	Non-parametric techniques for density estimation: Parzen-window method, K-Nearest Neighbour method, Fuzzy classifications. Unsupervised learning and Clustering: k-mean clustering, fuzzy k-mean clustering, similarity measures, criterion functions for clustering, hierarchical clustering.	8
5.	Neural Network Classifiers: Single and Multilayer Perceptron, Feedforward operations and classifications, network learning, training protocols, Back Propagation Learning, Bayes discriminants and neural networks.	6
6.	Stochastic Methods: Stochastic search, Boltzmann factor, simulated annealing algorithm, deterministic simulated annealing, Boltzmann learning. Evolutionary Methods: Genetic algorithms, genetic programming, particle swarm optimization.	8
	TOTAL	42

11. Suggested Books

S. No.	**Name of Books / Authors/ Publishers**	**Year of Publication/ Reprint**
	Text Books	
1.	R. O. Duda, P. Hart, D. Stork, Pattern Classification, 2nd Ed. Wiley, ISBN: 978-0-471-05669-0.	2000
2.	Bishop, C. M., Pattern Recognition and Machine Learning. Springer, ISBN 978-0-387-31073-2.	2007

3.	Bishop, C. M., Neural Networks for Pattern Recognition, Oxford University Press, ISBN-13: 978-0198538646.	1995
	Reference Books	
4.	Theodoridis, S. and Koutroumbas, K., Pattern Recognition, 4th Ed. Academic Press,SBN :9781597492720.	2008
5.	Hastie, T., Tibshirani, R. and Friedman, J., The Elements of Statistical Learning, Springer, ISBN:9780387848570.	2009

1. Subject Code: **SE417** Course Title: **Data Warehousing and Data Mining**
2. Contact Hours: L: 3 T: 0 P: 2
3. Examination Duration (ETE) (Hrs.): Theory 3 Hrs Practical 0
4. Relative Weightage: CWS 15 PRS 15 MTE 30 ETE 40 PR 00
5. Credits: 4
6. Semester: VII
7. Subject Area: DEC
8. Pre-requisite: Database Management System
9. Objective: To introduce the concept of Data Warehousing and Data Mining, respective techniques and applications in real world scenario.
10. Details of Course

S.No.	Contents	Contact Hours
1.	**Data Warehousing: -** Basic concepts in data warehousing, Collecting the requirements of data warehouse, Data Warehouse Architecture, Design, Implementation & Maintenance, OLAP in data warehouse, Data warehousing and the web, Data Cube Technology, From Data Warehousing to Data Mining.	8
2.	**Data Mining Concepts:** Data mining primitives, Basics of data mining, Query language, Architectures of data mining systems	6

3.	**Mining Association Rules in Large Databases:** Association Rule Mining, Mining Single Dimensional Boolean Association Rules from Transactional Databases, Mining Multilevel Association Rules from Transaction Databases, Mining Multidimensional Association Rules from Relational Databases and Data Warehouses, From Association Mining to Correlation Analysis, Constraint Based Association Mining.	8
4.	**Classification and Prediction:** Issues Regarding Classification and Prediction, Classification by Decision Tree Induction, Bayesian Classification, Classification by Back propagation, Classification Based on Concepts from Association Rule Mining, Other Classification Methods, Prediction, Classifier Accuracy.	8
5.	**Cluster Analysis in Data Mining:** Types of Data in Cluster Analysis. A Categorization of Major Clustering Methods, Partitioning Methods, Density Based Methods, Grid Based Methods; Model Based Clustering Methods, Outlier Analysis	6
6.	**Mining Complex Types of Data:** Multidimensional Analysis and Descriptive Mining of Complex Data Objects, Mining Spatial Databases, Mining Multimedia Databases, Mining Time Series and Sequence Data, Mining Text Databases. **Applications and trends in Data Mining: -** Applications, Systems products and research prototypes, Additional themes in data mining, Trends in Data mining, spatial mining, and Web Mining. .	6
	TOTAL	42

11. Suggested Books

S.No.	Name of Books / Authors/ Publishers	Year of Publication/ Reprint
	Text Books:	
1.	Data Warehousing Fundamentals, P. Ponnian, John Wiley.	2011 (

		Reprint)
2.	Data Mining Introductory & Advanced Topics, M.H. Dunham, Pearson Education	2012(Tenth Impression)
3.	Data Mining Concepts & Techniques, Han Kamber, M. Kaufman, 2nd ed.	2011 (Reprint)
	Reference Book:	
4.	The Data Warehouse Lifecycle Tool Kit, Ralph Kimball, John Wiley	2002
5.	Master in Data Mining, M. Berry , G. Linoff, John Wiley	1997
6.	Building the Data Ware houses, W.H. Inmon, Wiley Dreamtech	2002

1. Subject Code: **SE419** Course Title: **Cyber Forensics**
2. Contact Hours: L: 3 T: 1 P: 0
3. Examination Duration (ETE) (Hrs.): Theory 3 Hrs Practical 0
4. Relative Weightage: CWS 25 PRS 0 MTE 25 ETE 50 PR 0
5. Credits: 4
6. Semester: VII
7. Subject Area: DEC
8. Pre-requisite: NIL
9. Objective: To introduce various techniques related to Cyber Forensics.
10. Details of Course

S.No.	Contents	Contact Hours
1.	**Introduction** : Review of TCP/IP and TCP, IP Header analysis , Introduction to Cyber World, Cyber attacks and cyber security , Information warfare and cyber terrorism, Types of cyber attacks, Cyber Crime and Digital Fraud , Overview of Types of computer forensics i.e. Media Forensics, Network forensics (internet forensics), Machine forensic, Email forensic (e-mail tracing and investigations)	10
2.	**Live Data collection and investigating windows environment** : windows Registry analysis , Gathering Tools to create a response toolkit (Built in tools like netstat , cmd.exe , nbtstat , arp , md5sum, regdmpetc and tools available as freeware like Fport , Pslistetc) , Obtaining volatile Data (tools like coffee ,	12

	Helix can be used) Computer forensics in windows environment, Log analysis and event viewer, File auditing, identifying rogue machines, hidden files and unauthorized access points	
3.	**Live Data collection and investigating Unix/Linux environment** : /Proc file system overview , Gathering Tools to create a response toolkit (Built in tools like losetup , Vnode , netstat , df , md5sum , straceetc and tools available as freeware like Encase , Carboniteetc) Handling Investigations in Unix/Linux Environment: Log Analysis (Network, host, user logging details), Recording incident time/date stamps, Identifying rogue processes, unauthorized access points, unauthorized user/group accounts	10
4.	**Forensic tools and report generation**: Recovery of Deleted files in windows and Unix, Analyzing network traffic, sniffers, Ethical Hacking, Hardware forensic tools like Port scanning and vulnerability assessment tools like Nmap, Netscan etc. Password recovery (tools like John the ripper, L0phtcrack, and THC-Hydra), Mobile forensic tools and analysis of called data record Template for computer forensic reports	10
	TOTAL	42

11. Suggested Books

1. Subject Code: **SE421** Course Title: **Robotics**
2. Contact Hours: L: 3 T: 1 P: 0
3. Examination Duration (ETE) (Hrs.): Theory 3 Hrs Practical 0
4. Relative Weightage: CWS 25 PRS 0 MTE 25 ETE 50 PR 0
5. Credits: 4
6. Semester: VII
7. Subject Area: DEC
8. Pre-requisite: Nil
9. Objective: To study Robot anatomy arm geometry, robot sensing and range proximity, manipulation and its programming language.
10. Details of Course

S.No.	**Contents**	**Contact Hours**
1.	Robot Anatomy Arm Geometry-Direct & Inverse Kinematics Problem, Arm Dynamics, D Alembert Equations of Motion, Synthesis of elements with movalulity constraints, manipulations-trajectory planning, joint interpolated trajectories.	12
2.	Control of Robot Manipulation-computed torque technique sequencing & adaptive control, resolved motion control Moluie Robots.	10
3.	Robot sensing-Range & Proximity & Higher-Level vision, illumination techniques, Imaging Geometry, Segmentation Recognition & Interpretation.	10
4.	Robot Programming Language Characteristics of Robot Level & Task Level languages. Robot intelligence-State Space search, Robot learning, Robot Task Planning, Knowledge Engineering.	10

	TOTAL	42

11. Suggested Books

S.No.	Name of Books / Authors/ Publishers	Year of Publication/ Reprint
	Text books	
1.	K.S Fu R.C. CSG Lee-Robotics Control, Sensing, Vision & Intelligence, McGraw-Hill.	1997
2.	M.P. Groover, M.Weins, R.N. Nagel, N.C. Odrey –Industrial Robotics, McGraw Hill ISBN-13: 9780070249899	2008
3.	Andrew C. Straugard-Robotics & AI, PHI.(ISBN13:9780137822690)	
	Reference books	
4.	S. Sitharama Iyengar, Alberto Elefes-Autonomous Mobile Robots Control, Planning & Architecture, IEEE Computer Society Press ISBN-13: 9780818691164	2013

1. Subject Code: **SE423** Course Title: **Machine Learning**
2. Contact Hours: L: 3 T: 1 P: 0
3. Examination Duration (ETE) (Hrs.): Theory 3 Hrs Practical 0
4. Relative Weightage: CWS 25 PRS 0 MTE 25 ETE 50 PR 0
5. Credits: 4
6. Semester: VII
7. Subject Area: DEC
8. Pre-requisite: Discrete Mathematics
9. Objective: The student should be able to understand the different supervised, unsupervised and reinforcement learning algorithms and choose the appropriate machine learning tool for different real world examples.
10. Details of Course

S.No.	Contents	Contact Hours
1.	**Introduction to Machine Learning:** Overview of different tasks: classification, regression, clustering, control, Concept learning, information theory and decision trees	6
2.	**Supervised Learning:** Decision trees, nearest neighbors, linear classifiers and kernels, neural networks, linear regression; Support Vector Machines.	8
3.	**Unsupervised Learning:** Clustering, Expectation Maximization, Dimensionality Reduction, Feature Selection, PCA, factor analysis, manifold learning.	8
4.	**Reinforcement Learning:** Value iteration; policy iteration; TD learning; Q learning; actor-critic	6
5.	**Other Topics:** Bayesian learning, online learning. Learning theoy, Bias Variance trade-offs	6
6.	**Recent applications & Research Topics:** Applications in the fields of web and data mining, text recognition, speech recognition	8
	TOTAL	42

11. Suggested Books

S.No.	Name of Books / Authors/ Publishers	Year of Publication/ Reprint
	Text Book	
1.	Introduction to Machine Learning, Alpaydin, E., MIT Press, 2004	2004
2.	Machine Learning, Tom Mitchell, McGraw Hill, 1997.	1997
3.	Elements of Machine Learning, Pat Langley Morgan Kaufmann Publishers, Inc. 1995. ISBN 1-55860-301-8	1995
	Reference Book	
4.	The elements of statistical learning, Friedman, Jerome, Trevor Hastie, and Robert Tibshirani. Vol. 1. Springer, Berlin: Springer series in statistics, 2001.	2001
5.	Machine Learning: A probabilistic approach, by David Barber.	2006
6	Pattern recognition and machine learning by Christopher Bishop, Springer Verlag, 2006	2006

1. Subject Code: **SE425** Course Title: **Intellectual Property Rights**
2. Contact Hours: L: 3 T: 1 P: 0
3. Examination Duration (ETE) (Hrs.): Theory 3Hrs Practical 0
4. Relative Weightage: CWS 25 PRS 0 MTE 25 ETE 50 PR 0
5. Credits: 4
6. Semester: VII
7. Subject Area: DEC
8. Pre-requisite: Nil
9. Objective: To familiarize the students with basic concepts in each type of IPR together with historical developments in the subject & its importance in modern times.
10. Details of Course

S.No.	Contents	Contact Hours
1.	Introduction: Concept of IPR, Historical development , kinds of IPR, brief description of patent, trademark, copyright ,industrial design, importance of IPR, IPR authorities.	5
2.	PATENTS :Introduction, Indian Patent Act 1970 &2002, Protectable subject matter--patentable invention, Procedure for obtaining patent, Provisional and complete specification Rights conferred on a patentee, transfer of patent, Revocation and surrender of patents, Infringement of patents, Action for infringement, Patent agents, Patent in computer programs.	8
3.	Trademark: Introduction, Statutory authorities, principles of registration of trademarks, rights conferred by registration of trademarks, Infringement of trademarks and action against infringement, procedure of registration and duration, licensing in trademark	7
4.	Copyright: Introduction, Author and ownership of copyright, rights conferred by copyright, term of copyright, assignment/licence of copyright, Infringement of copyright ,remedies against infringement of copyright, registration of copyright, copyright enforcement and societies	7
5.	Industrial design: The design act-200 0, register ability of a design, procedure of registration of a design, piracy of a registered design, Case law on designs	6
6.	International IPR & case laws: World intellectual property organization, WCT, WPPT, TRIPS, Copyright societies, international IPR dispute resolution mechanism. Case laws.	9
	TOTAL	42

11. Suggested Books

S.No.	Name of Books / Authors/ Publishers	Year of Publication/ Reprint
	Textbooks:	
1.	Law Relating to Intellectual property, fourth edition by B.L.Wadehra .Universal law publishing co. pvt. Ltd.	2007

	ISBN 978-81-7534-588-1	
	Reference books:	
2.	Intellectual property: Patents, copyright ,trademarks and allied rights. Fifth edition by W.R. Cornish. Sweet & Maxwell publisher. ISSN 9780421781207	2003
3	Law and practice of intellectual property in India by Vikas Vashishth **ISBN:** 81-7737-119-3	2006
4	Patents ,copyrights, trade marks and design by B L Wadhera	2014
5	Dr. B. L. Wadhera, "Intellectual Property Law Handbook". Universal Law Publishing.	2002

1. Subject Code: **SE406** Course Title: **Advances in Software Engineering**
2. Contact Hours: L: 3 T: 1 P: 0
3. Examination Duration (ETE) (Hrs.): Theory 3 Hrs Practical 0
4. Relative Weightage: CWS 25 PRS 0 MTE 25 ETE 50 PR 0
5. Credits: 4
6. Semester: VIII
7. Subject Area: DEC
8. Pre-requisite: Software Engineering
9. Objective: To study about formal specification, cleanroom software engineering, component based software engineering, client-server software engineering and web engineering.
10. Details of Course

S.No.	**Contents**	**Contact Hours**

1.	**Formal Methods:** Deficiencies of Less Formal Approaches, Mathematics in Software Development, Mathematical Preliminaries, Sets and Constructive Specification, Set Operators, Logic Operators, Sequences, Applying Mathematical Notation for Formal Specification , Formal Specification Languages , Using Z to Represent an Example Software Component.	8
2.	**CleanRoom Software Engineering:** The Cleanroom Approach, The Cleanroom, Functional Specification, Black-Box Specification, State-Box Specification, Clear-Box Specification, Cleanroom Design, Design Refinement and Verification, Advantages of Design Verification, Cleanroom Testing, Statistical Use Testing	6
3.	**Component-Based Software Engineering:** Engineering of Component-Based Systems, The CBSE Process, Domain Engineering, The Domain Analysis Process, Characterization Functions, Structural Modeling and Structure Points, Component-Based Development, Component Qualification, Adaptation, and Composition, Component Engineering, Analysis and Design for Reuse, Classifying and Retrieving Components , Economics of CBSE	10
4.	**Client/Server Software Engineering:** The Structure of Client/Server Systems, Software Engineering for c/s Systems, Analysis Modeling Issues, Design for c/s Systems, Architectural Design for Client/Server Systems, Conventional Design Approaches for Application Software, Database Design, An Overview of a Design Approach, Process Design Iteration, Testing Issues, Overall c/s Testing Strategy, Testing Tactics	6
5.	**Web Engineering**: The Attributes of Web-Based Applications, Quality Attributes, The Technologies, The WebE Process, Framework for WebE, Formulating/Analyzing Web-Based Systems, Formulation Analysis, Design for Web-Based Applications, Architectural Design, Navigation Design, Interface Design, Testing Web-Based Applications, Management Issues, The WebE Team, Project Management , SCM Issues for WebE.	6
6.	Reengineering: Business Process Reengineering, Software Reengineering, Reverse Engineering, Restructuring, Forward Engineering for Client/Server Architectures, Object-Oriented and for User Interfaces, The Economics of Reengineering.	6
	TOTAL	42

11. Suggested Books:

S.No.	Name of Books / Authors/ Publishers	Year of Publication/

		Reprint
	Text Books:	
1.	R. S. Pressman, "Software Engineering – A practitioner's approach", 3rd ed., McGraw Hill Int. Ed..	1992

1. Subject Code: **SE408** Course Title: **Information and Network Security**
2. Contact Hours: L: 3 T: 1 P: 0
3. Examination Duration (ETE) (Hrs.): Theory 3 Hrs Practical 0
4. Relative Weightage: CWS 25 PRS 0 MTE 25 ETE 50 PR 0
5. Credits: 4
6. Semester: VIII
7. Subject Area: DEC
8. Pre-requisite: NIL
9. Objective: To study various cryptographic algorithms and network security protocols.
10. Details of Course

S.No.	Contents	Contact Hours
1.	**Introduction:** Need for security, Introduction to security attacks, services and mechanism, introduction to cryptography, Conventional Encryption: Conventional encryption model, classical encryption techniques- substitution ciphers and transposition ciphers, cryptanalysis, stereography, stream and block ciphers, Intruders, Viruses and related threads.	8

2.	**Modern Block Ciphers:** Block ciphers principals, Shannon's theory of confusion and diffusion, fiestal structure, data encryption standard(DES), strength of DES, crypt analysis of DES, block cipher modes of operations, triple DES, IDEA encryption and decryption, strength of IDEA, key distribution.	6
3.	Introduction to graph, ring and field, prime and relative prime numbers, modular arithmetic, Fermat's and Euler's theorem, primarily testing, Euclid's Algorithm, Chinese Remainder theorem, discrete logarithms, Principals of public key crypto systems, RSA algorithm, security of RSA, key management, Diffle-Hellman key exchange algorithm, introductory idea of Elliptic curve cryptography, Elganel encryption.	10
4.	**Message Authentication and Hash Function:** Authentication requirements, authentication functions, message authentication code (MAC), hash functions, security of hash functions and MACS, MD5 message digest algorithm, Secure hash algorithm(SHA), Public Key Infrastructure(PKI): Digital Certificate, private key management, Digital Signatures: Digital Signatures, authentication protocols, digital signature standards (DSS), proof of digital signature algorithm.	6
5.	**Authentication Applications:** Kerberos and X.509, directory authentication service, password, challenge-response, biometric authentication, electronic mail security-pretty good privacy (PGP), S/MIME.	6
6.	**IP Security:** Architecture, Authentication header, Encapsulating security payloads, combining security associations, key management. **Web Security:** Secure Socket Layer(SSL) and transport layer security, TSP, Secure Electronic Transaction (SET), Electronic money, WAP security, firewall design principals, Virtual Private Network (VPN) security.	6
	TOTAL	42

11. Suggested Books

S.No.	Name of Books / Authors/ Publishers	Year of Publication/ Reprint

	Text Books:	
2.	William Stallings, “Cryptography and Network Security: Principals and Practice”, Prentice Hall, New Jersy.	2005
3.	Atul Kahate, “Cryptography and Network Security”, TMH.	2006
4.	Behrouz A. Forouzan, “Cryptography and Network Security”, TMH.	2008
	Reference Book:	
5.	Johannes A. Buchmann, “Introduction to Cryptography”, Springer-Verlag.	2004
6.	BruceSchiener, “Applied Cryptography”.	1996

1. Subject Code: **SE410** Course Title: **Swarm and Evolutionary Computing**

2. . Contact Hours: L: 3 T: 1 P: 0

3. Examination Duration (ETE)(Hrs.): Theory 3 Hrs Practical 0

4. Relative Weightage: CWS 25 PRS 0 MTE 25 ETE 50 PR 0

5. Credits: 4

6. Semester: VIII

7. Subject Area: DEC

8. Pre-requisite: Discrete Mathematics, Artificial Intelligence

9. Objective: The course explores a variety of evolutionary algorithms and their application for problem solving. The student should be able to understand the bio-inspired algorithms and apply them to optimize parameters in real-world problems.

10. Details of Course

S.No.	Contents	Contact Hours
1.	**Introduction to Evolutionary Computing** Global Optimization, Components of an evolutionary algorithm, Evolution strategies, Fitness Functions, Learning Classifier systems, Parameter Control, Multi-modal Problems	8
2.	**Swarm Intelligence** Introduction to Swarm Intelligence and its application to optimization problems, Particle Swarm Optimization algorithm, position and velocity updation	8
3.	**Genetic Algorithm** Genetic algorithm basics: Population and generation of chromosomes, Fitness function, survival of the fittest, reproduction, cross-over and mutation, Genetic algorithm convergence, Genetic programming	8
4.	**Hybrid Methods and Multi-objective Evolutionary Algorithms** Variants of Particle Swarm optimization and Genetic Algorithm, Hybridization of Particle Swarm and Genetic based optimizations, Hybrid Multi-objective Optimization algorithms	6
5.	**Recent nature-inspired evolutionary algorithms** Cockoo search algorithm, Artificial Bee Colony Optimization, Ant Colony Optimization, Fire-fly algorithm, Bacterial Foraging, Application to the travelling salesman problem	6
6.	**Application to real world optimization problems** Optimization examples from Machine Learning, Robotics, Image Processing and Computer Vision, Web and data mining, network traffic routing	6
		42

11. Suggested Books

S.No.	Name of Books / Authors/ Publishers	Year of Publication/ Reprint
Text Books		
1	" Computational Intelligence", Second Edition, by Andries P. Engelbrech, John Wiley & Sons, ISBN: 978-0-470-03561-0	2008
2	"An Introduction to Genetic Algorithm", Melanie Mitchell, MIT Press	1996

3	"Genetic Algorithms in Search, Optimization, and Machine Learning", David Goldberg. Addison-Wesley	1989
4	“Introduction to Evolutionary Computing”, A.E Eiben and J.E. Smith, Springer, second edition	2007
Reference Books		
5	"Evolutionary Computation", D. Dumitrescu et al. CRC Press	2000
6	"Evolutionary Computation, A "Unified Approach", K. DeJong. MIT Press	2006
7	“Evolutionary algorithms in engineering applications”, Dasgupta, Dipankar, and Zbigniew Michalewicz, . Springer Science & Business Media	2013

1. Subject Code: **SE412** Course Title: **Semantic Web and Web Mining**
2. . Contact Hours: L: 3 T: 1 P: 0
3. Examination Duration (ETE)(Hrs.): Theory 3 Hrs Practical 0
4. Relative Weightage: CWS 25 PRS 0 MTE 25 ETE 50 PR 0
5. Credits: 4
6. Semester: VIII
7. Subject Area: DEC
8. Pre-requisite: NIL
9. Objective: To introduce concepts of semantic web and various techniques of Web Mining
10. Details of Course

S.No.	Contents	Contact Hours
1.	**Introduction:** The Semantic Web Roadmap, evolution of Web Documents, Semantic Search Techniques.	10
2.	**XML Languages:** Detailed study of XML language & application to Web based developments.	10
3.	**Describing Web Resources**: Resource Description Framework (RDF), Taxonomies, Ontologies, Web Ontology Language (OWL), Design process of ontology, Annotation.	12
4.	**Advanced Topics:** Semantic Applications & Power, Latest on Semantic Web, Future Directions, W3C Consortium, Case studies in	10

	different application.	
	TOTAL	42

11. Suggested Books

S.No.	Name of Books / Authors/ Publishers	Year of Publication/ Reprint
	Text Books:	
1.	"A Semantic Web Primer", Grigoris Antoniou and Frank van Harmelen, MIT Press.	2004
2.	"Spinning the Semantic Web - Bringing the World Wide Web to Its Full Potential", MIT Press, Dieter Fensel, James A. Hendler, Henry Lieberman, and Wolfgang Wahlster (Eds.)	2003
3.	"The Semantic Web: A guide to the future of XML, Web Services and Knowledge Management", Michael C. Daconta, Leo J. Obrst Kevin T. Smith, Wiley Publishing.	2003
	Reference Book:	
4.	"Principles of Semantic Networks: Explorations in the representation of knowledge", John Sowa. Morgan Kaufmann.	1991
5.	Russell and Norvig, "Artificial Intelligence: A Modern	2009

