Proposed Scheme & Syllabus

For

Bachelor of Technology

Computer Science & Engineering Department

National Institute of Technology Delhi

A Choice Based Flexible Credit Requirement

Sl. No.	Category of Courses	Credits Offered	Minimum Credits to be Earned
1.	Basic Science Courses	26	26
2.	Other Engineering Courses	33	33
3.	Humanities and Social Science Courses	12	12
4.	Departmental Core Courses	68	68
5.	Elective Courses	21	15
6.	Open Elective Courses	06	03
7.	Other Mandatory Courses	09	09
8.	Departmental Major Projects	14	14

Minimum Credits Required for Award of B.Tech. (CSE) Degree = 180

COURSES OFFERED BY DEPARTMENT OF COMPUTER SCIENCE AND ENGINERRING

SEMESTER - I

Sl. No.	Course Code	Course Title	L	T	P	Credits
1.	CYL 100	Chemical Structures & Reactivity	3	1	0	4
2.	CSB 101	Problem Solving and Computer Programming	3	0	2	4
3.	MAL 101	Advanced Calculus	3	1	0	4
4.	MEB 100	Engineering Visualization	3	0	2	4
5.	HMB 101	Human Values and Ethics	3	0	2	4
6.	MEL 102	Engineering Mechanics	3	0	0	3
7.	CYP 100	Chemistry Laboratory	0	0	3	2
8.	MEP 103	Product Design and Realization Laboratory I	0	0	2	1
9.	EAP 101	Extra-Academic Activity	0	0	2	1
		Total Credits	**18**	**2**	**13**	**27**

SEMESTER-II

Sl. No.	Course Code	Course Title	L	T	P	Credits
1.	PHL 100	Electromagnetic and Quantum Physics	3	1	0	4
2.	CSB 102	Data Structures	3	0	2	4
3.	MAL 151	Linear Algebra and Complex Analysis	3	1	0	4
4.	EEB 100	Introduction to Electrical and Electronics Engineering	3	0	2	4
5.	HMB 100	Professional Communication	3	0	2	4
6.	MEL 101	Environmental Studies	3	0	0	3
7.	PHP 100	Physics Laboratory	0	0	3	2
8.	MEP 104	Product Design and Realization Laboratory II	0	0	2	1
9.	EAP 102	Extra-Academic Activity	0	0	2	1
		Total Credits	**18**	**2**	**13**	**27**

SEMESTER - III

Sl.No.	Course No.	Course Title	L	T	P	Credits
1.	MAL 241	Probability and Statistics	3	1	0	4
2.	ECB 206	Analog Electronics	3	0	2	4
3.	CSL 201	Discrete structures	3	1	0	4
4.	CSB 202	Database Management System	3	0	2	4
5.	ECB 204	Signals and Systems	3	0	2	4
6.	CSL 203	System Programming	3	1	0	4
7.	CSP 211	Colloquium/ Industrial Lecture/ Seminar	0	0	2	1
Total Credits			**18**	**3**	**8**	**25**

SEMESTER- IV

Sl.No.	Course No.	Course Title	L	T	P	Credits
1.	ECB 256	Communication Systems	3	0	2	4
2.	CSL 251	Theory of Computation	3	1	0	4
3.	CSB 252	Design and Analysis of Algorithms	3	0	2	4
4.	CSB 253	Software Engineering	3	0	2	4
5.	ECB 257	Digital Electronics and Logic Design	3	0	2	4
6.	CSB 27X	Elective I (From Bouquet I)	2	0	2	3
7.	MAP 281	Numerical Methods Lab	0	0	3	2
8.	CSP 312	Summer Internship-I (Credit will be added in next semester)	-	-	-	-
Total Credits			**17**	**1**	**13**	**25**

SEMESTER- V

Sl.No.	Course No.	Course Title	L	T	P	Credits
1.	CSB 301	Computer Organization	3	0	2	4
2.	CSL 36X	Elective-II (From Bouquet II)	3	0	0	3
3.	CSB 302	Operating System	3	0	2	4
4.	CSL 303	Artificial Intelligence	3	1	0	4
5.	CSB 304	Computer Networks	3	0	2	4
6.	HML 351	Engineering Economics & Accountancy	3	0	0	3
7.	CSP 311	Colloquium/ Industrial Lecture/ Seminar	0	0	2	1
8.	CSP 312	Summer Internship-I	-	-	-	1
Total Credits			**18**	**1**	**8**	**24**

SEMESTER- VI

Sl. No.	Course No.	Course Title	L	T	P	Credits
1.	CSB 351	Network Programming	3	0	2	4
2.	CSB 352	Data Mining	3	0	2	4
3	CSB 353	Compiler Design	3	0	2	4
4.	CSL 37X	Elective-III (From Bouquet III)	3	0	0	3
5.	ECB 355	Microprocessors and Interfacing	3	0	2	4
6.		Open Elective I	3	0	0	3
7.	HMP 352	Technical Communication	0	0	2	1
8.	CSP 411	Summer Internship/ Summer Project-II (Credit will be added in next semester)	-	-	-	-
Total Credits			**18**	**0**	**10**	**23**

SEMESTER- VII

Sl. No	Course No.	Course Title	L	T	P	Credits
1.	CSB 401	Theory of App Development	2	0	3	4
2.	CSL 4XX	Elective-IV (From Bouquet IV)	3	0	0	3
3.	CSL 4XX	Elective –V (From Bouquet IV)	3	0	0	3
4.		Open Elective – II	3	0	0	3
5.	CSP 400	Project Work	0	0	6	4
7.	CSP 411	Summer Internship-II	-	-	-	1
		Total Credits	**11**	**0**	9	**18**

SEMESTER- VIII

Sl.No.	Course No.	Course Title	L	T	P	Credits
1.	CSB 451	Network Security and Cryptography	3	0	2	4
2.	CSL 4XX	Elective –VI (From Bouquet IV)	3	0	0	3
3.	CSL 4XX	Elective-VII (From Bouquet IV)	3	0	0	3
4.	CSP 450	Project Work	0	0	15	10
		Total Credits	**9**	**0**	**17**	**20**

ELECTIVE COURSES

BOUQUET I

Sl. No.	Course No.	Course Title	L	T	P	Credits
1.	CSB 271	Java Technologies	2	0	2	3
2.	CSB 272	Foundation of Programming	2	0	2	3
3.	CSB 273	Object Oriented Programming	2	0	2	3
4.	CSB 274	Web Programming	2	0	2	3

BOUQUET II

Sl. No.	Course No.	Course Title	L	T	P	Credits
1.	CSL 371	Advances in Algorithms	3	0	0	3
2.	CSL 362	Middleware Technologies	3	0	0	3
3.	CSL 363	Graph Theory and Combinatorics	3	0	0	3
4.	CSL 364	Software Quality and Testing	3	0	0	3
5.	CSL 365	Software Metrics and Software Project Management	3	0	0	3

6.	CSL 366	Architectural and Design Patterns	3	0	0	3

BOUQUET III

Sl.No.	Course No.	Course Title	L	T	P	Credits
1	CSL 361	Advance Data Base Management Systems	3	0	0	3
2	CSL 372	Concurrent and Parallel Programming	3	0	0	3
3	CSL 373	Computer Graphics	3	0	0	3
4	CSL 374	Advanced Computer Networks	3	0	0	3
5	CSL 375	Soft Computing	3	0	0	3
6	CSL 376	Cloud Computing	3	0	0	3
7	CSL 377	Natural Language Processing	3	0	0	3
8	CSL 378	Distributed Computing	3	0	0	3

BOUQUET IV

Sl.No.	Course No.	Course Title	L	T	P	Credits
1	CSL 461	Computational Complexity	3	0	0	3
2	CSL 462	Digital Image Processing	3	0	0	3
3	CSL 463	Computer Vision	3	0	0	3
4	CSL 464	Simulation and Modeling	3	0	0	3
5	CSL 465	Neural Networks	3	0	0	3
6	CSL 466	Information Security	3	0	0	3
7	CSL 467	Wireless Mobile Communications	3	0	0	3
8	CSL 468	Mobile Computing	3	0	0	3
9	CSL 469	Complex Networks	3	0	0	3
10	CSL 470	Real Time Systems	3	0	0	3
11	CSL 471	Next Generation Networks	3	0	0	3
12	CSL 472	E-Governance	3	0	0	3
13	CSL 473	Pattern Recognition	3	0	0	3
14	CSL 474	Machine Learning	3	0	0	3
15	CSL 475	Information Storage & Retrieval	3	0	0	3
16	CSL 476	Information Theory and Coding	3	0	0	3
17	CSL 477	Game Theory	3	0	0	3
18	CSL 478	Multi Agent Systems	3	0	0	3
19	CSL 479	Reconfigurable Computing	3	0	0	3
20	CSL 480	Bio-informatics	3	0	0	3

Sl.No.	Course No.	Course Title	L	T	P	Credits
21	CSL 481	Biomedical Image Processing	3	0	0	3
22	CSL 482	Fault Tolerant Computing	3	0	0	3
23	CSL 483	Wireless Sensor Networks	3	0	0	3

Basic Science Courses:

Sl.No.	Course No.	Course Title	L	T	P	Credits
1.	PHL 100	Electromagnetic and Quantum Physics	3	1	0	4
2.	MAL 101	Advanced Calculus	3	1	0	4
3.	CYL 100	Chemical Structures and Reactivity	3	1	0	4
4.	MAL 151	Linear Algebra and Complex Analysis	3	1	0	4
5.	PHP 100	Physics Laboratory	0	0	3	2
6.	CYP 100	Chemistry Laboratory	0	0	3	2
7.	MEL 103	Probability and Statistics	3	1	0	4
8.	MAP 281	Numerical Methods Lab	0	0	3	2
		Total Credits	**15**	**5**	**9**	**26**

Other Engineering Courses:

Sl. No.	Course No.	Course Title	L	T	P	Credits
1.	EEB 100	Introduction to Electrical and Electronics Engineering	3	0	2	4
2.	MEP 103	Product Design and Realization Laboratory-I	0	0	2	1
3.	MEP 104	Product Design and Realization Laboratory-II	0	0	2	1
4.	MEB 100	Engineering Visualization	3	0	2	4
5.	MEL 102	Engineering Mechanics	3	0	0	3
6.	ECB 257	Digital Electronics & Logic Design	3	0	2	4
7.	ECB 256	Communication Systems	3	0	2	4
8.	ECB 204	Signals & Systems	3	0	2	4
9.	ECB 206	Analog Electronics	3	0	2	4
10.	ECB 355	Microprocessors and Interfacing	3	0	2	4
		Total Credits	**24**	**0**	**18**	**33**

Humanities Courses:

Sl. No.	Course No.	Course Title	L	T	P	Credits
1.	HMB 100	Professional Communication	3	0	2	4
2.	HMB 101	Human Values and Ethics	3	0	2	4
3.	HML 351	Engineering Economics and Accountancy	3	0	0	3
4.	HMP 352	Technical Communication	0	0	2	1
		Total Credits	**9**	**0**	**6**	**12**

Departmental Elective Courses:

Sl. No.	Course No.	Course Title	L	T	P	Credits
1.	CSL 24X	Departmental Elective – I	3	0	0	3
2.	CSL 36X	Departmental Elective – II	3	0	0	3
3.	CSL 37X	Departmental Elective – III	3	0	0	3
4.	CSL 46X	Departmental Elective – IV	3	0	0	3
5.	CSL 46X	Departmental Elective – V	3	0	0	3
6.	CSL 44X	Departmental Elective – VI	3	0	0	3
7.	CSL 46X	Departmental Elective – VII	3	0	0	3
		Total Credits	**21**	**0**	**0**	**21**

Open Elective Courses:

Sl. No.	Course No.	Course Title	L	T	P	Credits
1.		Open Elective – I	3	0	0	3
2.		Open Elective – II	3	0	0	3
		Total Credits	**6**	**0**	**0**	**6**

Major Project Courses:

Sl. No.	Course No.	Course Title	L	T	P	Credits
1.	CSP 400	Project – I	0	0	6	4
2.	CSP 450	Project – II	0	0	15	10
		Total Credits	**0**	**0**	**21**	**14**

Other Mandatory Courses:

Sl. No.	Course No.	Course Title	L	T	P	Credits
1.	MEL 101	Environmental Studies	3	0	0	3
2.	CSP 312	Summer Internship/ Summer Project – I	0	0	2	1
3.	CSP 411	Summer Internship/ Summer Project – II	0	0	2	1
4.	CSP 211	Colloquium/ Industrial Lecture/ Seminar	0	0	2	1
5.	CSP 312	Colloquium/ Industrial Lecture/ Seminar	0	0	2	1

			L	T	P	Credits
6.	EAP 101	Extra-Academic Activity - I	0	0	2	1
7.	EAP 102	Extra-Academic Activity – II	0	0	2	1
		Total Credits	**3**	**0**	**12**	**9**

Core Engineering Courses:

Sl. No.	Course No.	Course Title	L	T	P	Credits
1.	CSB 101	Problem Solving and Computer Programming	3	0	2	4
2.	CSB 102	Data Structures	3	0	2	4
3.	CSL 201	Discrete structures	3	1	0	4
4.	CSB 253	Software Engineering	3	0	2	4
5.	CSB 252	Design and Analysis of Algorithm	3	0	2	4
6.	CSL 251	Theory of Computation	3	1	0	4
7.	CSB 301	Computer Organization	3	0	2	4
8.	CSB 202	Database Management System	3	0	2	4
9.	CSL 203	System Programming	3	1	0	4
10.	CSB 353	Compiler Design	3	0	2	4
11.	CSB 302	Operating System	3	0	2	4
12.	CSL 303	Artificial Intelligence	3	1	0	4
13.	CSB 351	Network Programming	3	0	2	4
14.	CSB 304	Computer Networks	3	0	2	4
15.	CSB 352	Data Mining	3	0	2	4
16.	CSB 451	Network Security and Cryptography	3	0	2	4
17.	CSB 401	Theory of App Development	2	0	3	4
		Total Credits	**50**	**4**	**27**	**68**

COURSE CONTENT PERFORMA

Department: Computer Science and Engineering

Course no: CSB 101	Open course (YES/NO)		HM Course (Y/N)	DC (Y/N)	DE (Y/N)	
	NO		NO	NO	NO	
Type of course	**Core**					
Course Title	**PROBLEM SOLVING AND COMPUTER PROGRAMMING**					
Course Coordinator						
Course objectives:	This course aims to provide the students with a foundation in computer programming. The goals of the course are to develop the basic programming skills in students, and to improve their proficiency in applying the basic knowledge of programming to solve problems related to their field of engineering.					
POs						

Semester	**Autumn: Yes**			**Spring:**		
I	**Lecture**	**Tutorial**		**Practical**	**Credits**	**Total teaching hours**
Contact Hours	3	0		2	4	36
Prerequisite course code as per proposed course numbers	NIL					
Prerequisite credits	NIL					
Equivalent course codes as per proposed course and old course	NIL					
Overlap course codes as per proposed course numbers	NIL					
Text Books:						
1	Title	Programming in ANSI C				
	Author	E. Balagurusamy				
	Publisher	TATA McGraw Hill				
	Edition	6th edition, 2012				
Reference Book:						
1	Title	Let Us C				
	Author	Yashavant Kanetkar				
	Publisher	Infinity Science Press				
	Edition	13th edition, 2012				
2	Title	The C Programming Language				
	Author	Brian Kernighan & Dennis Ritchie				

		Publisher	Prentice Hall
		Edition	2nd Edition, 1988
3		Title	Schaum's Outline of Programming with C
		Author	Byron S Gottfried
		Publisher	TATA Mc Graw Hill
		Edition	2nd edition, 1996
Content	**Unit – 1** (5 Hours) Introduction to Computers: Hardware and Software. Basic Model of Computation, Notion of Algorithms, Flowcharts, Top down design, Bottom up approaches of problem solving, Number system. **Unit – 2** (9 Hours) Introduction to programming language, Basics of C, Basic Data types – int, float, double, char, Bool, Void. Arithmetic and logical operators: precedence and associativity. Flow of Control- Conditional statements- If-else, Switch-case constructs, Loops- While, do-while, for. **Unit – 3** (7 Hours) Function – User defined functions, library functions, Parameter passing – call by value, call by reference, recursion. **Unit – 4** (7 Hours) Arrays- Advantages and drawbacks, One dimensional, Multi-Dimensional Arrays and strings: Declaration, Initialization, Accessing, Passing arrays and strings as parameters to functions. Pointers, Dynamic memory allocation, Dynamic arrays – One dimensional, Multidimensional dynamic arrays. **Unit – 5** (8 Hours) Structure: Declaration, Initialisation, passing structure to function, Use of pointers in structure. Preprocessors, Macros, File management in C I/O – Opening, closing and editing files. Correctness & Efficiency Issues in Programming, Time & Space measures.		
Course Assessment	Continuous Evaluation 25%		
	Mid Semester 25%		
	End Semester 50%		

Course no: MAL 101	Open course (YES/NO)	HM Course (Y/N)	DC (Y/N)		DE (Y/N)	
	NO	N	N		N	
Type of Course	Theory					
Course Title	**ADVANCED CALCULUS**					
Course Coordinator	DR. SUNIL KUMAR					
Course objectives:	This course is aimed to cover differential, integral and vector calculus for functions of one and more than one variable. These mathematical tools and methods are used extensively in physical sciences, engineering, and computer graphics.					
POs						
Semester	Autumn: Yes		Spring:			
I	Lecture	Tutorial	Practical		Credits	Total Teaching Load
Contact Hours	3	1	0		4	48
Prerequisite course code as per proposed course numbers	NIL					
Prerequisite Credits	NIL					
Equivalent course codes as per proposed course and old course	NIL					
Overlap course codes as per proposed course numbers	NIL					
Text Books:						
1.	Title	Thomas' Calculus				
	Author	G. Thomas, M. Weir, J. Hass				
	Publisher	Pearson Pub.				
	Edition	2010				
2.	Title	Introduction to Real Analysis				
	Author	R.G. Bartle, D.R. Sherbert				
	Publisher	John Wiley and Sons				
	Edition	2011				
3.	Title					
	Author					
	Publisher					
	Edition					
Reference Books:						
1.	Title	Advanced Engineering Mathematics				
	Author	E. Kreyszig				
	Publisher	Jon Wiley and Sons				
	Edition	2008				
2.	Title					