	Approach", Prentice Hall.	
6.	Han Reichgelt, "Knowledge Representation: An AI Perspective", Ablex Publishing.	1991

1. Subject Code: **SE414** Course Title: **Cloud Computing**
2. Contact Hours: L: 3 T: 1 P: 0
3. Examination Duration (ETE) (Hrs.): Theory 3 Hrs Practical 0
4. Relative Weightage: CWS 25 PRS 0 MTE 25 ETE 50 PR 0
5. Credits: 4
6. Semester: VIII
7. Subject Area: DEC
8. Pre-requisite: NIL
9. Objective: To study the concepts, architecture, models of a cloud and its security issues and service management parameters.
10. Details of Course

S.No.	Contents	Contact Hours
1.	Overview of Computing Paradigm and introduction to cloud computing: Recent trends in Computing (Grid Computing, Cluster Computing, Distributed Computing, Utility Computing, Cloud Computing), Evolution of cloud computing(Business driver for adopting cloud computing), Cloud Computing (NIST Model) , Cloud service providers, Properties, Characteristics & Disadvantages, Cloud computing vs. Cluster computing vs. Grid computing, Role of Open Standards	8
2.	Cloud Computing Architecture: Cloud computing stack: Comparison with traditional computing architecture (client/server), Services provided at various levels, How Cloud Computing Works, Role of Networks in Cloud computing, protocols used, Role of Web services, Service Models (XaaS) :Infrastructure as a Service(IaaS), Platform as a Service(PaaS), Software as a Service(SaaS), Deployment Models(Public cloud, Private cloud, Hybrid cloud, Community cloud)	6

3.	Infrastructure as a Service(IaaS):Introduction to IaaS ,IaaS definition, Introduction to virtualization, Different approaches to virtualization, Hypervisors, Machine Image, Virtual Machine(VM),Resource Virtualization(Server, Storage, Network), Virtual Machine(resource) provisioning and manageability, storage as a service, Data storage in cloud computing(storage as a service)	6
4.	Platform as a Service(PaaS):Introduction to PaaS, Service Oriented Architecture (SOA), Cloud Platform and Management (Computation,Storage) Examples: Google App Engine ,Microsoft Azure, SalesForce.com Software as a Service(SaaS): Introduction to SaaS, Web services, Web 2.0, Web OS,Case Study on SaaS	8
5.	Service Management in Cloud Computing: Service Level Agreements(SLAs) (Billing & Accounting, Comparing Scaling Hardware: Traditional vs. Cloud , Economics of scaling: Benefitting enormously, Managing Data, Looking at Data, Scalability & Cloud Services, Database & Data Stores in Cloud, Large Scale Data Processing	8
6.	Cloud Security: Infrastructure Security(Network level security, Host level security, Application level security), Data security and Storage (Data privacy and security Issues, Jurisdictional issues raised by Data location), Identity & Access Management, Access Control, Trust, Reputation, Risk, Authentication in cloud computing, Client access in cloud, Cloud contracting Model, Commercial and business considerations	6
	TOTAL	42

11. Suggested Books

S.No.	Name of Books / Authors/ Publishers	Year of Publication/ Reprint
	Text Books	
1.	Cloud Computing Bible, Barrie Sosinsky, Wiley-India;(**ISBN**: 978-0-470-90356-8)	2010
2.	**Cloud Computing: Principles and Paradigms, Editors: Rajkumar Buyya, James Broberg, Andrzej M. Goscinski, Wile(***ISBN: 978-0-470-88799-8***)**	2011
3.	**Cloud Computing: Principles, Systems and Applications, Editors: Nikos Antonopoulos, Lee Gillam, Springer,(***ISBN 978-1-84996-240-7***)**	2012

	Reference Books	
4.	Cloud Security: A Comprehensive Guide to Secure Cloud Computing, Ronald L. Krutz, Russell Dean Vines, Wiley-India(ISBN: 978-0-470-58987-8)	2010

1. Subject Code: **SE416** Course Title: **Big Data Analytics**
2. Contact Hours: L: 3 T: 1 P: 0
3. Examination Duration (ETE) (Hrs.): Theory 3 Hrs Practical 0
4. Relative Weightage: CWS 25 PRS 0 MTE 25 ETE 50 PR 0
5. Credits: 4
6. Semester: VIII
7. Subject Area: DEC
8. Pre-requisite: Database management systems.
9. Objective: Understand the fundamentals of various big data analysis techniques, Hadoop structure, environment and framework.
10. Details of Course

S.No.	Contents	Contact Hours
1.	INTRODUCTION TO BIG DATA : Introduction to Big Data Platform – Challenges of Conventional Systems - Intelligent data analysis – Nature of Data - Analytic Processes and Tools - Analysis vs Reporting - Modern Data Analytic Tools - Statistical Concepts: Sampling Distributions - Re-Sampling - Statistical Inference - Prediction Error.	8
2.	MINING DATA STREAMS : Introduction To Streams Concepts – Stream Data Model and Architecture - Stream Computing - Sampling Data in a Stream – Filtering Streams – Counting Distinct Elements in a Stream – Estimating Moments – Counting Oneness in a Window – Decaying Window - Real time Analytics Platform(RTAP) Applications - Case Studies - Real Time Sentiment Analysis, Stock Market Predictions.	8
3.	HADOOP: History of Hadoop- The Hadoop Distributed File System – Components of Hadoop- Analyzing the Data with Hadoop- Scaling Out- Hadoop Streaming- Design of HDFS-Java interfaces to HDFS- Basics-Developing a Map Reduce Application-How Map Reduce Works-Anatomy of a Map Reduce Job run-Failures-Job Scheduling-Shuffle and Sort – Task execution - Map Reduce Types and Formats- Map Reduce Features	10
4.	HADOOP ENVIRONMENT :Setting up a Hadoop Cluster - Cluster	8

	specification - Cluster Setup and Installation - Hadoop Configuration-Security in Hadoop - Administering Hadoop – HDFS - Monitoring-Maintenance-Hadoop benchmarks- Hadoop in the cloud	
5.	FRAMEWORKS: Applications on Big Data Using Pig and Hive – Data processing operators in Pig – Hive services – HiveQL – Querying Data in Hive - fundamentals of HBase and ZooKeeper - IBM InfoSphere BigInsights and Streams. Visualizations - Visual data analysis techniques, interaction techniques; Systems and applications	8
	Total	42

11. Suggested Books

S.No.	Name of Books / Authors/ Publishers	Year of Publication/ Reprint
	Text Books	
1.	Michael Berthold, David J. Hand, "Intelligent Data Analysis", Springer, 2007.	2007
2	Tom White " Hadoop: The Definitive Guide" Third Edition, O'reilly Media, 2012.	2012
3	Chris Eaton, Dirk DeRoos, Tom Deutsch, George Lapis, Paul Zikopoulos, "Understanding Big Data: Analytics for Enterprise Class Hadoop and Streaming Data", McGrawHill Publishing, 2012	2012
4	Anand Rajaraman and Jeffrey David Ullman, "Mining of Massive Datasets", Cambridge University Press, 2012.	2012
	Reference books:	
5	Bill Franks, "Taming the Big Data Tidal Wave: Finding Opportunities in Huge Data Streams with Advanced Analytics", John Wiley & sons, 2012.	2012
6	Glenn J. Myatt, "Making Sense of Data", John Wiley & Sons, 2007	2007
7	Pete Warden, "Big Data Glossary", O'Reilly, 2011.	2011
8	Jiawei Han, Micheline Kamber "Data Mining Concepts and Techniques", Second Edition, Elsevier, Reprinted 2008.	2008

9	Da Ruan,Guoquing Chen, Etienne E.Kerre, Geert Wets, Intelligent Data Mining, Springer,2007	2007
10.	Paul Zikopoulos ,Dirk deRoos , Krishnan Parasuraman , Thomas Deutsch , James Giles , David Corrigan , Harness the Power of Big Data The IBM Big Data Platform, Tata McGraw Hill Publications, 2012	2012
11	Michael Minelli (Author), Michele Chambers (Author), Ambiga Dhiraj (Author) , Big Data, Big Analytics: Emerging Business Intelligence and Analytic Trends for Today's Businesses,Wiley Publications,2013	2013
12	Zikopoulos, Paul, Chris Eaton, Understanding Big Data: Analytics for Enterprise Class Hadoop and Streaming Data, Tata McGraw Hill Publications, 2011	2011

1. Subject Code: **SE418** Course Title: **Wireless and Mobile Computing**

2. Contact Hours: L: 3 T: 0 P: 2
3. Examination Duration (ETE) (Hrs.): Theory 3 Hrs Practical 0
4. Relative Weightage: CWS 15 PRS 15 MTE 30 ETE 40 PR 0
5. Credits: 4
6. Semester: VIII
7. Subject Area: DEC
8. Pre-requisite: Computer Networks
9. Objective: To understand the concept of wireless communication, mobile computing paradigm, its novel applications and limitations.
10. Details of Course

S.No.	Contents	Contact Hours
1.	Introduction, issues in mobile computing, overview of wireless telephony: cellular concept, GSM: air-interface, channel structure, location management: HLR, VLR, hierarchical, handoffs, channel allocation in cellular systems, Cellular telephone, Digital Cellular Standards, Call Routing in GSM, Satellite Technology, FDMA, TDMA, CDMA and GPRS.	5
2.	Wireless Networking, Wireless LAN Overview: MAC issues, PCF, DCF , Frame types, addressing, IEEE 802.11 standards, Blue Tooth: Architecture , Layers and protocols, Wireless multiple access protocols, TCP over wireless, Wireless applications, data broadcasting, Mobile IP, WAP: Architecture, protocol stack, application environment, applications, WAP application environment(WAE), WML, WSP, WTP and WTLS	9
3.	Data management issues, data replication for mobile computers, Replication through data allocation, User profile replication scheme, optimistic replication and active replication, adaptive clustering for mobile wireless networks, File system, Disconnected operations.	6
4.	Mobile Agents computing: Introduction, Advantages, Application Domains; security and fault tolerance: Protecting server, code signaling, Firewall approach; security techniques and algorithms: DES, 3DES, AES, Diffie Hellman, RSA ; transaction processing in mobile computing environment: Structure, properties, Data consistency, Transaction relation, Recovery and wireless data Dissemination.	9
5.	Ad Hoc networks, localization, Routing protocols: Global state routing (GSR), Destination sequenced distance vector routing (DSDV), Fisheye state routing(FSR), Dynamic source routing (DSR), ABR, Route Discovery, Route Repair/Reconstruction, Establishment, Maintenance ; Ad Hoc on demand	9

	distance vector routing (AODV). File Directories, File Sharing, Implementation Issues	
6.	Temporary ordered routing algorithm (TORA), Quality of Service in Ad Hoc Networks, and applications.	3
	TOTAL	42

11. Suggested Books

S.No.	Name of Books / Authors/ Publishers	Year of Publication/ Reprint
	Text Books	
1.	Jochen Schiller, "Mobile Communications", Addison-Wesley, 2nd Edition.	2004
	Reference Books	
2.	Dharma Prakash Agarwal & Zeng, "Introduction to Wireless and Mobile Systems" , 2nd Edition, Cengage Learning India Private Limited.	2006
3.	Raj Pandya, "Mobile and Personal Communication systems and services", Prentice Hall of India.	2001
4.	A.K.Talukder and R.R.Yavagal, Mobile Computing, TMH.	2006
5.	Raj Kamal, "Mobile Computing", Oxford University Press.	2007

1. Subject Code: **SE420** Course Title: **Agile Software Process**

2. Contact Hours: L: 3 T: 1 P: 0

3. Examination Duration (ETE)(Hrs.): Theory 3Hrs Practical 0

4. Relative Weightage: CWS 25 PRS 0 MTE 25 ETE 50 PR 0

5. Credits: 4

6. Semester: VII

7. Subject Area: DEC

8. Pre-requisite: Software Engineering

9. Objective: To understand the basic concepts of agile software process, to gain knowledge in the area of various Agile Methodologies, to develop Agile Software Process and to know the principles of agile testing.

10. Details of Course

S.No.	Contents	Contact Hours
1.	**UNIT I–INTRODUCTION** Software is new product development – Iterative development – Risk-Driven and Client-Driven iterative planning – Time boxed iterative development – During the iteration, No changes from external stakeholders – Evolutionary and adaptive development - Evolutionary requirements analysis – Early "Top Ten" high-level requirements and skilful analysis – Evolutionary and adaptive planning – Incremental delivery – Evolutionary delivery – The most common mistake – Specific iterative and Evolutionary methods.	9
2.	**UNIT II–AGILE AND ITS SIGNIFICANCE** Agile development – Classification of methods – The agile manifesto and principles – Agile project management – Embrace communication and feedback – Simple practices and project tools – Empirical Vs defined and prescriptive process – Principle-based versus Rule-Based – Sustainable discipline: The human touch – Team as a complex adaptive system – Agile hype – Specific agile methods. The facts of change on software projects – Key motivations for iterative development – Meeting the requirements challenge iteratively – Problems with the waterfall. Research evidence – Early historical project evidence – Standards-Body evidence – Expert and thought leader evidence – A Business case for iterative development – The historical accident of waterfall validity. MI, PCMM, Malcolm Balridge, 3 Sigma, 6 Sigma, Software Quality Models.	9

3.	**UNIT III–AGILE METHODOLOGY**: Method overview – Lifecycle – Work products, Roles and Practices values – Common mistakes and misunderstandings – Sample projects – Process mixtures – Adoption strategies – Fact versus fantasy – Strengths versus "Other" history	9
4.	**UNIT IV–CASE STUDY** Agile – Motivation – Evidence – Scrum – Extreme Programming – Unified Process – Evo – Practice Tips.	7
5.	**UNIT V–AGILE PRACTICING AND TESTING** Project management – Environment – Requirements – Test – The agile alliances – The manifesto – Supporting the values – Agile testing – Nine principles and six concrete practices for testing on agile teams.	8
	TOTAL	42

11. Suggested Books

S.No.	Name of Books / Authors/ Publishers	Year of Publication/ Reprint
Text Books		
1.	Craig Larman, "Agile and Iterative Development – A Manager's Guide", Pearson Education – 2004.	2004
2.	Elisabeth Hendrickson Quality Tree Software Inc, "Agile Testing" 2008	2008
Reference Books		
3.	Alistair "Agile Software Development series" Cockburn - 2001.	2001

University Electives

University Elective Course

(Other than Engineering Physics Students)

CO351 ENTERPRISE & JAVA PROGRAMMING

1. Subject Code: CO351 Course Title: Enterprise & Java programming
2. Contact Hours: L: 3 T: 0 P: 0
3. Examination Duration (ETE)(Hrs.): Theory 3 Hrs Practical 0
4. Relative Weightage: CWS 25 PRS 0 MTE 25 ETE 50 PR 0
5. Credits: 3
6. Semester: ODD
7. Subject Area: UEC
8. Pre-requisite: Nil
9. Objective: To introduce fundamentals of Enterprise Java Programming, concepts of program development using beans.
10. Details of Course

Unit No.	Contents	Contact Hours
1.	**Collections :** Collection Interfaces, Concrete Collections, Collections Framework. **Multithreading :** Creating and running thread, Multiple thread synchronization, Thread communication, Thread group, Thread priorities, Daemon Thread, Life Cycle ofThread.	5
2.	**Fundamentals in Networking:** Sockets in Java - Internet Addressing - DNS – Ipv4,IPv6- URL class - TCP/IP and Datagram. **The interfaces and classes for networking :**Interfaces and classes of java.net package; InetAddress class : IP address scope - Host name resolution - Methods of InetAddress class; Program to look up the IP addresses for a hostname - Factory methods - Creating and using Sockets : Socket class - constructors and methods of Socket class. **Creating TCP servers &clients :** TCP/IP server sockets - Constructors and methods of ServerSocket class - Program to create a TCP/IP server and client. **Handling URL:** URL class - constructors and methods of URL class - URLConnection class - fields of URLConnection class - methods of URLConnection class. **Working with Datagrams:** DatagramPacket - Constructors for DatagramPacket class - Methods of DatagramPacket class - creating Datagram server and client.	6
3.	**JDBC Package :**JDBC – JDBC versus ODBC – Types of JDBC drivers – Connection – Statement – PreparedStatement.**ResultSet :**Fields of ResultSet – Methods of ResultSet – Executing a query - ResultSetMetaData – DatabaseMetaData. **Datatypes in JDBC :** Basic datatypes in JDBC – Advanced datatypes in JDBC – fields of Statement – methods of Statement – CallableStatement Interface – BatchUpdates	6
4.	**Servlets :** Using Servlets - Servlet Package - Servlet lifecycle - init() method - service() method , doGet() method, doPost() method and destroy() method . **Classes and interfaces of Servlet:** Servlet - GenericServlet - ServletConfig - ServletContext - ServletException - ServletInputStream - ServletOutputStream - ServletRequest – ServletResponse. **Classes and interfaces of HttpServlet:** HttpServlet - HttpServletRequest - HttpServletResponse - Reading HTML form data from Servlets - Response Headers - Response Redirection. **Handling Servlets :** Servlet Chaining - HttpUtils - Database access with JDBC inside servlet. **State and Session management :** Cookies - HttpSession - Server Side includes - Request forwarding – RequestDispatcher.	7
5.	**Concepts of Java Beans:** Java Beans - Advantage of Java Beans - Reflection and Introspection - Customizers – Persistence. **Developing Java Beans :** Bean Developer Kit (BDK) - Creating a Java Bean -	9

	Creating a Bean Manifest file - Creating a Bean JAR file. **Controls and Properties of a Bean :** Adding controls to Beans - Giving Bean Properties - BeanInfo interface - SimpleBeanInfo class. **Types of Properties:** Design pattern for Properties: Simple properties - Indexed Properties; Descriptor Classes - Giving Bean methods - Bound and Constrained Properties - Property Editors.	
6.	**Components of EntrepriseBeans :** Distributed Multitiered Applications - J2EE components: J2EE clients, Web components, J2EE containers. **Developing an Enterprise Bean :** Packaging - Enterprise JavaBeans Technology - Enterprise Bean - Contents of an Enterprise Bean. **Session Bean :** Stateful session bean – life cycle of stateful session bean - Stateless session bean – life cycle of stateless session – ejbCreate methods – Business methods – Home interface – Remote interface – Running the session bean. **Entity Bean :**Persistence - Bean managed Persistence - Container Managed Persistance - Shared Access - Primary key – Relationships. **Message Driven Bean :**life cycle of message driven bean – onMessage method.	9
	TOTAL	42

11. Suggested Books

S. No.	Name of Books / Authors/ Publishers
Text Books	
1.	Java 2 Programming Black Book - Steven Holzner dreamTech Press(ISBN-9788177226553), 2005
2.	JavaBeans Programming from the GroundUp - Joseph O'Neil, TMGH, New Delhi(ISBN-007463786X), 2001
	Reference Books
3	Head first EJB-O'Reilly (ISBN: 8173665265), 2003
4.	"Beginning Java™ EE 6 Platform with GlassFish 3 From Novice to Professional" by Antonio Goncalves– Apress publication(ISBN: 9781430219545), 2009

CO353 E-COMMERCE AND ERP

1. Subject Code: CO353 Course Title: E-Commerce and ERP
2. Contact Hours: L: 3 T: 0 P: 0
3. Examination Duration (ETE)(Hrs.): Theory 3 Hrs Practical 0
4. Relative Weightage: CWS 25 PRS 0 MTE 25 ETE 50 PR 0
5. Credits: 3
6. Semester: ODD
7. Subject Area: UEC
8. Pre-requisite: Nil
9. Objective: To introduce E-Commerce and ERP
10. Details of Course

Unit No.	Contents	Contact Hours
1.	Introduction: Definition of Electronic Commerce, E-Commerce: technology and prospects, incentives for engaging in electronic commerce, needs of E-Commerce, advantages and disadvantages, framework, Impact of E-commerce on business, E-Commerce Models.	7
2.	Network Infrastructure for E- Commerce: Internet and Intranet based E-commerce- Issues, problems and prospects, Network Infrastructure, Network Access Equipments, Broadband telecommunication (ATM, ISDN, FRAME RELAY). Mobile Commerce: Introduction, Wireless ApplicationProtocol, WAP technology, Mobile Information device.	7
3.	Web Security: Security Issues on web, Importance ofFirewall, components of Firewall, Transaction security, Emerging client server, Security Threats, Network Security, Factors to consider in Firewall design, Limitation of Firewalls.	6
4.	Electronic Payments: Overview, The SET protocol, Payment Gateway, certificate, digital Tokens, Smart card, credit card, magnetic strip card, E-Checks, Credit/Debit card based EPS, online Banking. EDI Application in business, E- Commerce Law, Formsof Agreement, Govt. policies and Agenda.	6
5.	ERP Introduction, Benefits, Origin, Evolution and Structure:Conceptual Model of ERP, The Evolution of ERP, The Structure of ERP. Business Process Reengineering, Data ware Housing, Data Mining, Online Analytic Processing(OLAP), Product Life Cycle Management(PLM),LAP, Supply chain Management.	8
6.	ERP Marketplace and Marketplace Dynamics:Market Overview,	8

	Marketplace Dynamics, The Changing ERP Market. ERP- Functional Modules: Introduction, Functional Modules of ERP Software, Integration of ERP, Supply chain and Customer Relationship Applications. ERP Implementation Basics, ERP Implementation Life Cycle, Role of SDLC/SSAD, Object Oriented Architecture, Consultants, Vendors and Employees, ERP & E-Commerce, Future Directives- in ERP, ERP and Internet.	
	TOTAL	42

11. Suggested Books

S.No.	Name of Books / Authors/ Publishers
1.	Goel, Ritendra “E-commerce”, New Age International
2.	Ravi Kalakota, Andrew Winston, “Frontiers of Electr onic Commerce”, Addison- Wesley.
3.	Vinod Kumar Garg and Venkitakrishnan N K, “Enterpri se Resource Planning – Concepts and Practice”, PHI
4.	Rahul V. Altekar “Enterprise Resource Planning”, T ata McGraw Hill,
5.	Alexis Leon, “ERP Demystified”, Tata McGraw Hill

CO355 CRYPTOGRAPHY AND INFORMATION SECURITY

1. Subject Code: CO355 Course Title: Cryptography and Information Security
2. Contact Hours: L: 3 T: 0 P: 0
3. Examination Duration (ETE)(Hrs.): Theory 3 Hrs Practical 0
4. Relative Weightage: CWS 25 PRS 0 MTE 25 ETE 50 PR 0
5. Credits: 3
6. Semester: ODD
7. Subject Area: UEC
8. Pre-requisite: NIL
9. Objective: To study various cryptographic techniques, mathematics related to cryptography and some network security protocols.