	Author	
	Publisher	
	Edition	
Content	**Unit I:** 18 Differential Calculus: Limit and Continuity of functions; differentiability; Jacobian, Rolle's theorem; Mean value theorem; Taylor's and Maclaurin's theorems with remainders, Expansions; Convergence of sequences and series of real numbers; Power series; Functions of several variables, limit and continuity, Partial Derivatives and Differentiability, Maxima & Minima of two variables, Lagrange method of multiplier. **Unit II:** 14 Integral Calculus: Fundamentals theorem of integral calculus, Riemann Integration, Improper Integrals, Double and Triple integrals-computation of surface area and volumes-change of variables in double and triple integrals. (14 hours) **Unit III:** 16 Vector Calculus: Scalar and vector field; Vector differentiation; Level surfaces, Directional Derivatives, Gradient of Scalar field; Divergence and Curl of a vector field; Laplacian, Line and Surface integrals; Green's theorem in plane Gauss Divergence's theorem and Stoke's theorem.	
Course Assessment	Continuous Evaluation 25% Mid Semester 25% End Semester 50%	

Course no: EEB 100	Open course (YES/NO)	HM Course (Y/N)	DC (Y/N)		DE (Y/N)	
	No	No	Yes		No	
Type of Course	Theory					
Course Title	**INTRODUCTION TO ELECTRICAL AND ELECTRONICS ENGINEERING**					
Course Coordinator						
Course objectives:	To introduce the fundamentals of Electrical and electronics Engineering including circuit analysis, transformers, machines, analog and digital electronics.					
POs						
Semester	**Autumn:** Yes		**Spring:** Yes			
II	Lecture	Tutorial	Practical	Credits	Total Teaching Hours	
Contact Hours	3	0	2	4	36(L) + 24(P)	
Prerequisite course code as per proposed course numbers	NIL					
Prerequisite Credits	NIL					
Equivalent course codes as per proposed course and old course						
Overlap course codes as per proposed course numbers	--					
Text Books:						
1.	Title	Electrical and Electronic Technology				
	Author	E Hughes				
	Publisher	Pearson				
	Edition					
2.	Title	Fundementals of Electrical and Electronics Engineering				
	Author	Smarajit Ghosh				
	Publisher	PHI				
	Edition	second				
3.	Title	Text book of Basic Electrical and Electronics Engineering				
	Author	J.B.Gupta				
	Publisher	S.K.Kataria				
	Edition					
Reference Books:						
1.	Title	Electrical Engineering Fundamentals				
	Author	V. D. Toro				
	Publisher	Prentice Hall				
	Edition					
2.	Title	Electrical Machinery				
	Author	P.S. Bimbhara				

	Publisher	Khanna
	Edition	
3.	Title	Integrated Electronics
	Author	Millmann&Halkias
	Publisher	TMH
	Edition	
4.	Title	Digital Logic & Computer Design
	Author	M. Morris Mano
	Publisher	Pearson
	Edition	
Content	**Unit I:** 08 Electrical Circuit Analysis: Voltage & Current sources: dependent & independent source, source conversion. Analysis of D.C. circuits: Mesh & Loop analysis, Nodal analysis. Network Theorems: Thevenin's, Norton's, superposition theorem etc. Star- Delta circuits. 1-Φ ac Circuits: Review of 1-Φ phase ac circuits under sinusoidal steady state conditions, Resonance, Active, Reactive and Apparent power, Power factor. 3-Φ ac circuits: Balanced and Unbalanced supply, Star and Delta connections, power measurement. **Unit II:** 06 Transformers: Magnetic Circuits: Review of laws of electromagnetism, Flux, MMF and their relation, analysis of magnetic and electric circuit. Single phase transformer: Basic concepts, constructional features, EMF equation, voltage, current and impedance transformation, Equivalent circuits. **Unit III:** 08 Electrical Machines: DC Machines: Constructional features, working principle, emf equation, types of dc machines and their characteristics. Induction Machines: Constructional features, working principle, emf equation, concept of slip and torque–slip characteristics. Synchronous Machines: Constructional features, working principle and emf equation. **Unit IV:** 08 Digital electronics: Number systems: decimal, binary, octal, hexadecimal, their complements, operation and conversion, floating point and signed numbers. Demorgan's theorem, Logic Gates: Basic and Universal Gates, their representation, truth table and realization, Half and Full adder circuits, Flip-Flops etc. **Unit V:** 06 Electronic Devices and Circuits: Introduction to semiconductors, Diodes: types of diodes and their characteristic. Bipolar Junction Transistors: working, configurations (CC, CB & CE) and mode of operation.	
Course Assessment	Theory: Continuous Evaluation 25% Mid Semester 25% End Semester 50%Lab: Continuous Evaluation 50% End Semester 50%60% weightage to theory and 40 % weightage to laboratory foroverall grading	

Course no: **HMB 100**	Open course (YES/NO)	HM Course (Y/N)	DC (Y/N)		DE (Y/N)
	No	**Yes**	**No**		**No**
Type of Course	Theory				
Course Title	**PROFESSIONAL COMMUNICATION**				
Course Coordinator					
Course objectives:	To inculcate linguistic skills in students.				
POs					
Semester	**Autumn: Yes**		**Spring: No**		
II	**Lecture**	**Tutorial**	**Practical**	**Credits**	**Total Teaching Hours**
Contact Hours	3	0	2	4	60
Prerequisite course code as per proposed course numbers	NIL				
Prerequisite Credits	NIL				
Equivalent course codes as per proposed course and old course	NIL				
Overlap course codes as per proposed course numbers	NIL				
Text Books:					
1.	Title	Technical Communication: Principles and Practice			
	Author	Raman, Meenakshi and Sharma, Sangeeta,			
	Publisher	Delhi: Oxford University Press			
	Edition	2004			
2.	Title	Technical Writing and Professional Communication,			
	Author	Thomas N Huckin and Leslie & Oslen,			
	Publisher	McGrow Hills			
	Edition	2004			
3.	Title				
	Author				
	Publisher				
	Edition				
Reference Books:					
1.	Title				
	Author				
	Publisher				
	Edition				
2.	Title				
	Author				
	Publisher				
	Edition				

Content	**Unit I:** 15
	Theory of communication, Cycle of communication, Types of communication, Verbal and Non-verbal Communication, Oral communication, Written Communication, Body language, Paralanguage, Proxemics, Chronemics, Haptics, Flow of communication, 7Cs of communication, Barriers to communication.
	Unit II: 15
	Reading Skills: Practice in reading a wide range of texts with a view to improving their reading comprehension, and also grammar and vocabulary. Reading Comprehension, Reading a Novel, Note Making, Interpretation of Non Verbal Data.
	Unit III: 15
	Writing Skills: Practice in Written Communication with a view to enabling independent, original and creative writing. Construction of Sentences and Paragraphs Writing for Correspondence (letters, memos, emails, and fax) Professional Writing (Process Writing, Technical Description and Report Writing), Tips for making presentation, Curriculum Vitae etc.
	Unit IV: 15
	Speaking and Listening Skills (Laboratory Work) Practice in Speaking and Listening Activities with a view to improving their oral and listening skills. Individual speech sounds, Stress and Intonation patterns, Personality Development Questionnaires, Role Play, Extempore, Group Discussions, Facing Interviews, Presentation Skills.
Course Assessment	Continuous Evaluation 25% Mid Semester 25% End Semester 50%

Course no: **MEL 101**	**Open course (YES/NO)**	**HM Course (Y/N)**	**DC (Y/N)**		**DE (Y/N)**	
	No	No	Yes		No	
Type of Course	Theory					
Course Title	**ENVIORNMENTAL STUDIES**					
Course Coordinator	DR. KAPIL SHARMA					
Course objectives:	Recognize major concepts in environmental sciences and demonstrate in-depth understanding of the environment. Develop analytical skills, critical thinking, and demonstrate problem-solving skills using scientific techniques.					
Pos						
Semester	**Autumn: NO**		**Spring: YES**			
II	**Lecture**	**Tutorial**	**Practical**		**Credits**	**Total teaching hours**
Contact Hours	3	0	0		3	36
Prerequisite course code as per proposed course numbers	Nil	Nil				
Prerequisite Credits	Nil	Nil				
Equivalent course codes as per proposed course and old course	MEL 101	Nil				
Overlap course codes as per proposed course numbers						
Text Books:						
1.	Title	Environmental Science and Engineering				
	Author	J.G. Henry and G.W. Heinke				
	Publisher	Pearson Education				
	Edition	2004				
2.	Title					
	Author					
	Publisher					
	Edition					
3.	Title					
	Author					
	Publisher					
	Edition					
Reference Books:						
1.	Title	Introduction to Environmental Engineering and Science				
	Author	G.B. Masters				
	Publisher	Pearson Education				
	Edition	2004				
Content	**Unit I:** 06 Multidisciplinary nature of environmental studies**:** Definition, scope and importance, need for public awareness					

	Unit II: **06** Ecosystems - Structure and function of an ecosystem. Producers, consumers and decomposers. Energy flow in the ecosystem. Ecological succession. Food chains, food webs and ecological pyramids. Introduction, types, characteristic features, structure and function of the following ecosystems: - a. Forest ecosystem b. Grassland ecosystem c. Desert ecosystem d. Aquatic ecosystems, Biogeochemical cycles **Unit III:** **06** Natural Resources: Concept of Renewable and non-renewable resources, Natural resources and associated problems. Role of an individual in conservation of natural resources. Equitable use of resources for sustainable lifestyles. Forest resources: Use and over-exploitation, deforestation, case studies. Timber extraction, mining, dams and their effects on forest and tribal people. Water resources: Use and over-utilization of surface and ground water, floods, drought, conflicts over water, dams-benefits and problems. Energy resources: Growing energy needs, renewable and non-renewable energy sources, use of alternate energy sources. Bioenergy and biofuels **Unit IV:** **06** Bio diversity and its conservation: Introduction – Definition: genetic, species and ecosystem diversity. Biogeographical classification of India. Value of biodiversity: consumptive use, productive use, social, ethical, aesthetic and option values. Biodiversity at global, National and local levels. Inida as a mega-diversity nation, Hot-sports of biodiversity. Threats to biodiversity: habitat loss, poaching of wildlife, man-wildlife conflicts. Endangered and endemic species of India. Conservation of biodiversity: In-situ and Ex-situ conservation of biodiversity **Unit V:** **06** Environmental pollution: Definition, Cause, effects and control measures of: a. Air pollution b. Water pollution c. Soil pollution d. Marine pollution e. Noise pollution f. Thermal pollution g. Nuclear hazards, Causes, effects and control measures of urban and industrial wastes. Pollution case studies. Solid waste Management **Unit VI:** **06** Social Issues and Environment: From Unsustainable to Sustainable development, Urban problems related to energy, Water conservation, rain water harvesting, watershed management, Resettlement and rehabilitation of people; its problems and concerns. Climate change, global warming, acid rain, ozone layer depletion and Eutrophication, Wasteland reclamation. Consumerism and waste products. Environment Protection Act. Air (Prevention and Control of Pollution) Act. Water (Prevention and control of Pollution) Act, Wildlife Protection Act, Forest Conservation Act.
Course Assessment	Continuous Evaluation 25% Mid Semester 25% End Semester 50%

Course no: **PHP 100**	Open course (YES/NO)	HM Course (Y/N)	DC (Y/N)		DE (Y/N)	
	No	No	No		No	
Type of course	Practical					
Course Title	**PHYSICS LABORATORY**					
Course Coordinator	DR GYANENDRA SHEORAN					
Course objectives:	The course is aimed at providing the practical knowledge of: i. Basic optics experiments (Interference, diffraction, and polarization) ii. Basic semiconductor devices experiments (diode, LED etc.) Modern physics experiments (Hall effect, Planck's constant, bandgap measurement, Thompson experiment)					
Pos						
Semester	**Autumn: NO**		**Spring: YES**			
II	**Lecture**	**Tutorial**	**Practical**		**Credits**	**Total teaching hours**
Contact Hours	0	0	3		2	
Prerequisite course code as per proposed course numbers						
Prerequisite Credits						
Equivalent course codes as per proposed course and old course						
Overlap course codes as per proposed course numbers						
Text Books:						
1.	Title					
	Author					
	Publisher					
	Edition					
Reference Books:						
1.	Title					
	Author					
	Publisher					
	Edition					
Content	1. To study the Hall Effect and determination of hall coefficient, and charge carrier concentration. 2. To study interference and diffraction of light by slits (single, double, and/or multiple). 3. To find out wavelength of light by using plane transmission diffraction grating. 4. To study the interference of light by Fresnel's biprism. 5. To determine the wavelength of light by Newton's rings method. 6. To determine specific rotation of sugar using half shade polarimeter. 7. To study the polarization of light and verify Malus' law. 8. To determine the energy bandgap of a semiconductor by resistivity					

	measurement.
	9. To determine the e/m ratio by Thomson's method.
	10. To study photoelectric effect and to determine the Planck's constant.
	11. To determine Planck's constant with LED.
	12. To determine the refractive index and Cauchy's constants using prism and spectrometer.
	13. To find out the Resolving power of diffraction grating using spectrometer.
	14. To determine the fill factor and efficiency of solar cell (in series and parallel).
	15. To study LCR circuit and to find out the resonance frequency.
	16. To study the V-I characteristics of silicon, germanium, and Zener diodes in forward and reverse bias.
	(**Note:** Any 8-10 experiments may be performed)
Course Assessment	Continuous Evaluation 50% End Semester 50%

Course no: **MEP 103**	Open course (YES/NO)	HM Course (Y/N)	DC (Y/N)		DE (Y/N)	
	No	No	No		No	
Type of Course	Laboratory					
Course Title	**PRODUCT DESIGN & REALIZATION LABORATORY- I**					
Course Coordinator	ABHISHEK GANDHI					
Course objectives:	This course is to introduce the basic principles 3D modeling of products. At the end of this course, the students could develop 3D models and their engineering drawings using softwares such as Solidworks, etc.					
POs						
Semester	**Autumn: YES**		**Spring: NO**			
I	**Lecture**	**Tutorial**	**Practical**		**Credits**	**Total Teaching Hours**
Contact Hours	0	0	2		1	24
Prerequisite course code as per proposed course numbers	Nil	Nil				
Prerequisite Credits	Nil	Nil				
Equivalent course codes as per proposed course and old course	MEP 103	Nil				
Overlap course codes as per proposed course numbers	Nil	Nil				
Text Books:						
1.	Title	Solidworks 2015 For Engineers And Designers				
	Author	Sham Tickoo				
	Publisher	Dreamtech Press				
	Edition	2016				
2.	Title					
	Author					
	Publisher					
	Edition					
3.	Title					
	Author					
	Publisher					
	Edition					
Reference Books:						
1.	Title	Exploring Solid works 2011: A Project Based Approach				
	Author	Prof. Sham Tickoo and Sandeep Prem				
	Publisher	Dreamtech Press				
	Edition	2011				
2.	Title					
	Author					
	Publisher					
	Edition					

Content	UNIT I: 02
	SolidWorks Basics and the User Interface: Design Intent, File References, Opening Files, The Solid Works User Interface
	UNIT II: 02
	Introduction to Sketching: 2D Sketching, Stages in the Process, Saving Files, What are We Going to Sketch, Sketching, Sketch Entities, Basic Sketching, Rules That Govern Sketches, Design Intent, Sketch Relations, Dimensions, Extrude, Sketching Guidelines
	UNIT III: 03
	Basic Part Modeling: Basic Modeling, Terminology, Choosing the Best ProfileChoosing the Sketch Plane, Details of the Part, Boss Feature Sketching on a Planar Face, Cut Feature, Using the Hole Wizard, View Options, Filleting, Detailing Basics, Drawing Views, Center Marks, Dimensioning, Changing Parameters
	UNIT IV: 02
	Modeling a Casting or Forging: Case Study: Ratchet, Design Intent, Boss Feature with Draft, Symmetry in the Sketch Sketching Inside the Model, View Options, Using Model Edges in a Sketch, Creating Trimmed Sketch Geometry, Using Copy and Paste
	UNIT V: 02
	Patterning: Why Use Patterns?, Reference Geometry, Linear Pattern, Circular Patterns, Mirror Patterns, Using Pattern Seed Only, Sketch Driven Patterns
	UNIT VI: 02
	Revolved Features: Case Study: Handwheel, Design Intent, Revolved Features, Building the Rim, Building the Spoke, Edit Material, Mass Properties, File Properties, SolidWorks SimulationXpress, Using SolidWorks SimulationXpress,
	UNIT VII: 02
	Shelling and Ribs: Shelling and Ribs, Analyzing and Adding Draft, Other Options for Draft, Shelling, Ribs, Full Round Fillets, Thin Features
	UNIT VIII: 02
	Editing: repairs: Part Editing, Editing Topics, Sketch Issues, FilletXpert, DraftXpert
	UNIT IX: 02
	Editing: Design Changes: Part Editing, Design Changes, Information From a Model, Rebuilding Tools, Sketch Contours, Editing with Instant 3D
	UNIT X: 02
	Configurations: Configurations, Using Configurations, Creating Configurations, Link ValuesEquations, Configure Dimension / Feature, Modeling Strategies for Configurations, Editing Parts that Have Configurations, Design Library.
	UNIT XI: 02
	Design Drawings: More About Making Drawings, Section View, Model Views, Broken View, Detail Views, Drawing Sheets and Sheet Formats, Projected Views, Annotations
	UNIT XII: 02

	Bottom up assemble modeling: Case Study: Universal Joint, Bottom-Up Assembly, Creating a New Assembly, Position of the First Component, FeatureManager Design Tree and Symbols, Adding Components, Using Part Configurations in Assemblies, Sub-assemblies, Smart Mates Using Assemblies, Analyzing the Assembly, Checking for Clearances, Changing the Values of Dimensions, Exploded Assemblies, Explode Line Sketch, Bill of Materials, Assembly DrawingsInserting Sub-assemblies, Pack and Go.
Course Assessment	Continuous Evaluation 50% End Semester 50%

Course no: CYL-100	Open Course (YES/NO) YES	HM Course (Y/N)	DC (Y/N)	DE (Y/N)	
	No	No	No	No	
Type of course	Theory				
Course Title	**Chemical Structure and Reactivity**				
Course Coordinator	Dr. A. P. Singh & Dr. Suman Srivastava				

Course objectives:	By learning this subject, students will be able to understand:
	  i. The basic concept of atomic structure bonding and reactivity.
	  ii. Also this course will also introduce students to basics of electrochemistry, reactions kinetics.
	  iii. This course is design to impart the knowledge of structures of various molecules, their interactions, synthesis route and structural relationship.
	  iv. At the end of this session students will able to understand about the applied chemistry especially about commercial polymer, petroleum products and engineering of materials.				