10. Details of Course

Unit No.	Contents	Contact Hours
1.	**Introduction:** Need for security, Introduction to security attacks, services and mechanism, introduction to cryptography, Conventional Encryption: Conventional encryption model, classical encryption techniques- substitution ciphers and transposition ciphers, cryptanalysis, stereography, stream and block ciphers, Intruders, Viruses and related threads.	6
2.	**Modern Block Ciphers:** Block ciphers principals, Shannon's theory of confusion and diffusion, Fiestal structure, data encryption standard(DES), strength of DES, crypt analysis of DES, block cipher modes of operations, triple DES, IDEA encryption and decryption, strength of IDEA, key distribution.	6
3.	Introduction to graph, ring and field, prime and relative prime numbers, modular arithmetic, Fermat's and Euler's theorem, primarily testing, Euclid's Algorithm, Chinese Remainder theorem, discrete logarithms, Principals of public key crypto systems, RSA algorithm, security of RSA, key management, Diffle-Hellman key exchange algorithm, introductory idea of Elliptic curve cryptography, Elganel encryption	8
4.	**Message Authentication and Hash Function:** Authentication requirements, authentication functions, message authentication code (MAC), hash functions, security of hash functions and MACS, MD5 message digest algorithm, Secure hash algorithm(SHA), Public Key Infrastructure(PKI): Digital Certificate, private key management, Digital Signatures: Digital Signatures, authentication protocols, digital signature standards (DSS), proof of digital signature algorithm.	6
5.	**Authentication Applications:** Kerberos and X.509, directory authentication service, password, challenge-response, biometric authentication, electronic mail security-pretty good privacy (PGP), S/MIME.	8
6.	**IP Security:** Architecture, Authentication header, Encapsulating security payloads, combining security associations, key management. **Web Security:** Secure Socket Layer(SSL) and transport layer security, TSP, Secure Electronic Transaction (SET), Electronic money, WAP security, firewall design principals, Virtual Private Network (VPN) security.	8
	TOTAL	42

11. Suggested Books

S.No.	Name of Books / Authors/ Publishers
1.	William Stallings, “Cryptography and Network Security: Principals and Practice”, Prentice Hall, New Jersy.
2.	AtulKahate, “Cryptography and Network Security”, TMH.
3.	Behrouz A. Forouzan, “Cryptography and Network Security”, TMH.
4.	Johannes A. Buchmann, “Introduction to Cryptography”, Springer-Verlag.
5.	BruceSchiener, “Applied Cryptography”.

CO357 OPERATING SYSTEM

1. Subject Code: CO357 Course Title: Operating System
2. Contact Hours: L: 3 T: 0 P: 0
3. Examination Duration (ETE)(Hrs.): Theory 3 Hrs Practical 0
4. Relative Weightage: CWS 25 PRS 0 MTE 25 ETE 50 PR 0
5. Credits: 3
6. Semester: ODD
7. Subject Area: UEC
8. Pre-requisite: NIL

9. Objective: To familiar with the fundamental principles of the operating system, its services and functionalities, the concepts of processes, synchronization and scheduling, memory management and need for protection in computer systems

10. Details of Course

Unit No.	Contents	Contact Hours
1.	**Introduction:** Operating system and function, Evolution of operating system, Batch, Interactive, Time Sharing and Real Time System, System protection. **Operating System Structure:** System Components, System structure, Operating System Services.	4
2.	**Concurrent Processes:** Process concept, Principle of Concurrency, Producer Consumer Problem, Critical Section problem, Semaphores, Classical problems in Concurrency, Inter Process Communication, Process Generation, Process Scheduling. **CPU Scheduling:** Scheduling Concept, Performance Criteria of Scheduling Algorithm, Evolution, Multiprocessor Scheduling.	9

3.	**Deadlock:** System Model, Deadlock Characterization, Prevention, Avoidance and Detection, Recovery from deadlock combined approach.	8
4.	**Memory Management:** Base machine, Resident monitor, Multiprogramming with fixed partition, Multiprogramming with variable partition, Multiple base register, Paging, Segmentation, Virtual memory concept, Demand paging, Performance, Paged replacement algorithms, Allocation of frames, Thrashing, Cache memory organization, Impact on performance.	9
5.	**I/O Management & Disk Scheduling:** I/O devices and organization of I/O function, I/O Buffering, DISK I/O, Operating System Design Issues. **File System:** File Concept, File Organization and Access Mechanism, File Directories, File Sharing, Implementation Issues	9
6.	**Case Studies:** Windows, Linux and Unix	3
	TOTAL	42

11. Suggested Books

S.No.	**Name of Books / Authors/ Publishers**
Text Books	
1.	Silbersachatz and Galvin, “Operating System Concepts”, Pearson, 5th Ed, 2001
2.	Tannenbaum, “Operating Systems”, PHI, 4th Edition, 2000
Reference Books	
3.	Milenekovic, “Operating System Concepts”, McGraw Hill
4.	Dietel, “An introduction to operating system”, Addison Wesley

CO359 INTELLECTUAL PROPERTY RIGHTS

1. Subject Code: CO359 Course Title: Intellectual Property Rights
2. Contact Hours: L: 3 T: 0 P: 0
3. Examination Duration (ETE)(Hrs.): Theory 3Hrs Practical 0
4. Relative Weightage: CWS 25 PRS 0 MTE 25 ETE 50 PR 0

5. Credits: 3

6. Semester: ODD

7. Subject Area: UEC

8. Pre-requisite: Nil

9. Objective:To familiarize the students with basic concepts in each type of IPR together with historical developments in the subject & its importance in modern times.

10. Details of Course

Unit No.	Contents	Contact Hours
1.	Introduction: Concept of IPR, Historical development , kinds of IPR,brief description of patent, trademark, copyright ,industrial design, importance of IPR, IPR authorities.	5
2.	PATENTS :Introduction, Indian Patent Act 1970 &2002, Protectable subject matter--patentable invention, Procedure for obtaining patent, Provisional and complete specification Rights conferred on a patentee, transfer of patent, Revocation and surrender of patents, Infringement of patents, Action for infringement, Patent agents, Patent in computer programs.	8
3.	Trademark: Introduction, Statutory authorities, principles of registration of trademarks, rights conferred by registration of trademarks, Infringement of trademarks and action against infringement, procedure of registration and duration,licensing in trademark	7
4.	Copyright: Introduction, Author and ownership of copyright, rights conferred by copyright,term of copyright, assignment/licence of copyright, Infringement of copyright ,remedies against infringement of copyright, registration of copyright, copyright enforcement and societies	7
5.	Industrial design: The design act-2000, registerability of a design, procedure of registration of a design, piracy of a registered design, Case law on designs	6
6.	International IPR & case laws: World intellectual property organization, WCT, WPPT, TRIPS, Copyright societies, international IPR dispute resolution mechanism. Case laws.	9
	TOTAL	42

11. Suggested Books

S.No.	Name of Books / Authors/ Publishers
	Textbooks:
1.	Law Relating to Intellectual property, fourth edition by B.L.Wadehra .Universal law publishing co. pvt. Ltd , 2007. ISBN 978-81-7534-588-1
Reference books:	
2.	Intellectual property: Patents, copyright ,trademarks and allied rights. Fifth edition by W.R. Cornish. Sweet & Maxwell publisher, 2003. ISSN 9780421781207
3	Law and practice of intellectual property in India by VikasVashishth, 2006 **ISBN:** 81-7737-119-3
4	Patents ,copyrights, trade marks and design by B L Wadhera, 2014
5	Dr. B. L. Wadhera, "Intellectual Property Law Handbook". Universal Law Publishing, 2002.

CO361 DATABASE MANAGEMENT SYSTEM

1. Subject Code: CO361 Course Title: Database Management System
2. Contact Hours: L: 3 T: 0 P: 0
3. Examination Duration (ETE)(Hrs.): Theory 3 Hrs Practical 0
4. Relative Weightage: CWS 25 PRS 0 MTE 25 ETE 50 PR 0
5. Credits: 3
6. Semester: ODD
7. Subject Area: UEC
8. Pre-requisite: NIL
9. Objective: To provide knowledge about the principles, concepts and applications of Database Management System.
10. Details of Course

Unit No.	Contents	Contact Hours
1.	**Introduction:** Data base system concepts and its architecture, Data models schema and instances, Data independence and data base language and interface, Data definition languages, DML. Overall data base structure. **Data modeling using Entity Relationship Model:** E.R. model concept, notation for ER diagrams mapping constraints, Keys, Concept of super key, candidate key, primary key generalizations, Aggregation, reducing ER diagrams to tables, extended ER model.	7
2.	**Relational Data Model and Language:** Relational data model concepts, integrity constraints, Keys domain constraints, referential integrity, assertions, triggers, foreign key relational algebra, relational calculus,	7

	domain and tuple calculus, SQL data definition queries and updates in SQL.	
3.	**Data Base Design:** Functional dependencies, normal forms, 1NF, 2NF, 3NF and BCNF, multi-valued dependencies fourth normal forms, join dependencies and fifth normal forms. Inclusion dependencies, loss less join decompositions, normalization using FD, MVD and JDs, alternatives approaches to database design.	6
4.	**File Organization, Indexing and Hashing** Overview of file organization techniques, Indexing and Hashing- Basic concepts, Static Hashing, Dynamic Hashing, Ordered indices, Multi-level indexes, B-Tree index files, B+- Tree index files, Buffer management **Transaction processing concepts:** Transaction processing system, schedule and recoverability, Testing of serializability, Serializability of schedules, conflict & view serializable schedule, recovery from transaction failures, deadlock handling.	8
5.	**Concurrency Control Techniques:** Locking Techniques for concurrency control, time stamping protocols for concurrency control, concurrency control in distributed systems. multiple granularities and multi-version schemes.	8
6	**Case Studies:** Commercial databases, Oracle, Postgress, MySQL	6
	TOTAL	42

11. Suggested Books

S.No.	**Name of Books / Authors/ Publishers**
Text Books	
1	Elmasri, Navathe,"Fundamentals of Database systems", Addision Wesley
2	Korth, Silbertz, Sudarshan,"Data base concepts", McGraw-Hill.
Reference Books	
1.	Ramakrishna, Gehkre, "Database Management System", McGraw-Hill
2.	Date C.J.,"An Introduction to Database systems"

EC351 MECHATRONICS

1. Subject Code: EC351 Course Title: Mechatronics
2. Contact Hours: L: 3 T: 1 P: 0
3. Examination Duration (ETE)(Hrs.): Theory 3 Hrs Practical 0
4. Relative Weightage: CWS 25 PRS 0 MTE 25 ETE 50 PR 0
5. Credits: 4
6. Semester: V
7. Subject Area: UE

8. Pre-requisite: Nil

9. Objective: To introduce fundamentals of Mechatronics

10. Details of Course

Unit No.	Contents	Contact Hours
1.	Introduction : Basic Definitions and key elements of Mechatronics, Mechatronic Design Approach: Functions of Mechatronic Systems, Ways of Integration, Information Processing Systems (BasicArchitecture and hardware and Software trade-offs, Concurrent Design Procedure for Mechatronic Systems	6
2.	System Interfacing, Instrumentation,and Control Systems: Input and output Signals of a Mechatronic System, Signal Conditioning and microprocessor control, Microprocessor-Based Controllers and Microelectronics, Programmable Logic Controllers	6
3.	Introduction to Micro- and Nanotechnology, Micro-actuators, Micro-sensors, Nanomachines. Modeling Electromechanical Systems: Models for Electromechanical Systems, Rigid Body Models, Basic Equations of Dynamics of Rigid Bodies, Simple Dynamic Models, Elastic System Modeling, Dynamic Principles for Electric and Magnetic Circuits, Earnshaw's Theorem and Electromechanical Stability	10
4.	The Physical Basis of Analogies in Physical System Models: The Force-Current Analogy: Across and Through Variables, Maxwell's Force-Voltage Analogy:Effort and Flow Variables, A Thermodynamic Basis for Analogies	6
5.	Introduction to Sensors and Actuators: Characteristics of Sensor and Actuator Time and Frequency Measurement, The Role of Controls an modelling in Mechatronics: Integrated Modeling, Design, and Control Implementation, Special Requirements of Mechatronics that Differentiate from Classic Systems and Control Design, Modeling as Part of the Design Process, Modeling of Systems and Signals	6
6.	Design Optimizationof Mechatronic Systems: Optimization Methods, Principles of Optimization : ParametricOptimization, General Aspects of the OptimizationProcess, Types of Optimization Methods, Selection of aSuitable Optimization Method, Optimum Design of Induction Motor (IM), IM Design Introduction : Classical IM Design, Use of a Neuron Network for the Identification ofthe Parameters of a Mechanical dynamic system, Mechatronics and Computer Modelingand Simulation, Mechatronics and the Real-Time useof Computers, Communications andComputer Networks,Control withEmbedded Computersand ProgrammableLogic Controllers	8
	TOTAL	42

11. Suggested Books

S.No.	Name of Books / Authors/ Publishers
1.	Mechatronics : an introduction by Robert H Bishop, Taylor & Francis
2	Introduction to Mechatronics by KK AppuKuttan Oxford University Press

EC353 COMPUTER VISION

1. Subject Code: EC-353 Course Title: Computer Vision
2. Contact Hours: L: 3 T: 1 P: 0
3. Examination Duration (ETE)(Hrs.): Theory 3 Hrs Practical 0
4. Relative Weightage: CWS 25 PRS - MTE 25 ETE 50 PR 0
5. Credits: 4
6. Semester: V
7. Subject Area: UE
8. Pre-requisite: Nil
9. Objective: To introduce fundamentals of Computer Vision and algorithms for object detection, recognition and tracking.
10. Details of Course

Unit No.	Contents	Contact Hours
1.	Introduction to computer vision: Role of Artificial intelligence and image processing in Computer Vision, Industrial Machine Vision applications, System architecture. Visual Sensors: Camera sensors: RGB, IR, Kinect sensor, Camera interfaces and video standards, Characteristics of camera sensors commercially available cameras. Camera Calibration: Interior, exterior calibration and rectification using Tsai's Calibration method.	5
2.	Basics of image processing – Pixel representations histograms ,transforms, colour filters, noise removal, Geometry: Math methods -linear algebra, vectors, rotations, Stereo – Epi-polar geometry, correspondence, triangulation ,Disparity maps . Basics of video processing – Background subtraction techniques – frame differencing, Gaussian Mixture Modelling (GMM), Object localization and processing:- Contours, edges, lines, skeletons.	7
3.	Image representation: Local Wavelet basis (multiscale), Global Fourier basis(Frequency), Adaptive basis (PCA and ICA) , Adaptive basis(discriminants) Basics of Object detection – Template matching, Cascade classifiers.	8
4.	Object Recognition : Object Modeling, Bayesian Classification, Feature Selection and Boosting, Scene and Object Discrimination.	6
5.	Motion and Tracking: Motion detection and tracking of point features, optical flow, SURF, SIFT. Tracking- Kalman filter, Particle Filter, Comparison of deterministic and probabilistic methods condensation, tracking humans, multi-frame reconstruction under affine and perspective projection geometry.	8
6.	Introduction to Computer Vision programming libraries: MATLAB/OpenCV. advantages and disadvantages of each .	8
	TOTAL	42

11. Suggested Books

S.No.	Name of Books / Authors/ Publishers
1.	Computer Vision: A Modern Approach (2nd Edition) 2nd Edition by David A. Forsyth (Author), Jean Ponce (Author), 2002

2.	Learning OpenCV: **Computer Vision with the OpenCVLibrary** G Adrian Kaehler, 2008

EC355 EMBEDDED SYSTEM

1. Subject Code: EC- 355 Course Title: Embedded Systems
2. Contact Hours: L: 3 T: 1 P: 0
3. Examination Duration (ETE)(Hrs.):Theory 3 Hrs Practical 0
4. Relative Weightage: CWS 25 PRS 0 MTE 25 ETE 50 PR 0
5. Credits: 4
6. Semester: V
7. Subject Area: UE
8. Pre-requisite: Knowledge of Computer Architecture and Microprocessors
9. Objective: To introduce fundamentals of 16 and 32 bit Microcontrollers, assembly language programming. The course also focuses on interfacing of different interrupt driven peripherals. It also covers in detail Real Time Operating Systems, Bus architecture, Digital Signal Processors and System On-Chip.
10. Details of Course

Unit No.	Contents	Contact Hours
1.	Overview of Embedded Systems: Characteristics of Embedded Systems. Comparison of Embedded Systems with general purpose processors. General architecture and functioning of micro controllers. PIC and 8051 micro controllers : Architecture, memory interfacing , interrupts, instructions, programming and peripherals .	8
2.	ARM : Architecture, memory interfacing , interrupts, instructions and Assembly Language programming. Exception processing and pipeline architecture and applications.	12
3.	Digital Signal Processors: DSP Architecture, DSP applications, algorithms, data path, memory, addressing modes, peripherals. TI and Sharc family of DSP processors.	4
4.	System On Chip : Evolution, features, IP based design, TI OMAP architecture and peripherals. Digital Multimedia processor: Architecture and peripherals.	4
5.	SRAM, DRAM working and organization. Interfacing memory with ARM 7. Elements of Network Embedded Systems	4
6.	RTOS : RT-Linux introduction, RTOS kernel, Real-Time Scheduling Bus structure: Time multiplexing, serial, parallel communication bus structure. Bus arbitration, DMA, PCI, AMBA, I2C and SPI Buses.	10
	TOTAL	42

11. Suggested Books

S.No.	Name of Books / Authors/ Publishers
1.	Computers as components: Principles of Embedded Computing System Design, Wayne Wolf, Morgan Kaufman Publication, 2000

2.	ARM System Developer's Guide: Designing and Optimizing System Software, Andrew N. Sloss, Dominic Symes, Chris Wright, , Morgan Kaufman Publication, 2004
3.	Design with PIC Microcontrollers, John B. Peatman, Pearson Education Asia, 2002
4.	The Design of Small-Scale embedded systems, Tim Wilmshurst, Palgrav, 2003
5.	Embedded System Design, Marwedel, Peter, Kluwer Publishers, 2004

EC357 DIGITAL IMAGE PROCESSING

1. Subject Code: EC 357 Course Title: Digital Image Processing
2. Contact Hours: L: 3 T: 1 P: 0
3. Examination Duration (ETE) (Hrs.): Theory 3Hrs Practical 0
4. Relative Weightage: CWS 25 PRS 0 MTE 25 ETE 50 PR 0
5. Credits: 4
6. Semester: V
7. Subject Area: UE
8. Pre-requisite: Signals and Systems
9. Objective: To introduce the fundamentals of visual information, representation of 2-D and 3-D information, enhancement of information, retrieval of information, and various colour models.
10. Details of Course

Unit No.	Contents	Contact Hours
1.	Introduction to Image processing, fundamental steps in DIP, concept of visual information, image formation model, image sampling and quantization, digital image representation, spatial and gray level resolution, relationship between pixels, application of image processing system.	6
2.	Introduction to Multidimensional signals and systems, 2D-Signals, 2D systems, classification of 2D system, 2D convolution, 2D Z-transform, Image Transform: 2D-DFT, discrete cosine, discrete sine, Haar, Walsh, Hadamard, Slant, KL, SVD, Hough, Radon, Ridgelet.	8
3.	Image enhancement; Spatial domain: linear transformation, image negative, grey level shifting, non-linear transformation, logarithmic transformation, exponential transformation, grey level slicing, bit plane slicing, image averaging, mask processing, histogram manipulations, histogram thresholding, histogram stretching, histogram equalization, noise removing filters, smoothing filters, sharpening filters. Enhancement in Frequency Domain; ideal low pas filter, Butterworth low pass filter, ideal high pass filters, Butterworth high pass filter, band pass filter, Gaussian filters, Homomorphic filtering.	10
4.	Image restoration: degradation model, noise models, restoration in presence of noise, periodic noise removal in frequency domain, notch filters, inverse filtering, Wiener filtering.	6
5.	Introduction to Morphological Image Processing operations, dilation and erosion, opening and closing, hit-or-miss transformation, boundary	6

	extraction, region filling, extraction connected components, convex hull, thinning, thickening, skeletons, pruning.	
6.	Introduction to various colour models: RGB, CMY, CMYK, HSI, HSV, and YCbCr. Concept of image compression, Image Segmentation: detection of discontinuities, edge linking and boundary detection, thresholding, region based segmentation, use of motion in segmentation.	6
	TOTAL	42

11. Suggested Books

S.No.	Name of Books / Authors/ Publishers
1.	Digital Image Processing/ Gonzalez and Woods/ Pearson Education, 2008/Third Edition
2.	Fundamentals of Digital Image Processing/ A.K. Jain/ PHI, Indian Edition
3.	Digital Image Processing using MATLAB/ Gonzalez, Woods, and Eddins/ McGraw Hill, Second/ 2013
4.	Digital Image Processing/ K.R. Castleman/ Pearson, 2014
5.	Digital Image Processing Algorithms and Applications/I. Pitas/John Wiley, 2002
6.	Image Processing, Analysis, and Machine Vision/Milan Sonka, Vaclav Hlavac, Roger Boyale/ Cengage Learning, 4th Edition

EC359 VLSI DESIGN

1. Subject Code: EC -359 Course Title: VLSI Design
2. Contact Hours: L: 3 T: 1 P: 0
3. Examination Duration (ETE) (Hrs.): Theory 3 Hrs Practical 0
4. Relative Weightage: CWS 25 PRS 0 MTE 25 ETE 50 PR 0
5. Credits: 4
6. Semester: V
7. Subject Area: UE
8. Pre-requisite: Nil
9. Objective: To give the student an understanding of the different design steps required to carry out a complete digital VLSI (Very-Large-Scale Integration) design in silicon.

10.Details of Course

Unit .No.	Contents	Contact Hours
1.	Introduction to VLSI, Manufacturing process of CMOS integrated circuits, CMOS n-well process design rules, packaging integrated circuits, trends in process technology. MOS transistor, Energy band diagram of MOS system,MOS under external bias, derivation of threshold voltage equation, secondary effects in MOSFETS	6

2.	MOSFET scaling and small geometry effects, MOScapacitances, Modeling of MOS transistors using SPICE, level I II and equations, capacitance models. The Wire: Interconnect parameters: capacitance, resistanceand inductance. Electrical wire models: The ideal wire, the lumpedmodel, the lumped RC model, the distributed RC model, the transmission line model, SPICE wire models.	6
3.	MOS inverters: Resistive load inverter, inverter with n-type MOSFET load, CMOS inverter: Switching Threshold, Noise Margin, Dynamic behavior of CMOS inverter, computing capacitances, propagation delay, Dynamic power consumption, static power consumption, energy, and energy delay product calculations, stick diagram, IC layout design and tools.	8
4.	Designing Combinational Logic Gates in MOS and CMOS: MOS logic circuits with depletion MOS load. Static CMOS Design: Complementary CMOS, Ratioedlogic, Pass transistor logic, BiCMOS logic, pseudo nMOS logic, Dynamic CMOS logic, clocked CMOS logic CMOS domino logic, NP domino logic, speed and power dissipation of Dynamic logic, cascading dynamic gates.	8
5.	Designing sequential logic circuits: Timing matrices for sequential circuits, classification of memory elements, static latches and registers, the bistability principle, multiplexer based latches , Master slave Edge triggered register , static SR flip flops, dynamic latches and registers, dynamic transmission gate edge triggered register, the C2MOS register	8
6.	Pulse registers, sense amplifier based registers, Pipelining, Latch verses Register based pipelines, NORA-CMOS. Two-phase logic structure; VLSI designing methodology –Introduction, VLSI designs flow, Computer aided design technology: Design capture and verification tools, Design Hierarchy Concept of regularity, Modularity & Locality, VLSI design style, Design quality.	6
	TOTAL	42

11. Suggested Books

S.No.	Name of Books / Authors/ Publishers
1.	Digital integrated circuits a design perspective byJan M Rabaey, Anantha Chadrakasan Borivoje Nikolic, Pearson education, 2011.
2.	CMOS digital integrated circuits by Sung MO KangYusuf Leblebici, Tata McGraw Hill Publication, 2002
3.	Principle of CMOS VLSI Design by Neil E Weste and Kamran Eshraghian, Pearson education, 2000.