POs					
Semester		Autumn: Yes		Spring: Yes	
I		Lecture	Tutorial	Practical	Credits	Total teaching hours
Contact Hours		3	1	0	4	48
Prerequisite course code as per proposed course numbers		NIL				
Prerequisite credits		NIL				
Equivalent course codes as per proposed course and old course		NIL				
Overlap course codes as per proposed course numbers		NIL				
Text Books:						
1.	Title	Inorganic Chemistry: Principles of Structure and Reactivity,				
	Author	J. E. Huheey				
	Publisher	Pearson India				
	Edition	4th Edition				
2	Title	Concise Inorganic Chemistry,				
	Author	J. D. Lee				
	Publisher	Wiley				
	Edition	5th Edition				
3	Title	Elements of Physical Chemistry,				
	Author	P. W. Atkins				
	Publisher	Oxford Univ Press				
	Edition	2nd Edition				
4	Title	Organic Chemistry				
	Author	R. T. Morrison				
	Publisher	Pearson				
	Edition	6th Edition				
5	Title	Engineering Chemistry				
	Author	Shikha Agarwal				
	Publisher	Cambridge University Press				
	Edition	1st Edition, 2015				

Content	**UNIT 1: Fundamentals of Inorganic Chemistry** **12**
	Periodic table, atomic and ionic radii, ionization energy, electron affinity, electronegativity and periodicity. Properties and chemical behaviour of s, p, d and f block elements. Chemical Bonding: Valence bond theory and its limitations, directional characteristics of covalent bond, various types of hybridization and shapes of simple inorganic molecules and ions, valence shall electron pair repulsion (VSEPR) theory to NH_3, H_3O^+, SF_4, CIF_3, ICl_2 and H_2O. Crystal Field Theory (CFT), comparison of the stability of octahedral and tetrahedral complexes on the basis of crystal field stabilization energy (CFSE), factor affecting the magnitude of CFSE, application of crystal field theory. Jahan-Teller effect definition and example from d^9 and high spin d^4 systems.
	
	UNIT 2: Fundamentals of Organic Chemistry
	08
	Nomenclature of organic molecules. Aromaticity: Benzenoid and non-benzenoid compounds generation and reactions. Organic reactive intermediates: Generation, stability and reactivity of carbocations, carbanions, free radicals, carbenes, benzynes and nitrenes. Organic reaction mechanisms involving addition, elimination and substitution reactions with electrophilic, nucleophilic or radical species. Important name reactions and rearrangements.
	
	UNIT 3: Electrochemistry and Chemical Kinetics **08**
	Electrochemistry: Introduction, Types of Conductors, Conductance in Electrolytic Solutions, Factor Affecting Conductance, Kohlrausch' law of Independent Migration of Ion. Conductometric titration, Electro Chemical Cell, Electrode Potential and EMF of a Galvanic Cell, Electrochemical Series., Types of Electrode, Batteries.
	Chemical Kinetics: Introduction, Rate of Reaction, Average Rate and Instantaneous Rate, Rate Law Expression, Rate Constant, Factor Influencing Rate of the Reaction. Order and Molecularity of the Reaction, Zero order, First Order Chemical Kinetics, Half-life of a reaction.
	
	UNIT 4: Analytical Techniques in Chemistry
	08 Types of Analysis. Separation Techniques, Potentiometry, pH metry, Spectroscopic techniques: UV-Visible spectroscopy, Lambert Beer's Law, principles and applications of UV-Visible spectroscopy, Infrared spectroscopy, Nuclear Magnetic Resonance Spectroscopy.
	
	UNIT 5: Applied Chemistry **12**
	   (i) **Petroleum Products and Technologies:** Petroleum and petrochemicals, Petroleum cracking, reforming, synthetic petrol, knocking in petrol and diesel engines.
	   (ii) **Industrial Polymers:** Classification of Polymers, Polymer reaction and mechanism of polymerization. Polymerization Techniques, molecular weight of polymers. Commercially important polymers: fibbers, elastomers, adhesives, plastics, vinylic and phenolics, polyesters, polyamide.
	   (iii) **Engineering Materials:** Cement, Gypsum ($CaSO_4.2H_2O$), Plaster of Paris ($2CaSO_4.H_2O$ or $CaSO_4.1/2H_2O$), Lime, Glass, Refractories, Insulating Material.

Course Assessment	Continuous Evaluation 25% Mid Semester 25% End Semester 50%

Course no: ECB 206	Open course (YES/NO)	HM Course (Y/N)	DC (Y/N)	DE (Y/N)
	No	No	Yes	No

Type of course	Theory

Course Title	**Analog Electronics**

Course Coordinator	

Course objectives:	To make the Students
	  i. Familiar with the structure of basic electronic devices.
	  ii. Exposed to the operation and applications of electronic devices.

POs	

Semester	**Autumn:** Yes		**Spring:** Yes		
III	**Lecture**	**Tutorial**	**Practical**	**Credits**	**Teaching Hours**
Contact Hours	**3**	**0**	**2**	**4**	**36(L) + 24(P)**
Prerequisite course code as per proposed course numbers	NA				
Prerequisite credits	NA				
Equivalent course codes as per proposed course and old course					
Overlap course codes as per proposed course numbers	--				

Text Books:		
1.	Title	Electronic Devices and Circuits
	Author	David A. Bell
	Publisher	Prentice Hall of India
	Edition	
2.	Title	Microelectronic Circuits
	Author	Sedra and smith
	Publisher	Oxford University Press
	Edition	2004
3.	Title	Electronic Devices and Circuit theory

		Author	Robert L.Boylestad
		Publisher	Pearson Education
		Edition	11 edition (2015)
4.		Title	Integrated Electronics
		Author	Millman & Halkias
		Publisher	McGraw Hill Education
		Edition	3 edition (2010)
Reference Book:			
1.		Title	Electronic Devices
		Author	Floyd
		Publisher	Pearson Asia
		Edition	9th Edition, 2012.
Content	**UNIT I Diodes** 4

Content

UNIT I Diodes   4

Review of semiconductors, p-n junction, forward and reverse biased junction, equivalent circuits; Applications - rectifier, clipper, clamper, voltage doubler, transfer characteristics; Zener diode; Power supply, filter, zener regulator; Special purpose diodes.

UNIT II Bipolar Junction transistors   9

npn and pnp transistors, input and output characteristics - cut-off, saturation and active regions; CE, CB and CC configurations, small signal model, BJT as amplifier; Biasing circuits; Stability analysis, DC and AC equivalent circuits.

Small-signal Analysis:h-parameter model of BJT, analysis of BJT amplifier circuits, cascaded amplifiers, frequency response of RC coupled amplifier.

UNIT III Power Amplifiers   3

DC and AC load lines; Class A operation; Class B operation, push-pull circuit; Biasing circuits, Class C amplifier; Current source

UNIT IV Field Effect Transistors   4

Operating characteristic, transductance, JFET as amplifier, biasing circuits; Applications.

UNIT V Operational Amplifier   9

Differential amplifier, level shifter, output stage and parameters of OPAMP;

Applications of OPAMP: inverting and non inverting amplifier, active filters-low pass, high pass, band pass, active diode, active full wave rectifier, clipper, clamper, waveform generator circuits – square, triangular and sine wave generator.

UNIT VI Oscillators **4**

Barkhausen criterion, damped oscillation in LC circuits; Harmonic oscillators-RC-phase shift oscillator, transistor phase shift oscillator, Wein's bridge oscillator; Tuned oscillator- Colpitts oscillator, Hartley oscillator; Crystal oscillator

UNIT VII Voltage Regulators **3**

Zener voltage regulator, emitter follower regulator, series voltage regulator, IC regulator

Laboratory Experiments:

1. Ripple And Regulation Characteristics Of Full Wave And Half Wave With Filters (C,L,Lc,Clc)

2. Clippers And Clampers

3. Half Wave And Full Wave Voltage Doubler, Tripler.

4. BJT Characteristics NPN & PNP (CB, CC And CE).

5. Biasing Circuits Of BJT

6. Amplifier Class A,B,AB By Using BJT

7. FET Characteristics (N & P Channel)

8. MOSFET Characteristics (N & P Channel)

9. Op Amp Inverting And Non-Inverting Amplifiers.

10. Active Filters (Low Pass , High Pass And Band Pass) Using Op –Amp

11. Wein-Bridge Oscillator Using Op- Amp

12. RC Phase Shift Oscillators By Using BJT

13. Zener Diode & IC Voltage Regulator

14. Series & Emitter Follower Voltage Regulator

Course Assessment	Theory: Continuous Evaluation 25% Mid Semester 25% End Semester 50%
	Lab: Continuous Evaluation 50% End Semester 50%
	60% weightage to theory and 40 % weightage to laboratory for overall grading