EE351 POWER ELECTRONICS SYSTEMS

1. Subject Code: EE-351 Course Title: Power Electronic Systems

2. Contact Hours : L: 3 T: 0 P: 0

3. Examination Duration (Hrs.) : Theory: 3 Practical: 0

4. Relative Weight CWS: 25 PRS: 0 MTE: 25 ETE: 50 PRE: 0

5. Credits: 3

6. Semester: VIII

7. Subject Area: UEC

8. Pre-requisite: EE-203, EE-301

9. Objective:To familiarize the students with power electronics and its applications.

10. Details of Course:

Unit No.	Contents	Contact Hours
1.	Solid State Power Devices: Principle of operation of SCR, dynamic characteristic of SCR during turn ON and turn OFF, parameters of SCR, dv/dt and di/dt protection, snubber circuit, commutation circuits; Principle of operation ofMOSFET, IGBT, GTO, MCT, SIT, SITH, IGCT, their operating characteristics.	8
2.	Single-phase Converter: Half wave converter, 2-pulse midpoint converter, half controlled and fully controlled bridge converters, input current and output voltage waveforms, effect of load and source impedance, expressions for input power factor, displacement factor, harmonic factor and output voltage, effect of free-wheeling diode, triggering circuits. Three-phase Converter: Half wave, full wave, half controlled and fully controlled bridge converters, effect of load and source impedance, expressions for input power factor, displacement factor, harmonic factor and output voltage,	8
3.	AC-AC Converters: Principle of operation of cycloconverter, waveforms, control technique; Introduction of matrix converter.	4
4.	DC-DC Converters: Principle of operation of single quadrant chopper, continuous and discontinuous modes of operation; Voltage and current commutation, design of commutating components; Introduction to SMPS.	4
5.	Inverters: Voltage source and current source inverters, Principle of operation of single-phase half bridge and full bridge voltage source inverters, voltage and current waveforms; Three-phase bridge inverter, 120^0 and 180^0 modes of operation, voltage and current waveforms with star and delta connected RL load; Voltage and frequency control of inverters; PWM techniques-single pulse, multiple pulse, selective harmonic elimination, sinusoidal PWM.	8
6.	Applications: FACTS Technology: Reactive power control in power systems,	10

	transmission system compensation, static series and shunt compensation, static shunt and series compensators- SVC, STATCOM, TCSC, SSSC and their working principles and characteristics. Combined series-shunt compensators –UPFC and its applications and characteristic. VSC-HVDC Systems: Principles and applications	
	Total	42

11. Suggested Books:

S. No.	Name of Authors /Books / Publishers
1.	Mohan N., Undeland T. M. and Robbins W. P., "Power Electronics-Converters, Applications and Design", 3rd Ed., Wiley India, 2002.
2.	Rashid M. H., "Power Electronics Circuits Devices and Applications", 3rd Ed., Pearson Education, 2004.
3.	N.G. Hingorani and L. Gyugyi, "Understanding FACTS", IEEE Press, 2000
4.	K.R. Padiyar, "Facts Controllers In Power Transmission and Distribution", New Age publishers, 2013
5.	HVDC power transmission system, K.R.Padiyar, NewAge Publishers,2011

EE353 ELECTRICAL MACHINES AND POWER SYSTEMS

1. Subject Code: EE-353 Course Title: Electrical Machines and Power Systems
2. Contact Hours: L: 3 T: 0 P: 0
3. Examination Duration (Hrs.): Theory: 3 Practical: 0
4. Relative Weight: CWS: 25 PRS: 0 MTE: 25 ETE: 50 PRE: 0
5. Credits: 3
6. Semester: VIII
7. Subject Area: UEC
8. Pre-requisite: EE-208, EE-303, EE-304
9. Objective:To familiarize the students with electrical machines and power systems.
10. Details of Course:

Unit No.	Contents	Contact Hours
1	Transformers : constructional features, types, Special constructional features – cruciform and multiple stepped cores, cooling methodology, conservators, breather, Buchholz relay, voltage, current and impedance relationships, equivalent circuits andphasor diagrams at no load and full load conditions,voltage regulation, losses and efficiency, all day efficiency, auto transformer and equivalent circuit, parallel operation and load sharing.	8
2	Asynchronous machines: General constructional features of poly phase asynchronous motors, concept of rotating magnetic field, principle of operation, phasor diagram, Equivalent circuit, torque and power equations, torque-slip characteristics, losses and efficiency.	8
3	Synchronous machines : General constructional features, armature winding, emf equation, effect of distribution and pitch factor,flux and mmf relationship, phasor diagram, non-salient pole machine, equivalent circuit, determination of equivalent circuit parameters by open and short circuit tests, voltage regulation using synchronous impedance method, power angle characteristics	9
4	Single line diagram of power system, brief description of power system elements, synchronous machine, transformer, transmission line, bus bar, circuit breaker and isolator. Supply System:different kinds of supply system and their comparison, choice of transmission voltage. Transmission Lines:configurations, types of conductors, resistance of line, skin effect	9
5	Transmission lines: Calculation of inductance and capacitance of single phase, three phase, single circuit and double circuit ,transmission lines, representation and performance of short, medium and long transmission lines, Ferranti effect,surge impedance loading.	8
	Total	42

11.Suggested Books

S. No.	Name of Authors /Books / Publishers
1	Fitzgerald. A.E., Charles KingselyJr, Stephen D.Umans, 'Electric Machinery', Tata McGraw Hill, 2006.
2	M.G. Say, 'Performance and Design of Alternating Current Machines', CBS Publishers, New Delhi, 2008

3	Nagrath I. J and Kothari D.P. 'Electric Machines', Tata McGraw Hill Publishing Company Ltd, 2010.
4	Power System Analysis, J. Grainger and W.D. Stevenson, TMH, 2006.
5	Electrical Power Systems,C. L.Wadhwa, New age international Ltd. Third Edition, 2010
6	Electric Power Generation, Transmission&Distribution,S.N.Singh, PHI Learning, 2008.

EE-355 INSTRUMENTATION SYSTEMS

1. Subject Code: EE-355 Course Title: Instrumentation Systems
2. Contact Hours: L: 3 T: 0 P: 0
3. Examination Duration (Hrs.): Theory: 3 Practical: 0
4. Relative Weight: CWS: 25 PRS: 0 MTE: 25 ETE: 50 PRE: 0
5. Credits: 3
6. Semester: VIII
7. Subject Area: UEC
8. Pre-requisite: EE-203, EE-313
9. Objective:To familiarize the students with instrumentation systems.
10. Details of Course:

Unit No.	Contents	Contact Hours
1	Transducers-I:Definition, advantages of electrical transducers, classification, characteristics, factors affecting the choice of transducers, strain gauges, resistance thermometer, thermistors, thermocouples, LVDT, RVDT	8
2	Transducers-II:Capacitive, piezoelectric, Hall effect and opto electronic transducers. measurement of motion, force, pressure, temperature flow and liquid level.	8
3	Telemetry:General telemetry system, land line & radio frequency telemetering system, transmission channels and media, receiver & transmitter. Data Acquisition System:A/D and D/A converters, analog data acquisition system, digital data acquisition system, modern digital data acquisition system and signal conditioning.	8
4	Display Devices and RecordersDisplay devices, storage oscilloscope, DSO, spectrum analyzer, digital recorders.RecentDevelopments:Introduction to virtual and intelligent instrumentation, fibre optic transducers, smart sensors,	8

	smart transmitters, process instrumentation diagrams.	
5	Programmable Logic Controllers :Evolution of PLC-sequential and programmable controllers, architecture and programming of PLC, relay logic and ladder logic, functional blocks, communication networks for PLC, field bus, profi-bus, mod-bus	10
	Total	42

11. Suggested Books:

S. No.	Name of Authors /Books / Publishers
1	Electronic Instrumentation and Measurement Techniques, W.D. Cooper and A.D. Helfrick, Prentice Hall International, 2009.
2	Measurement Systems Application and Design Ernest Doebelin, McGraw- Hill Higher Education, 5th edition , 2003
3	Instrumentation, Measurement and Analysis, B.C. Nakra& K. Chaudhry, Tata McGraw Hill, 2nd Edition, 2001.
4	Advanced Measurements and Instrumentation, A.K. Sawhney, DhanpatRai& Sons, 2010
5	Process Control Instrumentation Technology, Curtis D. Johnson, Pearson, 6th edition, 1999
6	Programmable Logic Controllers, Frank D. Petruzella McGraw-Hill Higher Education, 4th edition, 2010

EE357 UTILIZATION OF ELECTRICAL ENERGY

1. Subject Code: EE-357 Course Title: Utilization of Electrical Energy
2. Contact Hours: L: 3 T: 0 P: 0
3. Examination Duration (Hrs.): Theory: 3 Practical: 0
4. Relative Weight: CWS: 25 PRS: 0 MTE: 25 ETE: 50 PRE: 0
5. Credits: 3
6. Semester: VIII
7. Subject Area: UEC
8. Pre-requisite: EE-208, EE-303

9. Objective: To familiarize the students with the concept of electrical power, energy and its utilization.

10. Details of Course:

Unit No.	Contents	Contact Hours
1.	Illumination: Definition:- Luminous flux, solid angle, luminous intensity, illumination, luminous efficiency, depreciation factor, coefficient of utilization, space to height ratio, reflection factor, glare, shadow, lux. Nature of light, visibility spectrum curve of relative sensitivity of human eye and wave length of light, Review of laws of illumination, Different types of lighting sources and their use in domestic, street and industrial lighting, Energy considerations. LED's and their driving circuits.	10
2	Electric Heating : Advantages of electrical heating, Heating methods: Resistance heating – direct and indirect resistance heating, properties of resistance heating elements, Induction heating; principle of core type and coreless induction furnace, Electric arc heating; direct and indirect arc heating, construction, working and applications of arc furnace, Dielectric heating, applications in various industrial fields, Infra-red heating and its applications, Microwave heating	08
3.	Electric Welding: Introduction to electric welding, Welding methods, Principles of resistance welding, types – spot, projection seam and butt welding and welding equipment used, Principle of arc production, electric arc welding, characteristics of arc, Design of Power supply and welding control circuit, comparison between AC and DC arc welding, welding control.	08
4.	Electrolytic Processes: Need of electro-deposition laws of electrolysis, process of electro-deposition - clearing, operation, deposition of metals, polishing, buffing equipment and accessories for electroplating factors affecting electro-deposition , principle of galvanizing and its applications, anodising and its applications, electroplating on non-conducting materials, manufacture of chemicals by electrolytic process, electrolysis for water purification	08
5.	Refrigeration and Air Conditioning and Water Coolers: Principle of air conditioning, vapour pressure, refrigeration cycle, eco-friendly refrigerants, description of electrical circuit used in a) refrigerator, b) air-conditioner, and c) water cooler, variable speed drive for compressors, high speed compressors, insta-chill, Peltier effect, thermoelectric cooling, sterling engines, solar concentrator heating and cooling,	08
	Total	42

11. Suggested books:

S. No.	Name of Authors /Books / Publishers

1.	Dubey G. K., “Fundamentals of Electric Drives”, 2nd Ed., Narosa Publishing House,2007.
2.	Taylor E. O., “Utilization of Electric Energy (in SI units)”, Orient Longman, Revised in S.I. units by Rao, V.V.L,1999
3.	Hancock N. N., “Electric Power Utilisation”, Wheelers,1979.

EE-359 NON-CONVENTIONAL ENERGY SYSTEMS

1. Subject Code: EE-359 Course Title: Non-conventional Energy Systems

2. Contact Hours: L: 3 T: 0 P: 0

3. Examination Duration (Hrs.): Theory: 3 Practical: 0

4. Relative Weight: CWS: 25 PRS: 0 MTE: 25 ETE: 50 PRE: 0

5. Credits: 3

6. Semester: VIII

7. Subject Area: UEC

8. Pre-requisite: EE-301, EE-303

9. Objective: To familiarize the students with the non-conventional sources of energy and their integration to the grid.

10. Details of Course:

Unit No.	Contents	Contact Hours
1	Introduction to Non Conventional Energy Systems Various non-conventional energy resources Introduction, availability, classification, relative merits and demerits. Solar Cells: theory of solar cells, solar cell materials, solar cell array, solar cell power plant, limitations. Solar Thermal Energy: solar radiation, flat plate collectors and their materials, applications and performance, focusing of collectors and their materials, applications and performance, solar thermal power plants, thermal energy storage for solar heating and cooling, limitations.	10
2	Geothermal Energy Resources of geothermal energy, thermodynamics of geo-thermal energy conversion, electrical conversion, non-electrical conversion,environmental considerations. Magneto-hydrodynamics (MHD):principle of working of MHD power plant, performance and limitations.	8
3	Fuel Cells: Basic principle of working, various types of fuel cells, performance and limitations.	8
4	Thermo-electrical and thermionic conversions Principle of working of thermo-electrical and thermionic	8

	conversions, performance and limitations. Wind energy: wind power and its sources, site selection criteria, momentum theory, classification of rotors, concentrations and augments, wind characteristics, performance and limitations of wind energy conversion systems.	
5	Energy from Bio-mass, Ocean Thermal, Wave and bio-waste Availability of bio-mass and its conversion principles, ocean thermal energy conversion principles, performance and limitations, wave and tidal energy conversion principles, performance and limitations, bio-waste recycling power plants.	8
		42

11. Suggested books:

S. No.	Name of Authors /Books / Publishers
1	Renewable Energy Resources, John Twidell, Tony Weir, Taylor and Francis, 2nd edition,2005.
2	Solar Engineering of Thermal Processes,John A. Duffie, William A. Beckman, John Wiley & Sons, 4th edition,2013.
3	Biofuels, Solar and Wind as Renewable Energy Systems: Benefits and Risks,D. Pimentel, Springer,1st edition,2010.
4	Solar Photovoltaic Technology and Systems: A Manual for Technicians, Trainers and Engineers,Chetan Singh Solanki, PHI Learning,2013.
5	Non Conventional Energy Resources, D.S. Chauhan, New Age International Pvt Ltd.,2006

EE-361 EMBEDDED SYSTEMS

1. Subject Code: EE-361 Course Title: Embedded Systems
2. Contact Hours: L: 3 T: 0 P: 0
3. Examination Duration (Hrs.): Theory: 3 Practical: 0
4. Relative Weight: CWS: 25 PRS: 0 MTE: 25 ETE: 50 PRE: 0
5. Credits: 3 6. Semester: VIII 7. Subject Area: UEC
8. Pre-requisite: EE-306, EE-427
9. Objective:To familiarize the students with the concepts of embedded systems.
10. Details of Course:

Unit	Contents	Contact Hours

No.		
1.	Embedded Processing – Evolution, Issues and Challenges;	1
2	System and Processor Architecture : von Neumann, Harvard and their variants	2
3	Memory Architecture and Devices; Input-Output Devices and Mechanisms	5
4	Instruction Set and Addressing Modes, Interfacing of Memory and Peripheral Devices – Functional and Timing Issues	6
5	Application Specific Logic Design using Field Programmable Devices and ASICs	2
6	Analog to Digital and Digital to Analog Converters	2
7	Bus I/O and Networking Considerations, Bus and Wireless Protocols	4
8	Embedded Systems Software : Constraints and Performance Targets	2
9	Real-time Operating Systems : Introduction, Scheduling in Real-time Operating Systems	4
10	Memory and I/O Management : Device Drivers	2
11	Embedded Software Development : Flow, Environments and Tools	2
12	System Specification and Modelling	2
13	Programming Paradigms	2
14	System Verification	2
15	Performance Analysis and Optimisation : Speed, Power and Area Optimisation, Testing of Embedded Systems	4
	Total	42

11. Suggested Books:

S. No.	Name of Authors /Books / Publishers
1.	S. Heath, “Embedded Systems Design”, Elsevier India,2005
2.	M. Ben-Ari, “Principles of Concurrent and Distributed Programming”, Pearson,2005
3.	Jane Liu, “Real Time Systems”, Pearson,2002

EN-351 ENVIRONMENTAL POLLUTION AND E –WASTE MANAGEMENT

1. Subject Code: EN-351 Course Title: Environmental Pollution & E- Waste Management

2. Contact Hours: L: 3 T: 0 P: 0

3. Examination Duration (ETE) (Hrs.): Theory: 3 Hrs. Practical: 0

4. Relative Weightage: CWS 25 PRS 0 MTE 25 ETE 50 PR 0

5. Credits: 3

6. Semester:VI

7. Subject Area: UE

8. Pre-requisite: Nil

9. Objective: The overall aims of the course are for students to acquire understanding of the new and emerging contaminants from various industrial processes and their transformation products. Studying emerging environmental issues related to newer methods of manufacture of industrial products.

10. Details of Course

Unit No.	Contents	Contact Hours
1	UNIT-I New and emerging pollutants and related transformation products, Effects & risks of emerging contaminants on ecosystems and humans, Persistent pollutants. Analytical methods for identifying emerging pollutants and the products of their transformation	9
2	UNIT-II Micro pollutants- Pesticides, Pharmaceutical - Veterinary and human drugs, personal care products, Surfactants and surfactant metabolites, Flame retardants, Industrial additives and agents.Emerging pollutants' toxicity, and their water-related characteristics (degradability, solubility, sorption…)	9
3	UNIT-III Emerging Issues - E-waste, Hazardous Waste, Nuclear Waste, Nano pollution, Thermal Pollution, pollutant emission and treatment	8
4	UNIT-IV Emerging pollutants' emergence and fate in surface and ground water, as well as mathematical modelling, Sustainable Development, Risk mitigation	8

5	UNIT-V Transformation Products of Emerging Contaminants in the Environment, Removal of emerging contaminants from water, soil and air, methods and preventive measures.	8

Course Outcome:

1. Introduction to new and emerging contaminants and their transformation products.
2. Study of pollutants from manufacturing of goods.
3. Emerging area in environmental pollution.
4. Study of life cycle of a contaminant, modeling and mitigation.

11.Suggested Books:

S. No.	Name of Authors /Books / Publishers
1.	G. Buttiglieri, T.P. Knepper, (2008), Removal of emerging contaminants in Wastewater Treatment: Conventional Activated sludge Treatment, Springer-Verlag Berlin Heidelberg, HdbEnvChem, vol. 5, Part S/2:1-35, DOI: 10.1007/698_5_098
2.	Alok Bhandari; Rao Y. Surampalli; Craig D. Adams; Pascale Champagne; Say Kee Ong; R. D. Tyagi; and Tian Zhang, Eds., (2009) Contaminants of Emerging Environmental Concern, American Society of Civil Engineers, ISBN (print): 978-0-7844-1014-1, ISBN (PDF): 978-0-7844-7266-8
3.	Dimitra A. Lambropoulou, Leo M. L. Nollet Eds. () Transformation Products of Emerging Contaminants in the Environment: Analysis, Processes, Occurrence, Effects and Risks, 1st Edition, Wiley, ISBN-13: 978-1118339596, ISBN-10: 1118339592

EN353 OCCUPATIONAL HEALTH AND SAFETY MANAGEMENT

1. Subject Code: EN- 353 Course Title: Occupational Health and Safety Management
2. Contact Hours: L: 3 T: 0 P: 0
3. Examination Duration (ETE) (Hrs.):Theory 3 Hrs
4. Relative Weightage: CWS 25 PRS 0 MTE 25 ETE 50 PR 0
5. Credits: 3

6. Semester:VI7. Subject Area: DEC 8. Prerequisite: Nil

9. Course Objectives:

1. Introduction about occupational health and related issues.
2. To give a basic idea about environmental safety management, industrial hygiene.
3. To introduce about training cycle, chemical hazards and control measures.
4. To aware and provide knowledge about ergonomics and different disorders.
5. To provide knowledge about different standards related to safety and health.

10. Detail of Course:

Unit no.	Contents	Contact Hours
1	UNIT –I Definition of Occupational Health as per WHO/ILO. Occupational Health and Environmental Safety Management – Principles practices. Common Occupational diseases: Occupational Health Management Services at the work place. Pre-employment, periodic medical examination of workers, medical surveillance for control of occupational diseases and health records.	8
2	UNIT –II Occupational Health and Environment Safety Management System, ILO and EPA Standards. Industrial Hygiene: Definition of Industrial Hygiene, Industrial Hygiene: Control Methods, Substitution, Changing the process, Local Exhaust Ventilation, Isolation, Wet method, Personal hygiene, housekeeping and maintenance, waste disposal, special control measures.	8
3	UNIT –III Element of training cycle, Assessment of needs. Techniques of training, design and development of training programs. Training methods and strategies types of training. Evaluation and review of training programs. Chemical Hazard: Introduction to chemical hazards, dangerous properties of chemical, dust, gases, fumes, mist, Vapours, Smoke and aerosols. Evaluation and control of basic hazards, concepts of dose response relationship, bio-chemical action of toxic substances. Concept of threshold, limit values.	9
4	UNIT –IV Occupational Health Hazards, Promoting Safety, Safety and Health training, Stress and Safety, Exposure Limit. Ergonomics-Introduction, Definition, Objectives, Advantages. Ergonomics Hazards. Musculoskeletal Disorders and Cumulative Trauma Disorders. Physiology of respiration, cardiac cycle, muscle contraction, nerve conduction system etc. Assessment of Workload based on Human physiological reactions. Permissible limits of load for manual lifting and carrying. Criteria or fixation limits.	9

5	UNIT –V Bureau of Indian standards on safety and health 14489 - 1998 and 15001 – 2000, OSHA, Process Safety Management (PSM) as per OSHA, PSM principles, OHSAS – 18001, EPA Standards, Performance measurements to determine effectiveness of PSM. Importance of Industrial safety, role of safety department, Safety committee and Function.	8

Course Outcomes:

1. The student will be able to understand the basics of occupational health and related issues.
2. Understanding of the fundamental aspects of safety, industrial hygiene along with learning theory to safety training methodology.
3. Considerate about hazardous materials, emergency management, ergonomics and human factors
4. Able to understand the adverse effects of hazards and develop control strategies for
5. +hazardous conditions and work practices
6. Learn about Indian standards of health and safety and able to apply applicable standards, regulations and codes.

11.Suggested Books:

S. No.	Name of Authors /Books / Publishers
1.	Handbook of Occupational Health and Safety, NIC, Chicago, 1982.
2.	Encyclopedia of Occupational Health and Safety, Vol. I and II. International Labour Organisation, Geneva, 1985.
3.	Accident Preventional Manual, NSC Chicago, 1982.
4.	Henrich, H.W., Industrial Accident Prevention, McGraw Hill, 1980.

EN-355 GIS & REMOTE SENSING

1. Subject Code: EN-355 Course Title: GIS & Remote Sensing
2. Contact Hours: L: 3 T: 0 P: 0
3. Examination Duration (ETE) (Hrs.):Theory 3 Hrs
4. Relative Weightage: CWS 25 PRS 0 MTE 25 ETE 50 PRE 0
5. Credits: 3

6. Semester:VI7. Subject Area: UEC 8. Prerequisite: Nil

9. Course Objectives:

1) Introduce GIS and its significance in engineering and science.
2) To familiarize students with GIS data and its applications.
3) To familiarize students about the basics of remote sensing and its multi concepts.
4) To disseminate knowledge about sensors and different kind of resolution in the area of remote sensing.
5) To familiarize students about the diverse applications of remote sensing.

10. Detail of Course:

Unit no.	Contents	Contact Hours
1	Unit-1: Geographic Information System Introduction, Definition of GIS, Components of GIS, Input data for GIS, Geographical concepts	7
2	Unit-2:GIS Data GIS data types, Data representation, Data sources, Geo-referencing of GIS data, GIS database, Database Management System, Data analysis terminology, GIS software packages, GIS application	9
3	Unit-3:Remote Sensing Introduction to Remote Sensing and Remote Sensing System, Multi concept of remote sensing, Advantages and disadvantages of remote sensing, Electromagnetic radiation, Polarisation, Thermal radiation	8
4	Unit-4:Remote Sensing Platforms Important remote sensing satellites, Classifications of sensors and platforms, Passive and Active sensors, Major remote sensing sensors, Spatial resolution, Spectral resolution, Radiometric resolution, Temporal resolution, Glopal Positioning System	9
5	Unit-5:Application of Remote Sensing Digital Image Processing, Application of Remote Sensing in Land use and Land cover mapping, Ground water mapping, Urban growth studies, Wasteland mapping, Disaster management, Agriculture, Forestry application	9

Course Outcomes:

1. The Student will learn about basics of GIS and its significance.
2. The Student will be able to understand the utility of GIS data as well as Data Management System.
3. The Student will learn the fundamentals of remote sensing.
4. The unit of Remote Sensing Platform will generate a clear cut understanding among students about the satellites, their functioning and Global Positioning System. Geographical information system, its components, DMS and its various applications in real life.
5. The Student will be able to attain thorough knowledge about the application of remote sensing in different areas.

11.Suggested Books:

S. No.	Name of Authors /Books / Publishers
1.	Fundamentals of Remote Sensing – George Joseph, University Press, Hyderabad, India.
2.	Remote Sensing and Geographical Information System – AM Chandra & SK Ghosh Narosa Publishing House, New Delhi.
3.	Concepts and Techniques of Geographic Information Systems – C. P. Lo & Albert K.W. Yeung, PHI Learning Private Limited, New Delhi.
4.	Geographic Information System – Kang Tsung Chang, Tata Mc Graw hill, Publication Edition, 2002.

EP351 PHYSICS OF ENGINEERING MATERIALS

1. Subject code: EP351 Course title: Physics of Engineering Materials
2. Contact Hours: L: 3 T: 0 P: 0
3. Examination Duration (Hrs): Theory: 3 Practical: 0
4. Relative Weight: CWS: 25 PRS: 0 MTE: 25 ETE: 50 PRE: 0
5. Credits: 3
6. Semester: ODD
7. Subject area: UEC
8. Pre-requisite: NIL
9. Objective: To familiarize the fundamentals /basic concepts and advances of the different materials keeping in view of the engineering applications. There is ample opportunity to

become involved in cutting edge Materials Science and Engineering Research

10.Detail of Course: University Elective Course *(Other than Engineering Physics Students)*

Unit No.	Contents	Contact Hours
1.	**Crystallography:** Introduction to crystal physics,Space lattice, Basis and the Crystal structure, Bravais lattices; Miller indices, simple crystal structures,Interplanar spacing, Intra and Intermolecular bonds (Ionic, Covalent, Metallic, Van der Waals and Hydrogen Bond), Defects in crystals, Basics of X- ray diffraction and its applications	**10**
2.	**Semiconductors:** Band theory of solids, Intrinsic and Extrinsic semiconductors, Statistics of electrons and holes in intrinsic semiconductor, Hall effect, Effect of temperature on conductivity, Generation and recombination, drift and diffusion current, Einstein relation, Applications of Semiconducting Materials.	**10**
3.	**Dielectric and Magnetic Materials** *Dielectric Materials:* Dielectric polarization and dielectric constant, Various polarization processes, Applications of Dielectric Materials *Magnetic Materials:* Concept of Magnetism, Classification of dia-para, Ferro, Antiferro and Ferrimagnetism, ferrites, soft and hard magnetic materials, Applications of Magnetic Materials	**07**
4.	**Superconductivity:** Introduction and historical developments; General properties of super conductors, Meissner effect and its contradiction to the Maxwell's equation; Types of Superconductors, London equations, Penetration depth, High Temperature Superconductors, Applications of superconductors.	**07**
5.	**Advanced Engineering Materials:** Introduction, Synthesis, characterization and applications of Photonic glasses, Phosphors and Nanophosphors, other selective topics in advanced materials.	**08**
	Total	**42**

11.Suggested Books:

S. No.	Name of Books/ Authors
1.	Introduction to Solid State Physics, by C. Kittel, 1996/ John Wiley & sons
2.	Solid State Physics, by S. O. Pillai, 2010/ New Age International (P) Ltd.
3.	Materials Science and Engineering by V. Raghavan, 2009/PHI Learning Pvt. Ltd.
4.	Solid State Physics, N. W. Ashcroft and N. D. Mermin, 1976/ HBC Publication
5.	Engineering Materials Science by Milton Ohring, 1995/Academic Press
6.	Material Science and engineering: An Introduction By W. D. Callister Junior, 2007/ John Wiley & Sons, Inc
7.	Handbook of Electronic and Photonic Materials by SafaKasap, Peter Capper (Eds.), 2006/Springer

EP353 NUCLEAR SECURITY

1. Subject code: EP353 Course title: Nuclear Security
2. Contact Hours: L: 3 T: 1 P: 0
3. Examination Duration (Hrs): Theory: 3 Practical: 0
4. Relative Weight: CWS: 25, PRS:--, MTE: 25, ETE: 50, PRE: --
5. Credits: 4
6. Semester: EVEN/ODD
7. Subject area: UEC
8. Pre-requisite: Basic knowledge of Nuclear Physics
9. Objective: This course will provide basic understanding of Nuclear Security which is essential for establishing nuclear culture in the society

10. Detail of Course:5th/6th Semester

S. No.	Contents	Contact Hours
1.	Introduction to nuclear security: Basics of nuclear security, Practice and culture, Background, Objective, Scope, Structure, Nuclear security and safety culture: Characteristics of nuclear security culture	**08**
2.	Nuclear security regime, Importance of human factor and management leadership in nuclear security, Nuclear security threats: Threat informed security, The design basis threat	**07**

3.	System characterization, PPS requirements and objectives: Facility characterization, Target identification, Consequence analysis, PPS performance objectives	**06**
4.	Physical protection system technologies: Intrusion detection, Exterior and Interior Sensors, Access control, Contraband detection, Field detection sensors at borders/major public Events, Alarm assessment, Communication and display, Access delay, Response and neutralization, Response strategies and impact of On and Off site response, Cyber security.	**09**
5.	Security system design and evaluation: Adversary path analysis and Multi path optimization, Scenario development, Insider analysis, Transportation, Design approaches and vulnerability assessments, System design at major public events, Design of security systems to interrupt illicit trafficking, Analysis of quantitative risk assessment methods.	**08**
6.	Consequence mitigation and event response: Consequence management following nuclear events, Analysis of deterrence value of security measures, Roles and responsibilities of institutions and individuals	**04**
	Total	**42**

11.Suggested Books

S. No.	**Name of Books/ Authors**
1.	Nuclear security briefing book, by Wyn Bowen, Matthew Cottee, Chris Hobbs, Luca Lentini and Matthew Moran, 2014/King's College, London, UK
2.	IAEA Nuclear Security Series No. 13, Nuclear Security recommendations on physical protection of nuclear material and nuclear facilities by IAEA, 2011/International Atomic Energy Agency (IAEA)
3.	The International Legal Framework of Nuclear Security: IAEA International law series No. 4 by IAEA, 2011/International Atomic Energy Agency (IAEA)
4.	Seeking Nuclear Security Through Greater International Cooperation by Jack Boureston and Tanya Ogilvie-White, 2010/Council on Foreign Relations (CFR's) International Institutions
5.	Book Review: South Asia's Nuclear Security by Bhumitra Chakma , 2015/Oxon, UK, Routledge

HU351 ECONOMETRICS

1. Elective Paper - Econometrics

During	Subject Code	Open for Branches	Per week- L-T-P	During semester

Odd semester	351	MC, CE, EN, BT, EP, PS	3-0-1	5 th
Even semester	352	EE, EL, CO, SE, AE, ME, PE	3-0-1	6 th

(Note: i. History of this subject in DTU is different from other subjects. This subject was demanded by the students in final year. It is supported by the placement data also that number of non-technical companies visiting campus for recruitment is increasing over year.

2. Examination Duration: 3 Hrs.

3. Relative Weightage- will be decided at University level

4. Credits: 4 (Four)

5. Semester: Fifth and Sixth Semester

6. Subject Area: Economics (Social Science)

7. Pre-requisite- Nil

8. Details of Course

Syllabus Hours (Total - 56)

Unit	Contents	Contact Hrs
1	Introduction	
	1.1 What is Econometrics? Why a separate discipline? How it is different from Mathematical Economics, Type of Data, Sources of data 1.2 Estimating Economic Relationship, Methodology of Econometrics 1.3 Matrix and its Economic Application	6
2	Review of Calculus	12
	2.1 Differential Calculus and its application in Economics- Elasticity of demand- Price and Cross; Profit maximization under Perfect Competition, Monopoly, Oligopoly and Monopolistic Competition 2.2 Integral Calculus and its application in Economics - Capital Formation, Compound Interest; Capital value and Flow Value; Consumer surplus under pure competition and monopoly; Producers Surplus 2.3 Differential Equation and its application in Economics – Market Price Function; Dynamic Multiplier;	
3.	Review of Statistics	14
	3.1 Basic Ingredients of an Empirical study- Formulating a Model; Gathering data Descriptive Statistics and its use in Business- Measure of Central Tendency: AM, GM and HM, Median, Mode, Dispersion, Range, Quartile, standard Deviation, Skewness, Kurtosis, 3.2 Probability - Discrete and Continuous; Probability Distribution: Binomial and Poison distribution 3.3 Sampling techniques, Estimation and Hypothesis Testing, Interpreting	

	the results	
Mid semester		
4.	Regression	8 Hours
	Statistical verses Deterministic Relationships, Regression verses Causation; Two variable Regression Analysis; Population Regression Function (PRG), Stochastic specification of PRF; The Significance of the Stochastic Term; stochastic disturbance Term; the sample regression Function (SRF); Method of Ordinary Least Squares; Properties of Least Square Estimators: The Gauss-Markov Theorem, Coefficient of determination r^2 : A Measure of "goodness of fit"; Monto Carlo Experiments	
5.	Classical Normal Linear Regression Mode (CNLRM)	4 Hours
	The Probability distribution of Disturbances (meu); Normality Assumption, Method of Maximum Likelihood Multiple regression Analysis: The Problem of estimation; The problem of Inference Cobb-Douglas Production function; Polynomial Regression Model; Testing for structural or Parametric stability of regression Models; the Chow test	
6.	Dummy Variable (DV)	6 Hours
	Nature; ANOVA models; Regression with a mixture of Quantitative and Qualitative regressors: The ANCOVA Models; DV alternative to the Chow Test; Interaction effects using Dummy Variable; Use of DV in seasonal Analysis	
7.	Presentation on Application of Mathematics, Statistics, Operational Research , Computer Science or any other related subject to discuss any Aspect of Economics	6 hrs.

11.Suggested books

S.No.	Name of Books, Authors, Publishers
1.	Wooldridge Jeffrey , Introductory Econometrics, Cencage Learning- ISBN-13-978-81-315-1673-7; ISBN-1081-315-1673-3,2014
2.	Damodar N. Gujrati, Basic Econometrics, Mcgraw Hill Education (India) Limited, Fifth Edition,2013 ISBN-978-0-07-133345-0; ISBN; 0-07-133345-2
3.	Ramu Ramanathan, Introductory Econometrics with Applications, Harcourt Brace Jovanovich Publishers, Latest USA ISBN-

MA351 HISTORY CULTURE & EXCITEMENT OF MATHEMATICS

1. 1 Subject code: MA351 Course title: History Culture and Excitement of Mathematics
2. Contact Hours: L-3 T-0 P-0
3. Examination Duration (Hrs) Theory: 3hrs
4. Relative weightage: CWS: 25, PRS: -MTE: 25 ETE: 50 PRE: 0
5. Credits: 3
6. Semester Odd
7. Subject Area: UEC
8. Pre requisite --
9. Objective: To be capable in learning the history and culture on the Mathematics subjects

Unit No.	Contents	Contact Hours
1.	Ancient, Medieval and Modern Indian Mathematics: Aryabhata, Brahmagupta, Bhaskar, Lilavati, Ramanujan	7
2	Introduction to Ancient books of Indian Mathematicians: Sidhantas, Sulvasutras, Vedic Mathematics	7
3	Contribution of Indian Mathematicians in the field of Mathematics: Value of Pi, The symbol zero, Number theory, Trigonometry, and Mensuration, Hindu Multiplication, Long Division, Indeterminate equation	7
4	Mathematicians Around the world: Newton, Leibnitz, Cauchy, Lagrange in the field of Geometry, Calculus, Algebra, Probability	7
5	Algebra in the Renaissance: Solution of cubic equation, Ferrari's Solution in the quartic equation, Irreducible Cubics and complex numbers	7
6	Paradoxes, Fallacies and Pitfalls of Mathematics	7
	Total	42

11.Suggested books

S.No.	Name of Books, Authors, Publishers
1.	History of Mathematics, by carl B Boyer, Wiley International edition, 1968.
2.	Mathematics of Music, Susan Kelly, UW-L Journal of under graduate research, Vol-XIV, 2011.

ME 351 POWER PLANT ENGINEERING

1. Subject Code: ME 351 Course Title: Power Plant Engineering

2. Contact Hours: 42 L: 3 T: 0 P: 0

3. Examination Duration (Hrs.): Theory: 3 Practical: 0

4. Relative Weight: CWS: 25 PRS: 0 MTE: 25 ETE: 50 PRE: 0

5. Credits: 3 6. Semester: V 7. Subject Area: UEC

8. Pre-requisite: NIL

9. Objective: To familiarize the students with thermodynamic cycles and various components of power plants.

10. Details of Course:

S. No.	Contents	Contact Hours
1	Indian energy scenario, Indian coals: formation, properties, analysis, benefication and heating value calculation of coals; coking and non-coking coals, fuel handling systems; coal gasification. Classification of power plants, base load and Peak load power stations, co-generated power plant, captive power plant, and their fields of application & selection criteria,.	7
2	**Steam Generators:** High pressure utility boiler, natural and forced circulation, coking and non-coking coal, coal benefication, coal pulverization, pulverized fuel firing system, combustion process, need of excess air, cyclone furnace, fluidized bed boiler, electrostatic precipitators and wet scrubbers, boiler efficiency calculations, water treatment.	7
3	**Combined Cycle Power Plants:** Binary vapour cycles, coupled cycles, gas turbine- steam turbine power plant, gas pipe line control, MHD- Steam power plant.	7
4	**Other power plants:** Nuclear power plants - working and types of nuclear reactors, boiling water reactor, pressurized water reactor, fast breeder reactor, controls in nuclear power plants, hydro power plant -classification and working of hydroelectric power plants, tidal power plants, diesel and gas power plants.	7
5	**Instrumentation and Controls in power plants:** Important instruments used for temperature, flow, pressure, water/steam conductivity measurement; flue gas analysis, drum level control, combustion control, super heater and re-heater temperature control, furnace safeguard and supervisory system (FSSS), auto turbine run-up system(ATRS).	7
6	**Environment Pollution and Energy conservation:** Economics of power generation: load duration curves, power plant economics, pollution from power plants, disposal/management of nuclear power plant waste, concept of energy conservation and energy auditing.	7
	Total	**42**

Suggested Books:

S. No.	Name of Authors /Books / Publishers
1	**Power Plant Engineering** by M.M. Elwakil, Tata McGraw Hill, ISBN- 0070662746.
2	**Power Plant Engineering** by P.K Nag, Tata McGraw Hill, ISBN- 0070435993.
3	**Steam and Gas turbines** by A Kostyuk and V Frolov, MIR Publishers, ISBN- 9785030000329.
4.	**Modern Power Plant Engineering** by J Wiesman and R Eckart, Prentice hall India Ltd, ISBN-97801359725.
5.	**Planning Fundamentals of thermal Power Plants** by F.S Aschner, John Wiley, ISBN-07065159X.
6.	**Applied Thermodynamics** by T.D Eastop and McConkey, Longman Scientific and Technical, ISBN- 0582305351.
7.	**CEGB volumes on power plant, Cwntral Electricity Generation Board, ISBN- 0080155680.**

8.	**NTPC/NPTI publications on Power plants**, ISBN- 9788132227205.

ME353 RENEWABLE SOURCES OF ENERGY

1. Subject Code: ME 353 Course Title: Renewable Sources of Energy

2. Contact Hours: 42 L: 3 T: 0 P: 0

3. Examination Duration (Hrs.): Theory: 3 Practical: 0

4. Relative Weight: CWS: 25 PRS: 0 MTE: 25 ETE: 50 PRE: 0

5. Credits: 3 6. Semester: V 7. Subject Area: UEC

8. Pre-requisite: NIL

9. Objective: To familiarize the students with renewable energy sources like solar, geothermal, wind and tidal.

10. Details of Course:

Unit No.	Contents	Contact Hours
1	Man and Energy, world production and reserve of conventional energy sources, Indian production and reserves, Energy alternatives	7
2	Solar radiation: Origin, nature and availability of solar radiation, estimation of solar radiation. Photovoltaic cells. Design consideration and performance of different types of solar cells. Flat plate, focusing collectors. Effects of receiving surface location and orientation.	7
3	Devices for solar thermal collection and storage. Energy storage devices such as water storage systems, packed Bed storage systems, phase change storage systems. Heat transfer considerations relevant to solar energy. Characteristics of materials and surfaces used in solar energy absorption.	7
4	Application systems for space heating, solar water pumps, solar thermal pond, Solar Thermal Power plants, solar distillation, Solar Refrigeration and solar air conditioning, other solar energy utilization.	7
5	Solar PV systems. Fuel Cell Technologies. Generation and utilization of biogas, design of biogas plants, Wind energy systems.	7
6	Geothermal Energy Systems. Tidal energy systems. Oceanic power generation. Design considerations, Installation and Performance Evaluation. MHD power generations. Role of the nonconventional energy sources in power planning.	7
	Total	**42**

11.Suggested Books:

S. No.	Name of Authors /Books / Publishers
1	G. D. Rai, “Energy Technolgy”, Khanna Publishers, ISBN- 97881740907438.
2	S.P. Sukhatme, “ Solar Energy”, Tata-Mcgraw hill, New Delhi, ISBN- 0074624531.

3	"Solar Energy thermal process" JADuffie and W.A. Beckman, John Wiley& sons, New York, ISBN-1118418123.
4	Solar energy, Frank Kaieth& Yogi Goswami, Taylor and Francis, ISBN- 1560327146.
5	Treatise of Solar Energy, H.P. Garg, John Willey & sons, ISBN- 9027719306.

ME355 COMBUSTION GENERATED POLLUTION

1. Subject Code: ME 355 Course Title: Combustion Generated Pollution

2. Contact Hours: 42 L: 3 T: 0 P: 0

3. Examination Duration (Hrs.): Theory: 3 Practical: 0

4. Relative Weight: CWS: 25 PRS: 0 MTE: 25 ETE: 50 PRE: 0

5. Credits: 3 6. Semester: V 7. Subject Area: UEC

8. Pre-requisite: NIL

9. Objective: To introduce the students to different types of fuels, emissions from various engines, exhaust treatment of various engines and instruments used for measuring emissions.

10. Details of Course:

Unit No.	Contents	Contact Hours
1	Engine fundamentals: Fuels, alternative fuels for IC engines, Type of hydro carbons. Gasoline specifications. Effect of Engine parameters on performance, fuel injection for SI engines, Engine vehicle road performance, road performance and fuel economy.	7
2	Emissions and air pollution: Automotive Emissions and their role in air pollution. Photo-chemical smog. Chemistry of smog formation. Combustion in Homogeneous mixtures, emission formation. Incomplete combustion, formation of hydro-carbons, Carbon monoxide and oxides of nitrogen, Aldehyde emissions.	7
3	Influence of design and operating variables on gasoline engine exhaust emissions. Hydrocarbon Evaporative Emissions: Various sources and methods of their control. Canisters for controlling evaporative emissions. Emission control systems for gasoline engines: Blow by control closed PCV system design.	7
4	Exhaust treatment devices: Air injection into exhaust system.	7
5	Thermal reactors, Catalytic convertor. Stratified charge engines. Honda CVCC engine. Diesel engine combustion Emissions: Sources of emissions during combustion. Effect of air fuel ratio, speed, injection timing on performance and emission formation. D.I and I.D.I engine emissions.	7
6	Methods of reducing emissions, exhaust gas recirculation, smoke emission from diesel engines. Emission Instruments: Non- dispersive Infrared analyzer, Gas chromatograph,	7

	flame ionization detector, chemiluminescent analyzer	
	Total	**42**

11.Suggested Books:

S. No.	Name of Authors /Books / Publishers
1	Combustion generated air pollution, Earnest S Starkman, Springer, ISBN- 9780306305302.
2	Fundamentals of Air pollution engineering, Richard C. Hagan, Prentice Hall, ISBN- 0133325371.
3	Air pollution threat & response, David Alym, Addison-Wesley Publication, ISBN- 0201043556.

ME357 THERMAL SYSTEM

1. Subject Code: ME 357 Course Title: Thermal System

2. Contact Hours: 42 L: 3 T: 0 P: 0

3. Examination Duration (Hrs.): Theory: 3 Practical: 0

4. Relative Weight: CWS: 25 PRS: 0 MTE: 25 ETE: 50 PRE: 0

5. Credits: 3 6. Semester: V 7. Subject Area: UEC

8. Pre-requisite: NIL

9. Objective: To familiarise the students with the process of thermodynamic analysis of engineering systems and to enhance critical thinking and provide them with a wider view to handle engineering problems.

10. Details of Course:

S. No.	Contents	Contact Hours
1	**Fundamentals**: properties of pure substance in Solid, Liquid and Vapour Phases, PVT Behavior of simple compressible system, T-S and H-S diagram, Steam Tables, determination of quality of steam, Throttling Calorimeter, Combined Separating & Throttling Calorimeter, Maxwell and other thermodynamics relations, mixture of non reactive ideal gases, Real gases, Compressibility chart, Law of corresponding state, Air water vapor mixture, calculation of properties of air water vapour mixture.	7
2	**Rankine Cycle And Analysis**: Rankine cycle and its representation on T-S and H-S diagrams; Effect of low backpressure and high entry pressure and temperature and its limitations; necessity of re-heating, ideal and actual regenerative feed water heating cycle and its limitations. Typical feed water heating arrangements for various capacity power plants.	7
3	**Introduction To Boilers**: Classification of Boilers, Boiler mountings and accessories; draft systems, circulation system; Combustion and its calculations, and Boiler performance.	7
4	**Steam Nozzles**: Types of Nozzles, Flow of steam through nozzles; Condition for maximum discharge through nozzle; Nozzle efficiency. Effect of friction and Supersaturated flow through nozzle.	7
5	**Steam Turbines** : Working principle and types of steam turbines; Velocity diagrams for impulse and reaction turbines, compounding of impulse turbines;	7

	Optimum velocity ratio and maximum efficiency. Comparison of impulse and reaction turbines. Condition line and reheat-factor, losses in steam turbines; governing of steam turbines.	
6	**Condensers and Cooling towers**: Types and working of condensers, types and performance of cooling towers.	7
	Total	**42**

11.Suggested Books:

S. No.	Name of Authors /Books / Publishers
1	**Engineering Thermodynamics** by P.K.Nag, Tata McGraw Hill Publishing Company Limited, ISBN – 1259062562, 2013.
2	**Engineering Thermodynamics**byRogers, Pearson Education, ISBN- 631197036.
3	**Thermodynamics** by Kenneth Wark, Mcgraw-hill Book Company, 5th edition, ISBN- 0070682860, 1988.
4.	**Engineering Thermodynamics: work and heat transfer** by Gordon Rogers and Yon Mayhew, Longman, 4th edition, ISBN – 0471861731, 1992.
5.	**Fundamentals of Classical Thermodynamics** by Van Wylen and Sonntag, John Wiley & Sons Inc., 3rd edition, ISBN – 0471861731, 1986.
6.	**Fundamentals of Engineering Thermodynamics** by Moran and Shaprio, **John Wiley & Sons, Inc., 7th edition, ISBN – 0470917687, 2010.**
7.	**Thermodynamics: An Engineering Approach** by Cengel and Boles, The McGraw-Hill Companies, 8th edition, ISBN: 0073398179, 2014.
8.	**Applied Thermodynamics for Engineering Technologists**byT.D. Eastop, Prentice Hall, 5th edition, ISBN- 05820919344, 1993.
9.	**Treatise on Heat Engineering** by V. P.Vasandani and D.S. Kumar, Metropolitan Book Co. (p) Ltd., ISBN- 810003500.