Course no: CSB 102	Open course (YES/NO)		HM Course (Y/N)	DC (Y/N)	DE (Y/N)
	NO		NO	NO	NO
Type of course	**Core**				
Course Title	**DATA STRUCTURES**				
Course Coordinator					
Course objectives:	This course aims to provide the students with a foundation in computer programming. The goals of the course are to develop the basic programming skills in students, and to improve their proficiency in applying the basic knowledge of programming to solve problems related to their field of engineering.				
POs					

Semester	**Autumn:**		**Spring: Yes**		
II	**Lecture**	**Tutorial**	**Practical**	**Credits**	**Total teaching hours**
Contact Hours	3	0	2	4	36
Prerequisite course code as per proposed course numbers	NIL				
Prerequisite credits	NIL				
Equivalent course codes as per proposed course and old course	NIL				
Overlap course codes as per proposed course numbers	NIL				

Text Books:

1	Title	
	Author	
	Publisher	
	Edition	

Reference Book:

1	Title	Fundamentals of Data Structures
	Author	E. Horowitz, S. Sahni
	Publisher	Computer Science Press
	Edition	2nd Edition, 2008
2	Title	Data Structures Using C
	Author	E. Balagurusamy
	Publisher	TATA McGraw Hill
	Edition	2013
3	Title	Data Structure and Program Design
	Author	R.L. Kruse
	Publisher	Prentice Hall
	Edition	2nd Edition, 1996
4	Title	Data Structures Using C

	Author	A. M. Tanenbaum, Y. Langsam, M. J. Augenstein
	Publisher	Pearson Education
	Edition	1990

Content	**Unit** – 1 (5 Hours) Introduction: Dynamic aspects of operations on data, Characteristics of data structures, Creation and manipulation of data structures, Operations on data structures, Types of data structures – linear and nonlinear. Introduction to algorithm: Asymptotic notations, Analysis of algorithms: Time and Space complexity. **Unit** – 2 (7 Hours) Arrays: Dynamic memory allocation, one-dimensional arrays, multidimensional arrays, operations on arrays, storage – Row major order, Column major order. Linked lists: types of linked lists – singly, doubly and circularly linked lists, operations on linked lists. **Unit** – 3 (8 Hours) Stacks: Implementation of stacks– array and linked list, operations on stacks, Applications of Stacks, Notations – infix, prefix and postfix, Conversion and evaluation of arithmetic expressions using Stacks. Queues: Implementation of queues– array and linked list, operations on queues, Types of queues – queue, double ended queue and priority queue. **Unit** – 4 (8 Hours) Trees: Binary tree, Binary search tree, Threaded binary tree, Height balanced trees, Tries, Heaps, Hash tables. Graph traversals: Breadth First Search, Depth First Search, Shortest path: Depth first search in directed and undirected graphs. Union-find data structure and applications. Directed acyclic graphs; topological sort. **Unit** – 5 (8 Hours) Searching: Linear search, Binary search and Hashing. Algorithms and data structures for sorting: Insertion Sort, Bubble sort, Selection Sort, Merge sort, Quick Sort, Heap sort, Radix sort, Bucket sort. Algorithm design techniques: Divide and conquer, Greedy approach, dynamic programming.
Course Assessment	Continuous Evaluation 25% Mid Semester 25% End Semester 50%

Course no:	Open course	HM	DC (Y/N)		DE (Y/N)

MAL 151	(YES/NO)	Course (Y/N)		
	NO	N	N	N
Type of Course	Theory			
Course Title	**LINEAR ALGEBRA AND COMPLEX ANALYSIS**			
Course Coordinator	DR. AMIT MAHAJAN			
Course objectives:	This course covers matrix theory and linear algebra, emphasizing topics useful in other disciplines. The concepts of linear algebra are extremely useful in physics, economics and social sciences, natural sciences, and engineering. Also, this course covers basic concepts of complex analysis, such as limit, continuity, differentiability and integration, and also related theorems.			
POs				
Semester	**Autumn:**		**Spring: Yes**	

II	Lecture	Tutorial	Practical	Credits	Total Teaching Load
Contact Hours	3	1	0	4	48
Prerequisite course code as per proposed course numbers	Nil	Nil			
Prerequisite Credits	Nil	Nil			
Equivalent course codes as per proposed course and old course	Nil	Nil			
Overlap course codes as per proposed course numbers	Nil	Nil			
Text Books:					
1.	Title	Linear Algebra and its Applications			
	Author	David C. Lay			
	Publisher	Pearson Pub.			
	Edition	2011			
2.	Title	Complex variables and its applications			
	Author	R. V. Churchill			
	Publisher	McGraw Hill			
	Edition	1960			
Reference Books:					
1.	Title	Introduction to Linear Algebra			
	Author	Gilbert Strang			
	Publisher	Cambridge Press			
	Edition	2009			
2.	Title	Advanced Engineering Mathematics			
	Author	E. Kreyszig			
	Publisher	John Wiley and Sons			

	Edition	2008	
Content	**Unit I:**		**24**
	Linear Algebra: Elementary of row and column operations on a matrix, Rank of a matrix, Normal form, Inverse of matrix, Systems of linear equation and their solutions, Vector space and its subspaces, Spanning sets and linear independence, Determinant properties, Linear transformation, Range space and Rank, Null space and nullity, Eigenvalues and eigenvector, Diagonalization of matrices, Similarity of matrices, Inner product, Gram Schmidt process, Least square approximations.		
	Unit II:		**24**
	Complex Analysis: Complex number and elementary properties, Complex functions-Limit, continuity and differentiability, Polar form of Complex number, Cauchy Riemann Equations, Analytic and Harmonic functions, Cauchy's Theorem, Cauchy's Integral formula, Taylor and Laurent's series expansion, Zeros and singularities, Residues, Residue theorem and its applications.		
Course Assessment	Continuous Evaluation 25% Mid Semester 25% End Semester 50%		

Course no: MEB 100	Open course (YES/NO)	HM Course	DC (Y/N)	DE (Y/N)

		(Y/N)		
Type of Course	THOERY			
Course Title	**ENGINEERING VISUALIZATION**			
Course Coordinator	DR. ABHISHEK MISHRA			
Course objectives:	1. To impart and inculcate proper understanding of the theory of projection. 2. To improve the visualization skills. 3.To enable the students with various concepts like dimensioning, conventions and standards related to working drawings in order to become professionally efficient. 4. To impart the knowledge on understanding and drawing of simple residential/office buildings.			
POs	1. Students will be able to understand the theory of projection. 2. Students will be able to know and understand the conventions and the methods of engineering drawing. 3. Students will be able to improve their visualization skills so that they can apply these skills in developing new products. 4. Students will be able to prepare simple layout of factory buildings.			

Semester	**Autumn:**		**Spring:**		
I	**Lecture**	**Tutorial**	**Practical**	**Credits**	**Total Teaching Hours**
Contact Hours	3	0	2	4	60
Prerequisite course code as per proposed course numbers	NIL				
Prerequisite Credits	NIL				
Equivalent course codes as per proposed course and old course	NIL				
Overlap course codes as per proposed course numbers	NIL				

Text Books:		
1.	Title	Engineering Drawing
	Author	N. D. Bhatt
	Publisher	Charotar Publishing House Pvt. Ltd.
	Edition	Fifty Third 2014
2.	Title	
	Author	
	Publisher	
	Edition	
3.	Title	
	Author	
	Publisher	
	Edition	
Reference Books:		

1.	Title	AutoCAD 2007 Bible
	Author	E. Finkelstein
	Publisher	Wiley Publishing Inc.
	Edition	2007
2.	Title	
	Author	
	Publisher	
	Edition	
Content	**OVERVIEW:** Sketching concepts. Orthographic Projections and views: Principles of Axonometric projections and Development of Isometric, Dimensioning of Orthographic Views, Sectioning in Orthographic views and assembly drawings. Introduction: Overview of the course, Examination and Evaluation patterns.	
	Unit I: **09** Lines Lettering and Dimensioning: Types of lines, Lettering, Dimensioning, Geometrical Constructions, Polygons. Scales: Plain scales, Diagonal scales, Scale of chords.	
	Unit II: **09** Curves used in Engineering Practice: Ellipse, Parabola, Hyperbola, normal and tangents to these curves, Involute, Cycloid, Epi-cycloid, Hypo-cycloid, Spiral, Helix on cone and cylinder.	
	Unit III: **09** Orthographic projection of points: Principles of Orthographic projection, Projections of points.Projections of Lines: Projections of a line parallel to one of the reference planes and inclined to the other, line inclined to both the reference planes, Traces	
	Unit IV: **09** Projections of Planes: Projections of a plane perpendicular to one of the reference planes and inclined to the other, Oblique planes.	
	Unit V: **08** Projections of Solids: Projections of solids whose axis is parallel to one of the reference planes and inclined to the other, axis inclined to both the planes.	
	Unit VI: **08** Section of Solids: Sectional planes, Sectional views - Prism, pyramid, cylinder and cone, true shape of the section.	
	Unit VII: **08** Isometric views: Isometric axis, Isometric Planes, Isometric View, Isometric projection, Isometric views – simple objects.Assembly drawings of the machine parts.	
	NOTE: Interpretation of drawings: Introduction of CAD package to construct a simple solid model, Using a CAD package to construct solid models and generating orthographic, isometric, sectional views with dimensioning, Assembly of components and generation of corresponding drawings. Animation of single of machines in CAD.	
Course Assessment	Theory (60%): Continuous Evaluation 25%, Mid Semester 25% End Semester 50% Laboratory (40%): Continuous Evaluation 50%	