ME359 REFRIGERATION & AIR CONDITIONING

1. Subject Code: ME 359 Course Title: Refrigeration and Air Conditioning

2. Contact Hours: 42 L: 3 T: 0 P: 0

3. Examination Duration (Hrs.): Theory: 3 Practical: 0

4. Relative Weight: CWS: 25 PRS: 0 MTE: 25 ETE: 50 PRE: 0

5. Credits: 3 6. Semester: V 7. Subject Area: UEC

8. Pre-requisite: NIL

9. Objective: To learn properties of different refrigerants, and thermodynamic cycles of refrigeration.To understand comfort parameters and air conditioning.

10. Details of Course:

Unit No.	Contents	Contact Hours
1	**Introduction to Refrigeration**: Necessity and applications, unit of refrigeration and C.O.P., types of Ideal cycles	7

	of refrigeration, air-refrigeration, bell coleman cycle, open and dense air systems, actual air-refrigeration system problems, refrigeration needs of aircrafts, actual refrigeration system	
2	**Vapour Compression Refrigeration**: Working principle and essential components of the plant, simple vapour compression refrigeration cycle - COP, Representation of cycle on T-S and p-h charts - effects of sub cooling and super heating - cycle analysis - Actual cycle, Influence of various parameters on system performance – necessity of multistaging, multistage compression system, and their analysis, necessity and working of cascading system	10
3	**Refrigerants and Absorption Refrigeration:** Desirable properties of refrigerants, classification of refrigerants used, nomenclature, ozone depletion, global warming, vapor absorption system, calculation of max COP.	4
4	**Air Conditioning**: Psychometric properties & processes, comfort air-conditioning, summer and winter air-conditioning, cooling & dehumidification systems, load calculation and applied psychrometry.	7
5	**Human Comfort:** Requirements of human comfort and concept of effective temperature, comfort chart, comfort air-conditioning, requirements of industrial air-conditioning, air-conditioning load calculations.	7
6	**Control:** Refrigeration and air-conditioning control, air handling, air distribution and duct design	7
	Total	**42**

11.Suggested Books:

S. No.	Name of Authors /Books / Publishers
1	**Refrigeration and Air Conditioning** by C. P. Arora, Tata McGraw Hill, ISBN- 9788120339156.
2	**Refrigeration and Air Conditioning** by A. R .Trott and T. C. Welch, Butterworth- Heinemann, ISBN- 9780080540436.
3	**Refrigeration and Air ConditioningTechnology** by Whitman, Jhonson and Tomczyk, Thomson Delmer Learning, ISBN- 1111644470.
4	**Refrigeration and Air Conditioning** by Abdul Ameen, Prentice Hall of India Ltd, ISBN-9789303206560..
5	**Basic Refrigeration and Air Conditioning** by P. N. Ananthanarayan, Tata McGraw Hill, ISBN-9789383286560.
6	**Refrigeration and Air Conditioning** by Wilbert F. Stoecker and Jerold W. Jones, Tata McGraw Hill, ISBN- 007061623X.
7	**Refrigeration and Air Conditioning by** Richard Charles Jordan, Gayle B. Priester, Prentice hall of India Ltd, ISBN-9780406269313.
8	**ASHRAE Handbook – Refrigeration 2010,** ISBN- 9781933742922.

ME361 INDUSTRIAL ENGINERING

1. Subject Code: ME361 Course Title: Industrial Engineering

2. Contact Hours: 42 L: 3 T: 0 P: 0

3. Examination Duration (Hrs.): Theory: 3 Practical: 0

4. Relative Weight: CWS: 25 PRS: 0 MTE: 25 ETE: 50 PRE: 0

5. Credits: 4 6. Semester: V 7. Subject Area: UEC

8. Pre-requisite: NIL

9. Objective: To make students aware of industrial engineering concepts of work study and measurement, quality control and reliability etc.

10. Details of Course:

Unit No.	Contents	Contact Hours
1	**Introduction** Introduction, Definition and objectives of Industrial Engineering, Scope of Industrial Engineering, Production systems and their classifications; Productivity- Total and partial productivity, Reasons and remedy for poor productivity	7
2	**Job analysis and Work Measurement Systems** Work System Design: Taylor's scientific management, Gilbreth's contributions; method study, micro-motion study, principles of motion economy; work measurement - stop watch time study, micro motion and memo motion, work sampling, standard data, PMTS; ergonomics; job evaluation, merit rating, incentive schemes, and wage administration; business process reengineering	7
3	**Production Planning and Control** Types and characteristics of production systems Objective and functions of Production, Planning & Control, Routing, Scheduling and Operations scheduling, production scheduling, job shop scheduling problems, sequencing problems, scheduling tools and techniques, Loading, Dispatching and its sheets & Gantt charts	7
4	**Quality Engineering** Quality concept and costs; statistical quality control, Concept of specification limits, statistical control limits, process capability, Process control and control charts for both attributes and variable data. Acceptance Sampling- Single and double sampling	7
5	**Reliability and Maintenance** Reliability, availability and maintainability; distribution of failure and repair times; determination of MTBF and MTTR, reliability models; system reliability determination; Maintenance management and its objectives, Various types of Maintenance Planning, House Keeping, 5S concepts	7
6	**Material Handling** Principles, functions, and objectives of Material Handling; Selection and classification of Material Handling Equipments; Relation of material handling with plant layout	7
	Total	**42**

11.Suggested Books

S. No.	Name of Authors /Books / Publishers
1	Industrial Engineering and Management; B. Kumar, Khanna Publication, ISBN- 8174091963, 2011.
2	Introduction to work Study, International Labour Office, Geneva, 3rd edition, Oxford and IBH publishing Co. Pvt. Ltd, New Delhi, ISBN- 8120406028, 2008.
3	Industrial Engineering and Management, Pravin Kumar, Pearson Education, 1st edition, ISBN-9789332543560, 2015.

ME363 PRODUCT DESIGN & SIMULATION

1. Subject Code: ME363 Course Title: Product Design & Simulation
2. Contact Hours: 42 L: 3 T: 0 P: 0
3. Examination Duration (Hrs.): Theory: 3 Practical: 0
4. Relative Weight: CWS: 25 PRS: 0 MTE: 25 ETE: 50 PRE: 0
5. Credits: 3 6. Semester: V 7. Subject Area: UEC
8. Pre-requisite: NIL
9. Objective: To familiarize the students with the process of product design and development.
10. Details of Course:

Unit No.	Contents	Contact Hours
1	**Stages in design process:** Introduction to various stages of the design process: Formulation of problem, Generate alternatives, Evaluation, Guided Redesign. Case study.	5
2	**Product life cycle:** New product introduction: early introduction, increased product life. Life cycle management tool, System integration, QFD, House of quality, Pugh's method, Pahl and Beitz method. Case studies	5
3	**Value engineering:** Introduction, nature and measurement of value. Value analysis job plan. Creativity. Value analysis test. Case studies	5
4	**Concurrent/ reverse engineering:** Introduction, basic principles, components, benefits of concurrent engineering. Concept of reengineering	5
5	**Material selection:** Materials in design. The evolution of engineering materials. Design tools and material data. Material selection strategy, attribute limits, selection process, material selection. Case studies	5
6	**Process selection:** Introduction. Process classification: shaping, joining and finishing. Systematic process selection, process cost. Computer – aided process selection	5
7	**Design for manufacture and assembly:** Design for Manufacture and Assembly (DFMA). Reasons for not implementing DFMA. Advantages of DFMA with case studies. Design features and requirements with regard to assembly, Design for Manufacture in relation to any two manufacturing processes: machining and injection molding. Need, objectives	4
8	**System Simulation**: Techniques of simulation, Monte Carlo method, Experimental nature of simulation, Numerical computation techniques, Continuous	4

	system models, Analog and Hybrid simulation, Feedback systems, Computers in simulation studies, Simulation software packages	
9	**Simulation of Mechanical Systems**: Building of Simulation models, Simulation of translational and rotational mechanical systems, Simulation of hydraulic systems	4
	Total	**42**

11.Suggested Books:

S. No.	Name of Authors /Books / Publishers
	TEXT BOOKS:
1	David G Ullman, "The Mechanical Design Process." Publisher- McGrawhillIncSingapore, ISBN-13: 9780072975741, 1992.
2	Kevin Otto & Kristin Wood Product Design: "Techniques in Reverse Engineering and new Product Development." 1 / e 2004 , Publisher- Pearson Education New Delhi , ISBN-13: 9780130212719,
3	L D Miles "Value Engineering."Publisher- McGraw-Hill, 1972
4	Karl T Ulrich, Steven D Eppinger , " Product Design &Development."Publisher- Tata McGrawhill New Delhi, ISBN-13: 9780078029066, 2003
5	Hollins B & Pugh S "Successful Product Design." Publisher- Butter worths London, ISBN 9780408038614.
6	N J M Roozenberg , J Ekels , N F M Roozenberg " Product Design Fundamentals and Methods ."Publisher- John Willey & Sons, ISBN-13: 9780471954651, 1995.

ME365 COMPUTATIONAL FLUID DYNAMICS

1. Subject Code: ME 365 Course Title: Computational Fluid Dynamics (CFD)

2. Contact Hours: 42 L: 3 T: 0 P: 0

3. Examination Duration (Hrs.): Theory: 3 Practical: 0

4. Relative Weight: CWS: 25 PRS: 0 MTE: 25 ETE: 50 PRE: 0

5. Credits: 3 6. Semester: V 7. Subject Area: UEC

8. Pre-requisite: NIL

9. Objective: To provide basic concepts of CFD in terms of comprehensive theoretical study and its computational aspects.

10. Details of Course:

Unit No.	Contents	Contact Hours
1	Introduction to CFD, Historical background, Impact of CFD	3
2	The Governing Equations of Fluid Dynamics Derivation, Discussion of physical meanings and Presentation of forms particularly suitable to CFD.	7
3	Mathematical Behavior of Partial Differential Equations:	6

	Impact on CFD	
4	Basic Aspects of Discretization: Introduction to Finite Difference, Finite Elements and Finite Volume Methods. Detailed treatment of Finite Difference method, explicit and implicit methods, errors and stability analysis.	12
5	Grids with Appropriate Transformations Adaptive grids and unstructured meshes. Lift reduction, down force generation and drag reduction. An introduction to the aerodynamics of airflows for cooling.	7
6	Commercial codes (e.g. FLUENT etc.). Grid generation, techniques and application. Basic principles and concepts and the characteristics of wings and diffusers	7
	Total	**42**

11.Suggested Books:

S. No.	Name of Authors /Books / Publishers
1	Computational Fluid Dynamics",John Anderson," McGraw- Hill Ltd.
2	Computational Fluid Dynamics",Tu, Elsevier.
3	Introduction to Computational Fluid Dynamics,Niyogi, Pearson Education, Delhi

ME367 FINITE ELEMENT METHODS

1. Subject Code: ME 367 Course Title: Finite Element Methods

2. Contact Hours: 42 L: 3 T: 0 P: 0

3. Examination Duration (Hrs.): Theory: 3 Practical: 0

4. Relative Weight: CWS: 25 PRS: 0 MTE: 25 ETE: 50 PRE: 0

5. Credits: 3 6. Semester: V 7. Subject Area: UEC

8. Pre-requisite: NIL

9. Objective: To enable students to apply Galerkin method and virtual work principle to problems in solid mechanics. To teach them numerical solution of differential equations with finite element method.

10. Details of Course:

Unit No.	Contents	Contact Hours
1	Fundamental concepts of the Finite Element Method. One Dimensional Problem(Bar of uniform and variable cross sections), The Galerkin Approach, The potential –Energy Approach, shape Functions, Derivation of stiffness matrix and load vector for the element and for the entire domain. Evaluation of displacement, stresses and reaction forces.	12
2	**Trusses**:-. Introduction, Plane Trusses, Local and Global coordinate Systems, Element Stiffness Matrix and Stress calculations	3
3	Two –Dimensional problem using Constant strain triangles(CST), Two-	6

	dimensional isoparametric elements and numerical integration ,element stiffness matrix, Force vector.	
4	Applications of finite element method to heat transfer.	4
5	Application of finite element method to electrical systems.	10
6	**Dynamic analysis**:- Element mass matrices,Evaluation of Eigenvalues and Eigenvectors. Use of Softwares such as MAT LAB/ABAQUS/ANSYS/ NASTRAN/IDEAS. Basic feature of these softwares.	7
	Total	**42**

11.Suggested Books:

S. No.	**Name of Authors /Books / Publishers**
1	Finite Element Procedures, K.J. Bathe, Prentice Hall of India.
2	Finite Elements in Engineering by Chandrupatla and Belegundu.
3	Finite element Method by J.N.Reddy.
4.	Finite element Method,O.C. Zienkiewicz& R.A. Taylor
5.	Finite element Analysis,C.S. Krishnamurthy
6.	Finite element Method, Kenneth H. Hubener
7.	Finite Element Method, Desai & Abel

ME369 TOTAL LIFECYCLE MANAGEMENT

1. Subject Code: ME 369 Course Title: Total Lifecycle Management

2. Contact Hours: 42 L: 3 T: 0 P: 0

3. Examination Duration (Hrs.): Theory: 3 Practical: 0

4. Relative Weight: CWS: 25 PRS: 0 MTE: 25 ETE: 50 PRE: 0

5. Credits: 3 6. Semester: V 7. Subject Area: UEC

8. Pre-requisite: NIL

9. Objective: To familiarize the students with the concept of Total Life Cycle, and applying life cycle thinking to define tradeoffs. This course also introduces to sustainability and use of renewable resources.

10. Details of Course:

Unit No.	**Contents**	**Contact Hours**
1	**Introduction:** Extensive definition of Concurrent Engineering (CE), CE design methodologies, Review of CE techniques like DFM (Design for manufacture), DFA (Design for assembly), QFD (Quality function deployment), RP (Rapid prototyping), TD (Total design), for integrating these technologies, Organizing for CE, CE tool box, Collaborative product development	8

2	**Use of Information Technology:** IT support, Solid modeling, Product data management, Collaborative product Commerce, Artificial Intelligence, expert systems, Software hardware component design.	8
3	**Design Stage:** Lifecycle design of products, Opportunities for manufacturing enterprises, Modality of concurrent engineering design, automated analysis, Idealization control, CE in optimal structural design, Real time constraints	8
4	**Need for PLM:** Importance of PLM, Implementing PLM, Responsibility for PLM, Benefits to different managers ,Components of PLM, Emergence of PLM, Lifecycle problems to resolve, Opportunities to seize	9
5	**Components of PLM:** Components of PLM, Product lifecycle activities, Product organizational structure, Human resources in product lifecycle, Methods, techniques, Practices, Methodologies, Processes, System components in lifecycle, slicing and dicing the systems, Interfaces, Information, Standards	9
	Total	**42**

11.Suggested Books:

S. No.	Name of Authors /Books / Publishers
1	Integrated Product Development M.M. Anderson and L Hein IFS Publications
2	Design for Concurrent Engineering J. Cleetus CE Research Centre, Morgantown
3	Concurrent Engineering Fundamentals: Integrated Product Development Prasad Prentice hall India
4	Concurrent Engineering in Product Design and Development I Moustapha New Age International
5	Product Lifecycle Management John Stark Springer-Verlag, UK
6	Product Lifecycle Management Michael Grieves McGraw Hill
7	Concurrent Engineering: Automation tools and Technology Andrew Kusiak Wiley Eastern

ME371 VALUE ENGINEERING

1. Subject Code: ME 371 Course Title: Value Engineering

2. Contact Hours: 42 L: 3 T: 0 P: 0

3. Examination Duration (Hrs.): Theory: 3 Practical: 0

4. Relative Weight: CWS: 25 PRS: 0 MTE: 25 ETE: 50 PRE: 0

5. Credits: 3 6. Semester: V 7. Subject Area: UEC

8. Pre-requisite: NIL

9. Objective: To understand the concept and approaches of value analysis and engineering with an emphasis on case studies.

10. Details of Course:

Unit No.	Contents	Contact Hours
1	An Overview Of Value Engineering-Concepts and approaches of value analysis	8

	and engineering - importance of value, Function - identity, clarify – analysis	
2	Evaluation of VE-Evaluation of function, Problem setting system, problem solving system, setting and solving management - decision - type and services problem, evaluation of value	8
3	Results accelerators, Basic steps in using the systems	8
4	Understanding the decision environment, Effect of value analysis on other work in the business- Life Cycle Cost (LCC), Case studies	9
5	VE Level Of Effort-VE Team, coordinator, designer, different services, definitions, construction management contracts, value engineering case studies, Effective organization for value work, function analysis system techniques- FAST diagram, Case studies	9
	Total	**42**

11.Suggested Books:

S. No.	Name of Authors /Books / Publishers
1	Parker, D.E., "Value Engineering Theory", Sundaram publishers, 1990
2	Miles, L.D., "Techniques of Value Engineering and Analysis", McGraw Hill Book Co., 2nd End., 1972
3	Khanna, O.P., "Industrial Engineering and Management", Dhanpat Rai and Sons, 1999.

MG351 FUNDAMENTALS OF FINANCIAL ACCOUNTING AND ANALYSIS

1. Subject Code : MG351 Course Title: Fundamentals of Financial Accounting and Analysis
2. Content Hours L: 3 T: 0 P: 0
3. Examination Duration (ETE)(Hrs.): Theory 3 Hrs Practical 0
4. Relative Weightage: CWS: 25 PRS MTE: 25 ETE : 50 PR
5. Credits: 3
6. Semester: Third (ME+AE+PE+CE+ENE+BT+MC+AP+PT)/ Fourth (COE+IT+SE+EC+ EE+EEE)
7. Subject Area: Management
8. Pre-requisite: Nil
9. Objective: Familiarizing the students with the financial environment of business, especially the financial markets and acquaint them with accounting mechanics, process and system.
10. Details of Course:

Unit No.	Detail Contents	No. Of

		Hrs.
1	**Introduction to Management** :Basic concepts of management, management process, principles of management, functions, levels, managerial roles and skills, managerial ethics and corporate social responsibility	8
2	**Introduction to Financial Environment and accounting:** Financial Markets - Capital Markets, Basics of capital market mechanism, instruments, financing and rating institutions. Importance, Objectives and Principles of Accounting, Accounting Concepts and conventions, and the Generally Accepted Accounting Principles (GAAP) Overview of the Accounting Process. Accounting standards as Issued by Institute of Chartered Accountants of India (ICAI).	10
3	**Overview of Business Activities and Principal Financial Statements:** Observe the types of information provided by the three principal financial statements and how firms might use this information in managing and evaluating a business. Understand the rationale and the information value of the statements of Balance Sheet, Profit and Loss statement, cash flows.	8
4	**Financial Analysis-I:** Distinction between cash profits and book profits. Understanding the cash flow statement and the funds flow statement.	8
5	**Financial Analysis –II**: Importance, objectives and concept of Ratio Analysis- Liquidity, leverage, solvency and profitability ratios.	8
	Total	**42**

11.Suggested Books

S. No.	**Name of Books / Authors/ Publishers**
1	Fundamental of Management, Stephen P. Robbins, David A. De Cenzo and Mary Coulter, Pearson Education,2011, ISBN- 978-0273755869
2	Introduction to Accountancy, 10 ed., T.S. Grewal, S. Chand and Company (P) Ltd., New Delhi,2009, ISBN- 9788121905695
3	Advance Accounts by M.C Shukla and T.S Grewal and SC Gupta, S. Chand and Company (P) Ltd., New Delhi,1997, ISBN- 9788121902786
4	Financial Accounting, 4 ed, S.N. Maheshwari and S.K. Maheshwari, Vikas Pulication,2005, ISBN- 8125918523
5	Financial Accounting Reporting & Analysis, Cengage, 7/e, W Albrecht Stice & James Stice, Cengage Learning,2010, ISBN- 0538746955

MG353 FUNDAMENTALS OF MARKETING

1. Subject Code :MG353 Course Title : Fundamentals of Marketing
2. Content Hours L: 3 T: 0 P: 0
3. Examination Duration (ETE)(Hrs.): Theory: 3 Hrs Practical 0
4. Relative Weightage: CWS:25 PRS MTE:25ETE:50PR
5. Credits: 3
6. Semester: Third (ME+AE+PE+CE+ENE+BT+MC+AP+PT)/ Fourth (COE+IT+SE+EC+ EE+EEE)
7. Subject Area: Management
8. Pre-requisite: Nil
9. Objective: The basic objective of this paper is to make students aware of fundamental concepts of marketing necessary for making decisions in complex business situations by managers and start up entrepreneurs.
10. Details of Course:

Unit No.	Detail Contents	No. Of Hrs.
1	**Basic concepts of management**: management process, principles of management, functions, levels, managerial roles and skills, managerial ethics and corporate social responsibility	8
2	**Introduction to marketing**: nature and scope of marketing, marketing mix, marketing vs. sales, role of marketing in society, interface of marketing with other departments in organization, Customer Life Time Value, ethical issues in marketing Concept of market segmentation: consumer and industrial, targeting and positioning, sales forecasting	9
3	**Product mix decisions:** new product development process, test marketing, concept of Product Life Cycle, product packaging decisions	8
4	**Pricing decisions** : consideration in setting price, major pricing strategies, promotional mix decisions: advertising, sales promotion, personal selling, publicity, opportunities and avenues of online promotion	9
5		9

	Promotion and distribution decisions :design and management of distribution channel for physical products and services, reasons of channel conflict, handling strategies, basic challenges in supply chain management of e-commerce firms	
	Total	**42**

11. Suggested Books

Unit No.	**Name of Books / Authors/ Publishers**
1	Fundamental of Management, Stephen P. Robbins, David A. De Cenzo and Mary Coulter, Pearson Education, 2011, ISBN-978-0273755869
2	Marketing Management, 14th ed., Philip Kotler , Kevin Lane Keller, Abraham Koshy and MithileswarJha, Pearson Education, New Delhi, 2013,(**ISBN-10:** 9788131767160)
3	Marketing, 14th ed., Etzel, Bruce J Walker, William J Stanton and Ajay Pandit, Mc Graw Hill Education, 2009, ISBN -9780070151567
4.	MKTG, Charles W Lamb, Joe F Hair, Carl NcDaniel and Dheeraj Sharma, Cengage Learning,2012, ISBN- 9788131517086
5.	Marketing Management, RajanSaxena, Tata Mc Graw Hill Education, 2005, ISBN- 9780070599536

MG355 HUMAN RESOURCE MANAGEMENT

1. Subject Code : MG355 Course Title : Human Resource Management
2. Content Hours L: 3 T: 0 P: 0
3. Examination Duration (ETE)(Hrs.): Theory: 3 Hrs Practical 0
4. Relative Weightage: CWS:25 PRS MTE:25 ETE:50 PR
5. Credits: 3
6. Semester: Third (ME+AE+PE+CE+ENE+BT+MC+AP+PT)/ Fourth (COE+IT+SE+EC+ EE+EEE)
7. Subject Area: Management
8. Pre-requisite: Nil
9. Objective: To develop necessary understanding in design and execution of human resource strategies for the achievement of organization goals.

10. Details of Course**:**

Unit No.	Content	Contact hours
1.	**Basic concepts of management:** management process, principles of management, functions, levels, managerial roles and skills, managerial ethics and corporate social responsibility	8
2.	**Introduction:** Concept, nature, scope, objectives and importance of HRM; Evolution of HRM; Environment of HRM; Personnel Management vs HRM. Acquisition of Human Resources: HR Planning; Job analysis – job description and job specification; recruitment – sources and process; selection process – tests and interviews; placement and induction. Job changes – transfers, promotions/demotions, separations.	9
3.	**Training and Development:** Concept and importance of training; types of training; methods of training; design of training programme; evaluation of training effectiveness; executive development – process and techniques; career planning and development.	8
4.	**Performance Appraisal:** Performance appraisal – concept and objectives; traditional and modern methods, limitations of performance appraisal methods.	8
5.	**Compensation and Maintenance:** Compensation: job evaluation – concept, process and significance; components of employee remuneration – base and supplementary; maintenance: overview of employee welfare, health and safety, social security.	9
	Total	42

11.Suggested Books

S. No	Name of the book /Authors /Publishers
1	Fundamental of Management, Stephen P. Robbins, David A. De Cenzo and Mary Coulter, Pearson Education, 2011, ISBN-978-0273755869
2	**Human Resource Management, G. Dessler, B. Varkkey, Pearson prentice Hall, 2011, (ISBN – 978-81-317-5426-9)**
3	International HRM a cross cultural approach, T. Jackson, Sage publications, London, 2002, (ISBN – 0-7619-7404-0)
4	HRM and Performance: Achievements and Challenges, D. E. Guest, J .Paauwe, P. Wright, John Wiley and sons, UK, 2013, (ISBN – 978-1-118-48261-2)

5	A Handbook of Human Resource Management Practice, M. Armstrong, Kogan Page Limited, UK, 2007 ,(ISBN – 978–0–7494–4631-4)

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MG357 KNOWLEDGE AND TECHNOLOGY MANAGEMENT

1. Subject Code :MG 357 Course Title : Knowledge and Technology Management
2. Content Hours L: 3 T: 0 P: 0
3. Examination Duration (ETE)(Hrs.): Theory: 3 Hrs Practical 0
4. Relative Weightage: CWS:25 PRS MTE:25 ETE:50 PR
5. Credits: 3
6. Semester: Third (ME+AE+PE+CE+ENE+BT+MC+AP+PT)/ Fourth (COE+IT+SE+EC+ EE+EEE)
7. Subject Area: Management
8. Pre-requisite: Nil
9. Objective: Preparing the students to understand how the new age organizations are leveraging on the power of knowledge and technology. Acquiring the knowledge to address the issues faced by the corporate world for a deeper understanding.
10. Details of Course:

Unit No.	Contents	Contact Hours
1.	**Basic concepts of management**, management process, principles of management, functions, levels, managerial roles and skills, managerial ethics and corporate social responsibility	8
2.	Introduction to Knowledge Management: Data, Information, Knowledge Management (KM), Knowledge Society, Knowledge Economy, Types of Knowledge, Tacit knowledge and explicit knowledge, Essential components of KM model Building Knowledge Assets: Various knowledge assets, Tools of Knowledge, Knowledge Audit, AAR (After Action Review), Analyzing current knowledge state.	9
3.	Creating Strategies for Success: KM strategy, Codification, Personalization, Knowledge Management Implementation, Generating a KM-specific vision, Integrating organizational and business goals with KM, Choosing the right KM techniques, Relevant case studies in this area.	9

4.	Understanding Technology: Definition, Key concepts, Need for technology, History of technological developments, Role and importance of technology in 21st century, Recent developments in the field of technology.	8
5.	Technology-Management integration: Management as a concept, Technology management, Life cycle approach to technology management, Innovation, Creativity, Technology innovation process.	8
	Total	**42**

11.Suggested Books

S. No.	Name of Books /Authors/Publishers
1.	Fundamental of Management, Stephen P. Robbins, David A. De Cenzo and Mary Coulter, Pearson Education,2011, ISBN-978-0273755869
2	Knowledge Management in Organizations: A Critical Introduction, Donald Hislop, Oxford University Press,2013, ISBN: 9780199691937.
3	The Knowledge-Creating Company: How Japanese Companies Create the Dynamics of Innovation, IkujiroNonaka and Hirotaka Takeuchi, Oxford University Press,1995, ISBN: 0195092694.
4	Hitotsubashi on Knowledge Management (Hardcover), Hirotaka Takeuchi and IkujiroNonaka, John Wiley and Sons, 2004, ISBN: 0470820748.
5	Management of Technology: The Key to Competitiveness and Wealth Creation, Tarek Khalil and Ravi Shankar, McGraw Hill Education (India) Private Limited, 2nd Edition, 2012, ISBN: 9780070677371.

PE351 ADVANCED MACHINING PROCESS

1. Subject Code: PE-351 Course Title: Advanced Machining Process

2. Contact Hours*:* L: 3 T: 0 P: 0

3. Examination Duration (Hrs.): Theory: 3 Practical: 0

4. Relative Weight: CWS: 25 PRS: 0 MTE: 25 ETE: 50 PRE: 0

5. Credits: 3 6. Semester: V 7. Subject Area: UEC

8. Pre-requisite: NIL

9. Objective: To understand basic principles of various processes and their applications. State various parameters influencing the machining process.

10. Details of Course:

Unit No.	Contents	Contact Hours
1	Introduction, need of advanced machining processes, hybrid processes, microelectro mechanical system, (MEMS), nano electromechanical systems(NEMS),Ultrasonic micro machining - mechanics of cutting, parametric analysis, process capabilities, applications.	7
2	Abrasive jet machining: Introduction, set ups, gas propulsion system, abrasivefeeder, machining chamber, AJM nozzle, abrasive parametric analysis, processcapabilities, applications, abrasive micro machining, Water jet machining:Introduction, process characteristics, process performance, applications, Abrasive Water jet machining: Abrasive finishing process: Working principle, parametric analysis, process variables, process performance and applications,	8
3	Abrasive flow machining- Working principle, parametric analysis, process variables, process performance and applications, Magnetorheological abrasive flow finishing- Working principle, parametric analysis,process variables, process performance and applications, Magnetic float polishing,Magnetic abrasive finishing- Working principle, parametric analysis, processvariables, process performance and applications	10
4	Electro discharge machining (EDM): Introduction, Working principle, parametricanalysis, process variables, process characteristics, applications, hybrid processessuch as electro discharge grinding, diamond grinding, wire EDM, Electrodischargemicro grinding,	7
5	Laser beam machining- production of laser, working principle, types of laser, processcharacteristics and applications. Electron beam machining: Working principle,process parameter, process characteristics, and applications. Ion beam machining:Working principle, process parameter, process characteristics, and applications.	8
6	Plasma arc machining: Working principle, Plasma arc cutting system, applications.	2
Total		**42**

11. Suggested Books:

S. No.	Title, Author, Publisher and ISBN No.
1	Advanced machining process, Dr.V.K.Jain, Allied publisher, **ISBN**:978-81-7319-915-8.
2	Non traditional methods of manufacturing, Shan&Pandey, **ISBN**, 0070965536

PE353 SUPPLY CHAIN MANAGEMENT

1. Subject Code: PE-353 Course Title: Supply Chain Management

2. Contact Hours: L: 3 T: 0 P: 0

3. Examination Duration (Hrs.): Theory: 3 Practical: 0

4. Relative Weight: CWS: 25 PRS: 0 MTE: 25 ETE: 50 PRE: 0

5. Credits: 3 6. Semester: V 7. Subject Area: UEC

8. Pre-requisite: NIL

9. Objective: To understand the key considerations at the various stages involved in the supply of product in order to maintain the smooth flow from source to the point of consumption so that overall organizational performance may improve.

10. Details of Course:

Unit No.	Contents	Contact Hours
1	**Introduction:**Perspective of Supply Chain Management, Managing uncertainty, Key issue in supply chain management.	6
2	**Inventory Management and Risk Pooling:** Inventory management, Classification of inventory, Centralized versus Decentralized Warehousing and Risk pooling, Value of Information, Quantification of Bullwhip effect, Causes and remedies of Bullwhip effect.	8
3	**Resource planning:** Aggregate Production Planning- Chase and leveling strategies, MRP, MRP-II, Agile manufacturing Systems	6
4	**Procurement and Outsourcing strategies:**Introduction, outsourcing benefits and risks, Make/Buy decision, e-procurement, Vendor selection and quota allocation.	7
5	**Strategic Alliances:** Introduction, Third party logistics, Demand driven strategies,	8

	Distribution strategies- direct shipment, cross docking, transshipment, Supplier relationships management, Customer relationship management.	
6	**International Issues in Supply Chain Management:** Concepts in Globalization, Globalization forces, Risks and Advantages of International supply chains, Issues in International supply chain management, Regional differences in logistics.	7
Total		**42**

11. Suggested Books:

S. No.	**Title, Author, Publisher and ISBN No.**
1.	Simchi-Levi, Kaminsky, Philip K. and 'Designing and Managing the Supply Chain: Concepts, Strategic and Case Studies', McGraw-Hill/Irwin, (ISBN, 10: 0072357568, 13: 978-0072357561).
2	Supply Chain Management by Chopra and Mendle, **ISBN**: 9780132743952
3	Supply Chain Management: Text and Cases by JannatSah.,**ISBN**-10: 8131715175.

PE355 WORK STUDY DESIGN

1. Subject Code: PE-355 Course Title:Work Study Design

2. Contact Hours: L: 3 T: 0 P: 0

3. Examination Duration (Hrs.): Theory: 3 Practical: 0

4. Relative Weight: CWS: 25 PRS: 0 MTE: 25 ETE: 50 PRE: 0

5. Credits: 3 6. Semester: V 7. Subject Area: UEC

8. Pre-requisite: NIL

9. Objective: To provide basic understanding to the students about the concept and significance of work study and ergonomics. To impart thorough knowledge to the students about various techniques of work-study for improving the productivity of an organization.

10. Details of Course:

Unit No.	**Contents**	**Contact Hrs**

1	Productivity: Definition, reasons for low productivity, methods to improve productivity, Work-study and productivity	4
2	Human factor in work-study: Relationship of work-study man with management, supervisor & workers, qualities of a work-study man.	5
3	Method-study: Definition, objectives, step-by-step procedure, questioning techniques, charts and diagrams for recording data. Like outline process charts, flow process charts, multiple activity charts, two handed process chart, string diagram, travel chart, cycle graph, Chrono-cycle graph, therbligs, micro motion study and film analysis, Simo chart, principles of motion economy. Development and installation of new method..	9
4	Work-Measurement: Definition, various techniques of work-measurement work-sampling, stopwatch time study & its procedure, Job selection, Equipment and forms used for time study, rating, methods of rating, allowances and their types, standard time, numerical problems, predetermined - time standards and standard data techniques. Incentive: Meaning, objectives of an incentive plan, various types of incentive plans	9
5	Ergonomics: Introduction, history of development, man-machine system and its components. Introduction to structure of the body- features of the human body, stress and strain, metabolism, measure of physiological functions- workload and energy consumption, biomechanics, types of movements of body members, strength and endurance, speed of movements. NIOSH lifting equation, Lifting Index, Maximum acceptable Weights and Forces, Distal upper extremities risk factors, Strain Index, RULA, REBA.	8
6	Applied anthropometry - types, use, principles in application, design of work surfaces and seat design. Visual displays for static information, visual displays of dynamic information, auditory, tactual and olfactory displays and controls. Assessment of occupational exposure to noise, heat stress and dust .Effect of vibration/ noise, temperature, illumination and dust on human health and performance	7
Total		**42**

11. Suggested Books:

S. No.	**Title, Author, Publisher and ISBN No.**
1.	Barnes Ralph M., "Motion & Time study: Design and Measurement of Work", Wiley Text Books, **ISBN-10:** 8126522178, 2009.
2	Marvin E, Mundel& David L, "Motion & Time Study: Improving Productivity", Pearson Education,**ISBN-10:** 0136030440, 2000.
3	Benjamin E Niebel and FreivaldsAndris, "Methods Standards & Work Design", McGraw Hill,**ISBN-10**1259064840, 1997.
4	International Labour organization, "Work-study", Oxford and IBH publishing company Pvt. Ltd.,

	N.Delhi, **ISBN-10** 8120406028, 2001

PE357 PRODUCT DESIGN & SIMULATION

1. Subject Code: PE-357 Course Title: Product Design & Simulation

2. Contact Hours: L: 3 T: 0 P: 0

3. Examination Duration (Hrs.): Theory: 3 Practical: 0

4. Relative Weight**:** CWS: 25 PRS: 0 MTE: 25 ETE: 50 PRE: 0

5. Credits: 3 6. Semester: V 7. Subject Area: UEC

8. Pre-requisite: NIL

9. Objective: To allow students to develop the technical, analytical, and managerial skills necessary to perform the tasks successfully.

10. Details of Course:

Unit No.	Content	Contact Hours
1	**Stages in design process:** Introduction to various stages of the design process: Formulation of problem, Generate alternatives, Evaluation, Guided Redesign. Case study.	6
2	**Product life cycle:** New product introduction: early introduction, increased product life. Life cycle management tool, System integration, QFD, House of quality, Pugh's method, Pahl and Beitz method. Case studies.	6
3	**Value engineering:**Introduction, nature and measurement of value. Value analysis, job plan. Creativity and techniques of creativity. Value analysis test. Case studies. **Material selection:**Materials in design. The evolution of engineering materials. Design tools and material data. Functional material, shape and process. Material selection strategy, attribute limits, selection process, common methods of material selection. Case studies.	6
4	**Concurrent/ reverse engineering:** Introduction, basic principles, components, benefits of concurrent engineering. Concept of reengineering.	6

	Process selection: Introduction. Process classification: shaping, joining and finishing. Systematic process selection, Ranking, process cost. Computer – aided process selection.	
5	**Design for manufacture and assembly:**Design for Manufacture and Assembly (DFMA). Reasons for not implementing DFMA. Advantages of DFMA with case studies. Design features and requirements with regard to assembly, product Design for Manufacture in relation to any two manufacturing processes: machining and injection molding. Need, objectives.	8
6	**System Simulation**: Techniques of simulation, Monte Carlo method, Experimental nature ofsimulation, Numerical computation techniques, Continuous system models, Analog andHybrid simulation, Feedback systems, Computers in simulation studies, Simulation softwarepackages. **Simulation of Mechanical Systems**: Building of Simulation models, Simulation oftranslational and rotational mechanical systems, Simulation of hydraulic systems.	10
	Total	**42**

11. Suggested Books:

S. No.	**Title, Author, Publisher and ISBN No.**
1	**Product Design and Development**, "Karl T. Ulrich, Steven D. Eppinger"Mc GrawHill.**ISBN:**9780072296471
2	**Integrated Product and Process Development**, "John M. Usher, Utpal Roy and H. R. Parasaei.ISBN: 978-0-471-15597-3
3	**Product Design for Manufacture and Assembly**, "G. Boothroyd, P. Dewhurst and W. Knight" MarceDaker.ISBN:978-1420089271
4.	**Engineering Design and Design for Manufacturing**: A structured approach, "John R. Dixon and CPoli" Field Stone Publishers, USA. ISBN: 9780964527201
5.	**Material Selection in Mechanical Design**, "M. F. Ashby"Elsevier. ISBN: 9780080419077

PE359 TOTAL LIFE CYCLE MANAGEMENT

1. Subject Code: PE359 Course Title: Total Life Cycle Management

2. Contact Hours: L: 3 T: 0 P: 0

3. Examination Duration (Hrs.): Theory: 3 Practical: 0

4. Relative Weight**:** CWS: 25 PRS: 0 MTE:25 ETE:50 PRE: 0

5. Credits: 3 6. Semester: V 7. Subject Area: UEC

8. Pre-requisite: NIL

9. Objective: To familiarize the students with the concept of Total Life Cycle, management of old vehicles, applying life cycle thinking to define tradeoffs. This course also introduces to sustainability, use of renewable resources.

10. Details of Course:

S. No.	Contents	Contact Hours
1	**Introduction :** Definition of Total Life Cycle (TLC) – Conceptof TLC - Life Cycle Impacts - Integrating Life Cycle Technologies- Products and Processes Within TLC - TLC Methodology- TLC AccessementData to Complex Products – ResultantImprovement for Product	8
2	**Vehicles End of Life** : Design for End of Old VehicleManagement - Problems of Old Vehicles in EmergingMarkets - Recovery and Economic Feasibility of MaterialsSuch As Plastic, Rubber, Aluminium, Steel, etc.	8
3	**Trade-offs :** Applying Life Cycle Thinking to Define TradeoffsAlong the Supply, Manufacture - Use and End of Life Chain- Effects on the Customer - Expectation of the Customer -Evaluate Product Cost on Fuel Consumption, Emission,Durability, Environment and Health	10
4	**Sustainability:**What Is Sustainability - Use of RenewableResources - View to Design Horizon.	8
5	**Harmonization of Environmental Goals:** TLC for Emerging Vs Developed Markets - Rules and Regulations to Guide Designers - International Common Practices for End of LifeVehicles.	8
	Total	**42**

11. Suggested Books:

S. No.	Name of Authors /Books / Publishers
1	Life Cycle Management Case Study of an Instrument Panel /SAE, 1997/
2	Accident Reconstruction: Automobiles, Tractor-semitrailers, Motorcycles, and Pedestrians /Society of Automotive Engineers, 1987 /0898834546, 9780898834543.

PE361 TOTAL QUALITY MANAGEMENT

1. Subject Code: PE-361 Course Title: Total Quality Management

2. Contact Hours: L: 3 T: 0 P: 0

3. Examination Duration (Hrs.): Theory: 3 Practical: 0

4. Relative Weight: CWS: 25 PRS: 0 MTE: 25 ETE: 50 PRE: 0

5. Credits: 3 6. Semester: V 7. Subject Area: UEC8. Pre-requisite: NIL

9. Objective: To understand the philosophy and core values of Total Quality Management (TQM); determine the voice of the customer and the impact of quality on economic performance and long-term business success of an organization;

10. Details of Course:

Unit No.	Content	Contact Hours
1	**Introduction to Quality-** Definition of Quality- product, user, value, and manufacturing based perspectives, Dimensions of Quality, Quality Planning, Quality costs- optimization of quality costs, seven tools of quality control;Philosophies of Quality Gurus- Deming, Juran, Crosby, Feigenbaum, Ishikawa, Taguchi. Comparison of Quality Philosophies.	9
2	**Statistical Process Control-**Introduction to Quality characteristics-variables and attributes, Types and causes of variations, Control Charts for variables and attributes, Process capability.	8
3	**Acceptance Sampling-**Sampling process and lots formation; Advantages and applications of acceptance sampling; characteristics of O.C. Curve; Single, double, multiple, sequential sampling; ASN, ATI, AOQL, AOQ, AQL, LQL, Producer's and Consumer's risks.	7
4	**Six Sigma and ISO 9000:2000-** Principles of Six Sigma, Statistical basis, Tools and techniques, DMAIC principle, application of six sigma in manufacturing and service organizations, structure of ISO standards, Factors leading to ISO, Implementation and registration, Benefits of ISO.	6
5	**Life Testing-Reliability-**Life testing: objective, failure data analysis, MTTF, MTBF, hazard rate, exponential and Weibull models, system reliability-series, parallel and mixed configurations, Markov model.	6
6	**Reliability Design and Allocation-** Design for reliability, reliability improvement techniques, active redundancy and standby redundancy,	6

	K-out-of-N redundancy and maintenance policies.	
	Total	**42**

11. Suggested Books:

S. No.	Title, Author, Publisher and ISBN No.
1.	Evans JR,Lindsay WM, "The Management and Control of Quality", Cengage learning, India, **ISBN-10:** 8131501361, 2011
2	BediKanishka,"Quality Management",Oxford University Press India, **ISBN-10:** 0195677951, 2006
3	Besterfield,"Total Quality Management", Pearson Education, **ISBN-10:** 9332534454, 2015
4	Gryna FM, Chua RCH, Defeo JA, "Juran‟s Quality Planning and Analysis for Enterprise Quality", McGraw Hill Education (India) Private Limited, **ISBN-10:** 0070618488, 2006

PT361 HIGH PERFORMANCE POLYMERS

1. Subject Code: PT361 Course Title: High Performance Polymers
2. Contact Hours: L: 03 T: 00 P: 00
3. Examination Duration (Hrs.): Theory: 03 Practical: 00
4. Relative Weight: CWS: 25 PRS: 00 MTE: 25 ETE: 50 PRE: 00
5. Credits: 03
6. Semester: ODD-V
7. Subject Area: UEC
8. Pre-requisite: NIL
9. Objective: To impart knowledge about heat resistant polymers, liquid crystalline polymers, conducting and other special polymers.

10. Details of Course

S. No.	Contents	Contact Hours
1	Heat resistant polymers: Requirements for heat resistance, Determination of heat resistance, Synthesis, Structure-property relationships, Applications of heat resistant polymers like polyamides, polyimides and its derivatives, polyquinolines, polyquinoxalines, PBT, PBO, PBI, PPS, PPO, PEEK, engineering plastic blends.	9
2	Liquid crystalline polymers, Concept of liquid crystalline phase, Theories of liquid crystallinity, Characteristics of LC state and LCPs, Rheology of liquid crystalline polymers, Blends of LCPs, Self reinforced composites, Applications.	9

3	Conducting polymers, Conduction mechanism, semi-conductors and conducting polymers, Band theory, Doping of polymeric systems, Processing and testing of conducting polymers, Applications and recent advances in conducting polymers.	9
4	Synthesis and applications of photosensitive polymers, Curing reactions.	6
5	Polymers in specialty applications: Polymers in agricultural applications, Green houses, Mulches, Control release of agricultural chemicals, Seed coatings, Polymers in construction and building applications.	9

11. Suggested Books

S. No.	Name of Books/Authors/Publisher
1	Encyclopedia of Polymer science and Engineering Vol.1-17/ J.I. Kroschwitz, 2007
2	Additive for coatings/ John Bieleman/ Wiley-VCH, 2000.
3	Fire Properties of Polymeric Composites Materials/ A.P. Mouritz, A G. Gibson/ Springer, 2006.
4	Modern Biopolymers science: Bridging the divide between fundamentals treatise and industrial application/S. Kasapis, I.T. Nortan, J.B. Ubbink/ Elsevier 2009

PT363 SEPARATION TECHNOLOGY

1. Subject Code: PT363 Course Title: Separation Technology
2. Contact Hours: L: 03 T: 00 P: 00
3. Examination Duration (Hrs.): Theory: 03 Practical: 00
4. Relative Weight: CWS: 25 PRS: 00 MTE: 25 ETE: 50 PRE: 00
5. Credits: 03
6. Semester: ODD-V
7. Subject Area: UEC
8. Pre-requisite: NIL
9. Objective:
10. Details of Course

Unit No.	Contents	Contact Hours
1	Separation factors and its dependence on process variables, classification and characterization, thermodynamic analysis and energy utilization, kinetics and mass transport, Theory of cascades and its applications.	7
2	Membrane Separations, Merits and demerits, Commercial, pilot plant polarization of membrane processes and laboratory membrane permeators, Dialysis, Reverse osmosis, Ultrafiltration, Membrane	7

	operations, Design controlling factors.	
3	Separation by Sorption Techniques, Types and choice of adsorbents, chromatographic techniques, Retention theory mechanism, Design controlling factors, ion exchange chromatography equipment and commercial processes, recent advances in sorption technology.	7
4	Ionic Separations: Theory, mechanism and equipments for electrophoresis, dielectrophoresis and electro dialysis, Controlling factors, Applications, Design considerations.	7
5	Thermal Separation: Thermal diffusion, Rate law, Theories of thermal diffusion for gas and liquid mixtures, Equipments design and applications, Zone melting, Equilibrium diagrams, Controlling factors, Apparatus and applications.	7
6	Other Techniques: Adductive crystallization, Molecular addition compounds, Clathrate compounds and adducts, Equipments, Applications, Economics and commercial processes. Foam Separation: Surface adsorption, Nature of foams, Apparatus, Applications and Controlling factors.	7

11. Suggested Books

S. No.	Name of Books/Authors/Publisher
1	New Chemical Engineering Separation Techniques/ Schoen/ Wiley Interscience, New York, 1972.
2	Separation Processes/ C.J. King/ Tata McGraw Hill, New Delhi,1982.
3	Bioseparations – Principles and Techniques/ B. Sivasankar/ Prentice Hall of India Pvt. Ltd, New Delhi, 2005.
4	Separation process Principles/ Seader, Henley and Roper/ John Wiley & Sons 2010
5	Membrane Separation processes/ Kaushik Nath/ PHI , 2008.