Course no: HMB 101	Open course (YES/NO)	HM Course (Y/N)	DC (Y/N)	DE (Y/N)
	No	No	No	No

Type of Course	Practical				
Course Title	**HUMAN VALUES AND ETHICS**				
Course Coordinator					
Course objectives:	To inculcate ethical understanding in students.				
POs					
Semester	**Autumn: Yes**		**Spring: No**		
I	**Lecture**	**Tutorial**	**Practical**	**Credits**	**Total Teaching Hours**
Contact Hours	3	0	2	4	60
Prerequisite course code as per proposed course numbers	Nil				
Prerequisite Credits	Nil				
Equivalent course codes as per proposed course and old course	Nil				
Overlap course codes as per proposed course numbers	Nil				
Text Books:					
1.	Title	Organizational Behaviour: Text and Cases			
	Author	Chitale, et.al.			
	Publisher	PHI Learning Private Limited.			
	Edition				
2.	Title				
	Author				
	Publisher				
	Edition				
3.	Title				
	Author				
	Publisher				
	Edition				
Reference Books:					
1.	Title	Ethics in Engineering			
	Author	Mike W. Martin & Roland Schinzinger			
	Publisher	McGrow Hills			
	Edition				
2.	Title				
	Author				
	Publisher				
	Edition				
Content	**Unit I:** **15** Introduction: Organizational Systems and Resources Personality, Types of Personality, Determinants of Personality. Biographical and Personal factors. Environmental Factors. Psychological Factors. Big Five Personality				

	traits.
	Unit II: **15** Feelings, Classification of Feelings. Dimensions of Emotions. Emotions and External Constraints. Emotional Intelligence. Spiritual Intelligence. Authority, Responsibility and Accountability: Meaning of Authority, Responsibility and Accountability. Balance between Authority, Responsibility and Accountability. **Unit III:** **15** Human Resource Policies& Procedures. Introduction, Importance of Policies, Policy formation, Human resources planning. Decision-making &Ethics. **Unit IV:** **15** Concept of moral Relativism and Moral Imperialism. Cognitive Moral Development. Encouragement to Ethical Behaviour. Approaches to Fostering Ethical Behaviour.
Course Assessment	Continuous Evaluation 25% Mid Semester 25% End Semester 50%

Course no: MEL 102	Open course (YES/NO)	HM Course (Y/N)	DC (Y/N)	DE (Y/N)
	No	No	No	No
Type of Course	Theory			

Course Title	**ENGINEERING MECHANICS**				
Course Coordinator	ABHISHEK GANDHI				
Course objectives:	This course is to introduce the basic principles of engineering mechanics with emphasis on their analysis and application to practical engineering problems.				
POs					
Semester	**Autumn: YES**		**Spring YES**		
I	**Lecture**	**Tutorial**	**Practical**	**Credits**	**Total teaching hours**
Contact Hours	3	0	0	3	36
Prerequisite course code as per proposed course numbers	Nil	Nil			
Prerequisite Credits	Nil	Nil			
Equivalent course codes as per proposed course and old course	MEL 102	Nil			
Overlap course codes as per proposed course numbers	Nil	Nil			
Text Books:					
1.	Title	Engineering Mechanics			
	Author	Timoshenko, Young, Rao &Pati			
	Publisher	McGraw Hill Education India			
	Edition	5 (2013)			
2.	Title				
	Author				
	Publisher				
	Edition				
3.	Title				
	Author				
	Publisher				
	Edition				
Reference Books:					
1.	Title	Engineering Mechanics			
	Author	J.L. Meriam & L.G. Kraige			
	Publisher	Wiley			
	Edition	7 (2011)			
2.	Title				
	Author				
	Publisher				
	Edition				
Content	**UNIT I:** 03 System of Coplanar forces: Introduction to coplanar & non-coplanar force system. Forces and their components. Moment of the force about a point, couple. Resultant of coplanar force system - concurrent forces, parallel forces, non-concurrent non-parallel system of forces.				

	UNIT II: **03** Equilibrium of coplanar force system: Meaning of equilibrium, free body diagrams, equilibrium of concurrent, parallel and non-concurrent non-parallel (general) system of forces. Types of supports, determination of reactions at supports for various types of determinate beams. **UNIT III:** **03** Forces in Space: Rectangular components of forces in space, Resultant of concurrent forces, moment of a force about a point, moment of a force about a given axis, resultant of general force system, Equilibrium of a particle in space. **UNIT IV:** **03** Analysis of pin jointed frame/ truss: Perfect truss, Imperfect truss, Analysis of truss by method of joints and method of section. **UNIT V:** **03** Friction: Laws of friction, angle of friction, angle of repose, cone of friction, Equilibrium of bodies on rough horizontal and inclined plane, application to problems involving wedges, ladder. Belt friction, flat belts on the flat pulleys. **UNIT VI:** **03** Centroid of Plane Areas: Concept of Centroid of plane areas. Centroid of areas by integration. Centroid of composite areas. **UNIT VII:** **03** Moment of Inertia: Moment of inertia of plane areas, parallel axis theorem. Introduction to polar moment of inertia, product of inertia and mass moment of inertia. **UNIT VIII:** **03** Kinematics of Particle: Velocity and acceleration in terms of rectangular coordinate system, rectilinear motion, motion along plane curved path, tangential and normal component of acceleration, acceleration - time, velocity- time, graphs and their use, relative velocity, projectile motion, simple harmonic motion. **UNIT IX:** **03** Kinematics of rigid bodies: Translation, pure rotation and plane motion of rigid bodies, instantaneous, centre of rotation for velocity for bodies in plane motion, link mechanisms (upto two links) **UNIT X:** **03** Kinetics of Particles: Newton's laws of motion, D'Alembert's principle, equation of dynamic equilibrium, linear motion, curvilinear motion. **UNIT XI:** **03** Energy and Momentum Principles: Work done by a force, potential and kinetic energy, power, work energy equation, principle of conservation of energy, momentum, impulse and momentum principle, principle of conservation of momentum, impact of solid bodies, elastic impact, semi-elastic impact and plastic impact. **UNIT XII:** **03** Kinetics of rigid bodies: D'Alembert's principle for bodies under translational motion, rotational motion about a fixed axis and plane motion. Application to motion of bars, cylinders, spheres.
Course Assessment	Continuous Evaluation 25% Mid Semester 25% End Semester 50%

Course no: CYP-100	Open Course (YES/NO) YES	HM Course (Y/N)	DC (Y/N)	DE (Y/N)
	No	No	No	No
Type of course	Practical			
Course Title	**Chemistry Laboratory**			
Course Coordinator	Dr. A. P. Singh & Dr. Suman Srivastava			
Course objectives:	This course will provide the practical knowledge to the students on: i) Various types of Titrations ii) Synthesis and characterization of various organic and inorganic compounds. iii) Identification of unknown compounds iv) Hand on experience on various analytical equipments.			
POs				
Semester		Autumn: Yes		Spring: Yes	

I	Lecture	Tutorial	Practical	Credits	Laboratory hours
Contact Hours	0	0	3	2	36
Prerequisite course code as per proposed course numbers	NIL				
Prerequisite credits	NIL				
Equivalent course codes as per proposed course and old course	NIL				
Overlap course codes as per proposed course numbers	NIL				

Text Books:

1.	Title	Essentials of Experimental Engineering Chemistry,
	Author	Shashi Chawla
	Publisher	Dhanpat Rai and Co Pvt Ltd
	Edition	4th Edition
2.	Title	Vogel's Quantitative Inorganic Analysis
	Author	G. Svehla
	Publisher	Prentice Hall
	Edition	7th Edition

Content

1. To find the strength in grams per liter of the given solution of sodium hydroxide with the help of stander oxalic acid solution.
2. Estimation of water hardness by EDTA method.
   a. To determine the strength of calcium ion in given $CaCO_3$ solution by complexometric titrations.
   b. To determine the strength of magnesium ion in given $MgSO_4$ solution by complexometric titrations.
   c. To determine the total hardness of given water sample by complexometric titrations.
3. To determination the strength of ferrous ammonium sulphate with the help of $K_2Cr_2O_7$ solution.
4. To Preparation of a nickel complex $[Ni(NH_3)_6]Cl_2$ and estimation of nickel by complexometric titration.
5. Preparation of benzimidazole.
6. Identification of functional group present in an organic compound- unknown sample
7. Measurement of physical properties: Surface tension and viscosity.