PT365 NON-CONVENTIONAL ENERGY

1. Subject Code: PT365 Course Title: Non-Conventional Energy
2. Contact Hours: L: 03 T: 00 P: 00
3. Examination Duration (Hrs.): Theory: 03 Practical: 00
4. Relative Weight: CWS: 25 PRS: 00 MTE: 25 ETE: 50 PRE: 00
5. Credits: 03
6. Semester: ODD-V
7. Subject Area: UEC
8. Pre-requisite: NIL
9. Objective: To make student aware about the fundamentals and applications of non-conventional energy.

10. Details of Course

Unit No.	Contents	Contact Hours
1	Renewable and non-renewable energy sources, trends in energy consumption, Global and National scenarios, Prospects of renewable energy sources, Energy Management.	6
2	Solar Energy: Solar radiation - beam and diffuse radiation, solar constant, earth sun angles, measurement of solar radiation, flat plate collectors, concentrating collectors, Solar air heaters-types, solar driers, Storage of solar energy-thermal storage, Photo voltaics - solar cells & its applications.	6
3	Wind Energy: Basic system principles, Assessment of wind available, Design principles, Manufactured designs, Sizing and storage of energy, System efficiency, Overview of wind industry.	4
4	Energy from Biomass: Calorific value of Biomass samples, Pyrolysis, Biomass conversion technologies, Biogas generation plants, classification, advantages and disadvantages, constructional details, site selection, digester design consideration, filling a digester for starting, maintaining biogas production, Fuel properties of bio gas, utilization of biogas.	6
5	Geothermal Energy: Estimation and nature of geothermal energy, geothermal sources and resources like hydrothermal, geo-pressured hot dry rock, magma. Advantages, disadvantages, and application of geothermal energy.	4
6	Ocean Energy: Ocean Thermal Electric Conversion systems like open cycle, closed cycle, Hybrid cycle. Energy from tides, basic principle of tidal power, single basin and double basin tidal power plants, advantages, limitation and scope of tidal energy. Wave energy and power from wave, wave energy conversion devices, advantages and disadvantages of wave energy.	4
7	Magnetohydrdynamic Power Generation: Principle of MHD power generation, MHD system, Design problems and developments, gas conductivity, materials for MHD generators and future prospects.	4
8	Fuel Cells: Design principle and operation of fuel cell, Types of fuel cells, conversion efficiency of fuel cell, applications of fuel cells.	4
9	Hydrogen Energy: Hydrogen Production methods, Hydrogen storage, hydrogen transportation, utilization of hydrogen gas, hydrogen as alternative fuel for vehicles.	4

11. Suggested Books

S. No.	Name of Books/Authors/Publisher
1	Principles of Sustainable Energy Systems, Second Edition/ Frank Kreith, Susan Krumdieck/ CRC Press, 2013.

2	Non-conventional energy sources/ G.D. Rai/ Khanna Publishers, 2004.
3	Solar Energy: Fundamentals and Applications/ H.P. Garg & Jai Prakash/ Tata McGraw Hill, 2000
4	Solar Engineering of Thermal Processes/ Duffic and Beckman/ John Wiley, 2013
5	Non Conventional Energy Resources/ Saeed and Sharma/ S.K. Kataria& Sons ,2013

PT367 POLYMER WASTE MANAGEMENT

1. Subject Code: PT367 Course Title: Polymer Waste Management

2. Contact Hours: L: 03 T: 00 P: 00
3. Examination Duration (Hrs.): Theory: 03 Practical: 00
4. Relative Weight: CWS: 25 PRS: 00 MTE: 25 ETE: 50 PRE: 00
5. Credits: 03
6. Semester: ODD-V
7. Subject Area: UEC
8. Pre-requisite: NIL
9. Objective: To impart knowledge about polymer waste and their management.

10. Details of Course

Unit No.	Contents	Contact Hours
1	Polymer and Plastics Waste: Definition of plastics waste and the associated problems, Identification, collection methods and separation. Integrated waste management – source reduction, recycling, energy recovering process through thermal and biological destruction, Land filling and composting.	8
2	Plastics waste management: Source reduction, reuse, repair, recycling, and incineration with examples. Plastics recycling: Classification, Code of practice, Primary, secondary, territory and quaternary recycling with examples, Waste plastics as fillers.	8
3	Recycling and degradation of plastics: Recycling and sustainability correlation, Basic principles and recovery, recycling and resource conservation.	9
4	Recycling of plastics by surface refurbishing, Application of a coating, polishing, Plastics, Environmental and Thermal ageing, Chemical degradation, Wear and erosion, Biodegradable plastics – an overview.	9
5	Environmental issues, policies and legislation in India.	8

11. Suggested Books

S. No.	Name of Books/Authors/Publisher
1	Plastics Recycling – Products and Processes/ Ehrig (Ed.)/ Hanser Publication, 1993
2	Recycling and recovery of plastics/ Brandrup/ Hanser Publishers, New York, 1996
3	Handbook of Plastics Recycling/ By Francesco La Mantia/ Rapra Tech Ltd , 2002
4	Introduction to Plastics Recycling/ By VannessaGoodship/ Rapra Tech Ltd ,2007

PT369 NANOTECHNOLOGY IN POLYMERS

1. Subject Code: PT369 Course Title: Nanotechnology in Polymers
2. Contact Hours: L: 03 T: 00 P: 00
3. Examination Duration (Hrs.): Theory: 03 Practical: 00
4. Relative Weight: CWS: 25 PRS: 00 MTE: 25 ETE: 50 PRE: 00
5. Credits: 03
6. Semester: ODD-V
7. Subject Area: UEC
8. Pre-requisite: NIL
9. Objective: To make student aware about the applications of nanopolymers in various fields.

10. Details of Course

S. No.	Contents	Contact Hours
1	Concepts of nanotechnology, Time and length scale in structures, Nanosystems, Dimensionality and size dependent phenomena, Surface to volume ratio-Fraction of surface atoms, Surface energy and surface stress, surface defects, Properties at nanoscale (optical, mechanical, electronic, and magnetic).	8
2	Nano-materials, Classification based on dimensionality, Quantum Dots, Wells and Wires, Carbon-based nano-materials, Metal based nano-materials, Nanocomposites, Nanopolymers, Nanoglasses, Nanoceramics, Biological nanomaterials.	8
3	Synthesis of nanopolymers, Chemical Methods, Metal Nanocrystals by Reduction, Solvothermal Synthesis, Photochemical Synthesis, Sonochemical Routes, Chemical Vapor Deposition, Metal Oxide - Chemical Vapor Deposition, Physical Methods such as ball Milling, electrodeposition, spray pyrolysis, flame pyrolysis, DC/RF magnetron sputtering, Molecular beam epitaxy.	9
4	Nanofabrication, Photolithography and its limitations, Electron beam lithography, Nanoimprint, Soft lithography patterning, Characterization with Field Emission Scanning Electron Microscopy, Environmental Scanning Electron Microscopy, High Resolution Transmission Electron Microscope, Scanning Tunneling Microscope, Surface enhanced Raman spectroscopy,	9

	X-ray Photoelectron Spectroscopy, Auger electron spectroscopy, Rutherford back scattering spectroscopy.	
5	Applications of nanomaterials, Solar energy conversion and catalysis, Molecular electronics and printed electronics, Nanoelectronics, Polymers with aspecial architecture, Applications in displays and other devices, Nanomaterials for data storage, Photonics, Plasmonics, Nanomedicine, Nanobiotechnology and Nanotoxicology.	8

11.Suggested Books

S. No.	Name of Books/Authors/Publisher
1	Organic and Inorganic Nanostructures/ Nabok/ Artech House, 2005.
2	Nanoscience: Nanotechnologies and Nanophysics/ Dupas, Houdy, Lahmani/ Springer-Verlag Berlin Heidelberg ,2007
3	Nanostructured Materials and Nanotechnology/ H.S. Nalwa/ Academic Press , 2002
4	A Textbook of Nanoscience and Nanotechnology/ Pradeep/ Tata McGraw Hill Education Pvt. Ltd. , 2012

PT371 APPLICATIONS OF POLYMER BLENDS AND COMPOSITE

1. Subject Code: PT371 Course Title: Applications of Polymer Blends and Composite
2. Contact Hours: L: 03 T: 00 P: 00
3. Examination Duration (Hrs.): Theory: 03 Practical: 00
4. Relative Weight: CWS: 25 PRS: 00 MTE: 25 ETE: 50 PRE: 00
5. Credits: 03
6. Semester: ODD-V
7. Subject Area: UEC
8. Pre-requisite: NIL
9. Objective: To make student aware about the applications of polymers, blends and composites.

10. Details of Course

Unit No.	Contents	Contact Hours
1	Concepts of polymer blends, Advantages of blends over conventional polymers, Significance of polymer blend technology, Different steps involved in designing of a blend, Different methods of blending, Characterization of polymer blends.	8
2	Compatibilization and Phase Morphology, Role of compatibilizers in blend technology, techniques of compatibilization, Phase structure development in polymer blends, Factors affecting morphology of	8

	polymer blends, Properties of polymer blends.	
3	Reinforcements, Properties and applications of Glass, Carbon, Kevlar, polyethylene, boron, ceramic and natural fibers. Concepts of matrix material, Thermoset matrix materials like - epoxy, polyester, vinyl esters, phenolic resin, polyimides, Thermoplastic matrix materials like - polyolefins, polyether ether ketones, polyphenylene sulfide, thermoplastic polyimides.	9
4	Concept of composites, particulate and fibrous composites, Properties of composites, Fabrication of continuous and short fiber composites and particulate composites, mechanical and physical properties	9
5	Applications of blends and composites for civil, aerospace, automobiles etc	8

11. Suggested Books

S. No.	**Name of Books/Authors/Publisher**
1	Fibre Reinforced composites/ P. K. Malik/ Marcel Deckar, 1988.
2	Composites Manufacturing: Materials, Product, and Process Engineering/ S.K. Mujumdar/ CRC press ,2002
3	Fibre-glass Reinforced Plastics/ N. P. Cheremisinoff (Ed)/ Noyce Pub, 1988.
4	Design Data for Reinforced Plastics/ N. L. Hancex, R. M. Mayer/ Chapman Hall, 1994.
5	Reinforced Plastics: Properties and Applications/ Raymond Seymour/ The Materials Information Society, 1991.

IT-351 Artificial Intelligence and Machine Learning

NAME OF DEPTT: Information Technology

1. Subject Code: IT351 Course Title: Artificial Intelligenceand Machine Learning

2. Contact Hours: L: 3 T: 1 P: 0

3. Examination Duration (ETE)(Hrs.): Theory 3 Hrs Practical 0

4. Relative Weightage: CWS 25 PRS 0 MTE 25 ETE 50 PR 0

5. Credits: 4

6. Semester: EVEN

7. Subject Area: DEC

8. Pre-requisite: Discrete Mathematics

9. Objective: The student should be able to understand the different supervised, unsupervised and reinforcement learning algorithms and choose the appropriate machine learning tool for different real world examples.

10. Details of Course

S.No.	Contents	Contact Hours
1.	**Introduction** to Artificial Intelligence and Machine learning, State Space representation of problems, Concept of Search, overview of different tasks: classification, regression, clustering, control, Concept learning.	6
2.	**Heuristic Search Techniques:** Generate and Test, Hill Climbing, Best-first search, Branch and bound, A* algorithm, Game playing.	6
3.	**Knowledge Representation:**Propositional logic, Predicate Logic, semantic nets, frames	8
4.	**Supervised Learning:** Decision trees, nearest neighbors, linear classifiers and kernels, neural networks, linear regression; Support Vector Machines.	8
5.	**Unsupervised Learning:** Clustering, Expectation Maximization, Dimensionality Reduction, Feature Selection, PCA, factor analysis, manifold learning.	8
6.	**Applications &Research Topics**: Applications in the fields of web and data mining, text recognition, speech recognition	6
	TOTAL	42

11. Suggested Books

S.No.	Name of Books / Authors/ Publishers	Year of Publication/ Reprint
Text Book		
1.	Artificial Intelligence by Elaine Rich, K. Knight, McGrawHill	2009
1.	Introduction to Machine Learning, Alpaydin, E., MIT Press, 2004	
2.	Machine Learning, Tom Mitchell, McGraw Hill, 1997.	1997
3.	Elements of Machine Learning, Pat Langley Morgan Kaufmann Publishers, Inc. 1995. ISBN 1-55860-301-8	1995
Reference Book		

4.	The elements of statistical learning, Friedman, Jerome, Trevor Hastie, and Robert Tibshirani. Vol. 1. Springer, Berlin: Springer series in statistics, 2001.	2001
5.	Machine Learning: A probabilistic approach, by David Barber.	2006
6	Pattern recognition and machine learning by Christopher Bishop, Springer Verlag, 2006	2006

IT-353 Data Structures and Algorithms

NAME OF DEPTT: Information Technology

1. Subject Code: IT353 Course Title: Data Structures and Algorithms

2. Contact Hours: L: 3 T: 1 P: 0

3. Examination Duration (ETE) (Hrs.): Theory 3 Hrs Practical 0

4. Relative Weightage: CWS 25 PRS 0 MTE 25 ETE 50 PR 0

5. Credits: 4

6. Semester: EVEN

7. Subject Area: DEC

8. Pre-requisite: Nil

9. Objective: The objective of the course is to familiarize students with basic data structures and their use in fundamental algorithms.

10. Details of Course

S.No.	Contents	Contact Hours
1.	**Introduction:** Introduction to Algorithmic, Complexity- Time-Space Trade off. Introduction to C programming through Arrays, Stacks, Queues and Linked lists.	8
2.	**Trees:** Basic Terminology, Traversals, Binary search trees, optimal and average BST's. 2-4 trees, Applications of Binary search Trees, Complete Binary trees, Extended binary trees.	7
3.	**Introduction to algorithms:** Concept of algorithmic efficiency, run time analysis of algorithms, Asymptotic Notations. Growth of Functions, Master's Theorem, **Searching and Searching:** Linear Search, Binary search, Insertion Sort, Quick sort, Merge sort, Heap sort, Radix Sort.	9
4.	**Graphs:** Terminology and Representations, Graphs & Multi-graphs, Directed Graphs, Representation of graphs, Breadth first search and connected components. Depth first search in directed and undirected graphs and strongly connected components.	8
5.	**Spanning trees:** Prim's and Kruskal's algorithm, union-find data structure. Dijkstra's algorithm for shortest paths, shortest path tree. Directed acyclic graphs: topological sort and longest path. **Dynamic programming**: Principles of dynamic programming. Applications: Matrix multiplication, Travelling salesman Problem.	10
		42

11. Suggested Books

S.No.	Name of Books / Authors/ Publishers	Year of Publication/ Reprint
Text Books:		
1.	Horowitz and Sahni, "Fundamentals of Data structures", Galgotia publications	1983
2.	Tannenbaum, "Data Structures", PHI	2007(Fifth Impression)
3.	T .H . Cormen, C . E . Leiserson, R .L . Rivest "Introduction to Algorithms", 3rd Ed., PHI.	2011 (reprint)
4.	E. Horowitz, S. Sahni, and S. Rajsekaran, "Fundamentals of Computer Algorithms," Galgotia Publication	
	Reference Books	
1.	R.L. Kruse, B.P. Leary, C.L. Tondo, "Data structure and program design in C", PHI	2009(Fourth Impression)
2.	Aho ,Ullman "Principles of Algorithms "	

IT-355 Communication and Computing Systems

NAME OF DEPTT: Information Technology

1. Subject Code: IT355 Course Title: Communication and Computing Technology

2. Contact Hours: L: 3 T: 1 P: 0

3. Examination Duration (ETE) (Hrs.): Theory 3 Hrs Practical 0

4. Relative Weightage: CWS 25 PRS 0 MTE 25 ETE 50 PR 0

5. Credits: 4

6. Semester: EVEN

7. Subject Area: DEC

8. Pre-requisite: Operating systems, Algorithm Design and Analysis and data structures

9. Objective: To introduce the concept of Communications in Computer networks

10. Details of Course

S.No.	Contents	Contact Hours
1.	**Introduction** to Goals and Applications of Networks, Network structure and architecture, The TCP/IP reference model, services, Network Topology.	6
2.	**Data Link Layer and Medium Access sub layer** - Channel Allocations, LAN protocols -ALOHA protocols - Overview of IEEE standards - FDDI. - Elementary Data Link Protocols, Sliding Window protocols.	6
3.	**Network Layer**: Routing, Congestion control, Internetworking -TCP / IP, IP packet, IP address, IPv6 and Mobile IP.	8
4.	**Transport Layer:** Design issues, TCP and UDP, connection management, Congestion control, Leaky bucket, Token bucket algorithm. QoS.	8
5.	**Application Layer:** File Transfer, Access and Management, Electronic mail, Virtual Terminals, Internet and Public Networks, Firewalls	6
6.	**Information and Web security**: IP Security, Architecture, Authentication header, Encapsulating security payloads, combining security associations, Secure Socket Layer(SSL) and transport layer security, TSP, Secure Electronic Transaction (SET), Electronic money.	8
	TOTAL	42

11. Suggested Books

S.No.	Name of Books / Authors/ Publishers	Year of Publication/

		Reprint
Text Book		
1.	S. Tananbaum, “Computer Networks”, 3rd Ed, PHI	1999
2.	U. Black, “Computer Networks-Protocols, Standards and Interfaces”, PHI	1996
3.	W. Stallings, “Computer Communication Networks”, PHI	1999
3.	Data Communications and Networking, Behrouz A. Forouzan 5/e	2013
Reference Book		
4.	William Stallings, “Cryptography and Network Security: Principals and Practice”, Prentice Hall, New Jersy.	2001
5.	Behrouz A. Forouzan, “Cryptography and Network Security”, TMH.	2006

IT-357 Internet and Web Programming

NAME OF DEPTT: Information Technology

1. Subject Code: IT357 Course Title: Internet and Web Programming

2. Contact Hours: L: 3 T: 1 P: 0

3. Examination Duration (ETE) (Hrs.): Theory 3 Hrs Practical 0

4. Relative Weightage: CWS 25 PRS 0 MTE 25 ETE 50 PR 0

5. Credits: 4

6. Semester: EVEN

7. Subject Area: DEC

8. Pre-requisite: Nil

9. Objective: To introduce the concept of internet and web programming

10. Details of Course

S.No.	Contents	Contact Hours
1.	**Internet and WWW:** Internet basic, Introduction to internet and its applications, E- mail, telnet, FTP, e-commerce, video conferencing, e-business. Internet service providers, domain name server, internet address World Wide Web (WWW): World Wide Web and its evolution, uniform resource locator (URL), browsers - internet explorer, netscape navigator, opera, firefox, chrome, mozilla. Search engine, web saver - apache, IIS, proxy server, HTTP protocol.	6
2.	**WEBSITES BASIC ANDWEB 2.0**: Web 2.0: Basics-RIA Rich Internet Applications - Collaborations tools - Understanding websites and web servers: Understanding Internet – Difference between websites and web server- Internet technologies Overview – Understanding the difference between internet and intranet; HTML and CSS: HTML 5.0 , XHTML, CSS 3.	6
3.	**E-MAIL SECURITY & FIREWALLS** : PGP - S/MIME - Internet Firewalls for Trusted System: Roles of Firewalls - Firewall related terminology- Types of Firewalls - Firewall designs - SET for E-Commerce Transactions, intellectual property: copyright, patents, trademarks, cyber laws	8
4.	**SERVELETS AND JSP**: JSP Technology Introduction-JSP and Servelets-Running JSP Applications Basic JSP- JavaBeans Classes and JSP-Tag Libraries and Files- Support for the Model- View- Controller Paradigm- Case Study- Related Technologies.	8
5.	**XML**: Introduction to XML, uses of XML, simple XML, XML key components, DTD and Schemas, Well formed, using XML with application.XML, XSL and XSLT. Introduction to XSL, XML transformed simple example, XSL elements, transforming with XSLT	6
6.	**PHP:** Starting to script on server side, Arrays, function and forms, advance PHP, Basic command with PHP examples, Connection to server, creating database, selecting a database, listing database, listing table names creating a table, inserting	8

	data, altering tables, queries, deleting database, deleting data and tables, PHP my admin and database bugs.	
	TOTAL	42

11. Suggested Books

S.No.	Name of Books / Authors/ Publishers	Year of Publication/ Reprint
	Text Books	
1.	Internet and Web Technologies by Raj Kamal, Tata McGraw Hill edition. (ISBN: 9780070472969)	2002
2.	An Introduction to Search Engines and Web Navigation, Mark Levene, Pearson Education. (ISBN: 978047052684)	2010
3.	Modeling the Internet and the Web,PierreBaldi,PaoloFrasconi, Padhraic Smyth, John Wiley and Sons Ltd. (ISBN: 978-0-470-84906-4)	2003
	Reference Books	
4.	HTML: A Beginner's Guide by Wendy Willard, Tata McGraw-Hill (ISBN: 9780070677234)	2009
5.	PHP and MySQL for Dynamic Web Sites, Ullman, Larry, Peachpit Press.1 (ISBN: 978-0-321-78407-0)	2012

IT-359 Java Programming

NAME OF DEPTT: Information Technology

1. Subject Code: IT359 Course Title: Java Programming

2. Contact Hours: L: 3 T: 1 P: 0

3. Examination Duration (ETE) (Hrs.): Theory 3 Hrs Practical 0

4. Relative Weightage: CWS 25 PRS 0 MTE 25 ETE 50 PR 0

5. Credits: 4

6. Semester: EVEN

7. Subject Area: DEC

8. Pre-requisite: Nil

9. Objective: To introduce the concept of java programming

10. Details of Course

S.No.	Contents	Contact Hours
1.	**Introduction to Java**: Programming language Types and Paradigms, Computer Programming Hierarchy, How Computer Architecture Affects a Language? , Why Java?, Flavors of Java, Java Designing Goal, Role of Java Programmer in Industry, Features of Java Language, JVM –The heart of Java , Java's Magic Byte code.	6
2.	**The Java Environment:** Installing Java, Java Program Development, Java Source File Structure, Compilation, Executions. Lexical Tokens, Identifiers, Keywords, Literals, Comments, Primitive Datatypes, Operators Assignments.	6
3.	**Object Oriented Programming**: Class Fundamentals , Object & Object reference, Object Life time & Garbage Collection, Creating and Operating Objects , Constructor & initialization code block, Access Control, Modifiers, methods Nested , Inner Class &Anonymous Classes, Abstract Class & Interfaces Defining Methods, Argument Passing Mechanism, Method Overloading, Recursion, Dealing with Static Members, Finalize() Method, Native Method.	8
4.	**Extending Classes and Inheritance**: Use and Benefits of Inheritance in OOP, Types of Inheritance in Java, Inheriting Data members and Methods, Role of Constructors in inheritance, Overriding Super Class Methods, Use of "super", Polymorphism in inheritance, Type Compatibility and Conversion Implementing interfaces.	8
5.	**Package**: Organizing Classes and Interfaces in Packages, Package as Access Protection, Defining Package, CLASSPATH Setting for Packages, Making JAR Files for Library Packages Import and Static Import Naming Convention For Packages.	6
6.	**GUI Programming**: Designing Graphical User Interfaces in Java, Components and Containers, Basics of Components, Using Containers, Layout Managers, AWT Components, Adding a Menu to Window, Extending GUI Features Using Swing Components, Java Utilities (java.util Package) The Collection Framework:	8

	Collections of Objects, Collection Types, Sets , Sequence, Map, Understanding Hashing, Use of Array List & Vector.	
	TOTAL	42

11. Suggested Books

S.No.	Name of Books / Authors/ Publishers	Year of Publication/ Reprint
	Text Books	
1.	The Complete Reference Java,, Herbert Schildt, ISBN: 978-0-07163177-8, Publisher: McGraw Hill	7th Edition
2.	Thinking in Java, Bruce Eckel, ISBN: 0-13-187248-6, Publisher: Prentice Hall	4th Edition,
3.	The Java Programming Languages,, Ken Arnold, ISBN-13: 978-032134980, Publisher: Sun	4th Edition,
4.	Java in Nutshell,, Benjamin,ISBN: 9781449371296, Publisher: O'Reilly Media, Inc.	6th Edition