	8. Chemical kinetics- Acid hydrolysis of ethyl acetate. 9. Acid-base titration using pH meter. 10. Acid-base titration by conductometry.
Course Assessment	Continuous Evaluation 50% End Semester 50%

Course no: MEP 104	Open course (YES/NO)	HM Course (Y/N)	DC (Y/N)		DE (Y/N)	
	No	No	Yes		No	
Type of Course	Laboratory					
Course Title	**PRODUCT DESIGN & REALIZATION LABORATORY - II**					
Course Coordinator	ABHISHEK GANDHI					
Course objectives:	The student will be able to identify the manufacturing processes required to manufacture an engineering product. The student will have a brief exposure of basic manufacturing machineries and processes, which are widely utilized in industries to manufacture products.					
POs						
Semester	**Autumn: NO**		**Spring: YES**			
II	**Lecture**	**Tutorial**	**Practical**	**Credits**	**Total teaching hours**	
Contact Hours	0	0	2	1	24	
Prerequisite course code as per proposed course numbers	NIL					
Prerequisite Credits	NIL					
Equivalent course codes as per proposed course and old course	MEP 104					
Overlap course codes as per proposed course numbers						
Text Books:						
1.	Title	Introduction to Basic Manufacturing Processes and Workshop Technology				
	Author	Rajendra Singh				
	Publisher	New Age International Publishers, India				
	Edition	2006				
2.	Title					
	Author					
	Publisher					
	Edition					
Reference Books:						
1.	Title	A Textbook of Workshop Technology : Manufacturing Processes				
	Author	R. S. Khurmi & J K Gupta				
	Publisher	S. Chand Publications				
	Edition	16/e				
2.	Title					
	Author					
	Publisher					
	Edition					
Content	**UNIT I:**					**04**

	Fitting trade: Preparation of T-Shape Work piece as per the given specifications. Preparation of U-Shape Work piece that contains: Filing, Sawing, Drilling, Grinding. Practice marking operations
	UNIT II: **04**
	Machine Shop: Study of machine tools in particular Lathe machine (different parts, different operations, study of cutting tools). Demonstration of different operations on Lathe machine. Practice of Facing, Plane Turning, step turning, taper turning, knurling and parting. Study of Quick return mechanism of Shaper.
	UNIT III: **04**
	Carpentry: Study of Carpentry Tools, Equipment and different joints. Practice of Cross Half lap joint, Half lap Dovetail joint and Mortise Tenon Joint
	UNIT IV: **04**
	Foundry trade: Introduction to foundry, Patterns, pattern allowances, ingredients of moulding sand and melting furnaces. Foundry tools and their purposes. Demo of mould preparation. Practice – Preparation of mould by using split pattern.
	UNIT V: **04**
	Welding: Introduction: Study of Tools and welding Equipment (Gas and Arc welding), Selection of welding electrode and current, Bead practice, Practice of Butt Joint, Lap Joint.
	UNIT VI: **04**
	Forging: Introduction, upsetting, drawing down, punching, bending, swaging and fullering.
Course Assessment	Continuous Evaluation 50% End Semester 50%

Course no: CSL 201	Open course (YES/NO)		HM Course (Y/N)	DC (Y/N)	DE (Y/N)
	NO		NO	NO	NO
Type of course	Core				
Course Title	DISCRETE STRUCTURES				
Course Coordinator					
Course objectives:	The purpose of this course is to understand and use discrete structures that are backbones of computer science. In particular, this course is meant to introduce logic, proofs, sets, relations, graphs, functions, groups, and combinatorics.				
POs					

Semester	Autumn: Yes		Spring:		
III	Lecture	Tutorial	Practical	Credits	Total teaching hours
Contact Hours	3	1	0	4	36
Prerequisite course code as per proposed course numbers	NIL				
Prerequisite credits	NIL				
Equivalent course codes as per proposed course and old course	NIL				
Overlap course codes as per proposed course numbers	NIL				

Text Books:		
1	Title	Discrete Mathematics and applications
	Author	K.H.Rosen
	Publisher	TataMcGraw Hill
	Edition	fifth edition 2003

Reference Book:		
1	Title	Elements of Discrete Mathematics
	Author	C.L.Liu
	Publisher	McGraw-Hill Book Company.
	Edition	Second edition 1985
2	Title	Discrete Mathematics for Computer Scientists and Mathematicians
	Author	1. J .L.Mott, A.Kandel, T.P .Baker
	Publisher	Prentice Hall of India
	Edition	Second edition 1986
3	Title	Logic and Discrete Mathematics
	Author	W.K.Grassmann and J.P.Tremblay
	Publisher	Pearson

	Edition	1995
Content	**Unit** – 1 (5 Hours) Mathematical reasoning; propositions; negation disjunction and conjuction; implication and equivalence; truth tables; predicates; quantifiers; natural deduction; rules of Inference; methods of proofs; use in program proving; resolution principle. **Unit**-2 (10Hours) Set theory; Paradoxes in set theory; inductive definition of sets and proof by induction; Peono postulates; Relations; representation of relations by graphs; properties of relations;equivalence relations and partitions; Partial orderings; Posets; Linear and well-ordered sets **Unit** – 3 (7 Hours) Graph Theory; elements of graph theory, Euler graph, Hamiltonian path, trees, tree traversals, spanning trees. **Unit** – 4 (7 Hours) Functions; mappings; injection and surjections; composition of functions; inverse functions;special functions; Peono postulates; pigeonhole principle; recursive function theory. **Unit** – 5 (7 Hours) Definition and elementary properties of groups, semigroups, monoids, rings, fields, vector spaces and lattices. Elementary combinatorics; counting techniques; recurrence relation; generating functions.
Course Assessment	Continuous Evaluation 25%
	Mid Semester 25%
	End Semester 50%

Course no: CSB 202	Open course (YES/NO)		HM Course (Y/N)	DC (Y/N)	DE (Y/N)
	NO		NO	NO	NO
Type of course	**Core**				
Course Title	**Database Management Systems**				
Course Coordinator					
Course objectives:	Provides fundamental knowledge of, and practical experience with, database concepts. Includes study of information concepts and the realization of those concepts using the relational data model. Practical experience gained designing and constructing data models and using SQL to interface to both multi-user DBMS packages and to desktop DBMS packages.				
POs					

Semester	**Autumn: Yes**		**Spring:**		
III	**Lecture**	**Tutorial**	**Practical**	**Credits**	**Total teaching hours**
Contact Hours	3	0	2	4	36
Prerequisite course code as per proposed course numbers	NIL				
Prerequisite credits	NIL				
Equivalent course codes as per proposed course and old course	NIL				
Overlap course codes as per proposed course numbers	NIL				

Text Books:

1	Title	Fundamentals of Database Systems
	Author	R. Elmasri and S.B. Navathe
	Publisher	Pearson
	Edition	2016

Reference Book:

1	Title	Database Systems Concepts
	Author	H.f.Korth and Silberschatz
	Publisher	McGraw Hill
	Edition	
2	Title	Data Base Design
	Author	C.J. Date
	Publisher	Addison Wesley
	Edition	
3	Title	DBM and Design

		Author	Hansen and Hansen
		Publisher	PHI
		Edition	
4		Title	Database System
		Author	Hector Garcia-Molina, Jeff Ullman, and Jennifer Widom
		Publisher	Pearson
		Edition	2nd Edition
Content	**Unit** – 1 (4 Hours) Introduction - General introduction to database systems; Database - DBMS disctinction, approaches to building a database, data models, database management system, three-schema architecture of a database, challenges in building a DBMS, various components of a DBMS. **Unit** – 2 (7 Hours) Database design and ER Model:- Overview, ER-Model, Constraints, ER-Diagrams, ERD Issues, weak entity sets, Codd's rules, Relational Schemas, Introduction to UML Relational database model: Logical view of data, keys, integrity rules. Relational Database design: features of good relational database design, atomic domain and Normalization (1NF, 2NF, 3NF, BCNF). **Unit** – 3 (8 Hours) Relational algebra: introduction, Selection and projection, set operations, renaming, Joins, Division, syntax, semantics. Operators, grouping and ungrouping, relational comparison. Calculus: Tuple relational calculus, Domain relational Calculus, calculus vs algebra, computational capabilities. **Unit** – 4 (10 Hours) SQL - Introduction, data definition in SQL, table, and key and foreign key definitions, update behaviors. Querying in SQL - basic select-from-where block and its semantics, nested queries - correlated and uncorrelated, notion of aggregation, aggregation functions group by and having clauses, embedded SQL. Data Storage and Indexes - file organizations, primary, secondary index structures, various index structures - hash-based, dynamic hashing techniques, multi-level indexes, and B+ trees. **Unit** – 5 (7 Hours) Transaction management and Concurrency control: Transaction processing and Error recovery - concepts of transaction processing, ACID properties, and serializability concurrency control, Lock based concurrency control (2PL, Deadlocks), Time stamping methods, optimistic methods, and database recovery management. Error recovery and logging, undo, redo, undo-redo logging and recovery methods.
Course Assessment	Continuous Evaluation 25% Mid Semester 25% End Semester 50%

Course no: ECB 204	Open course (YES/NO)	HM Course (Y/N)	DC (Y/N)		DE (Y/N)	
	No	No	Yes		No	
Type of Course	Theory		**Core Engineering Course**			
Course Title	**SIGNALS AND SYSTEMS**					
Course Coordinator	DR. RAJIV KUMAR TRIPATHI					
Course objectives:	Coverage of continuous and discrete-time signals and systems, their properties and representations and methods those are necessary for the analysis of continuous and discrete-time signals and systems. Knowledge of time-domain representation and analysis concepts as they relate to difference equations, impulse response and convolution, etc. Knowledge of frequency-domain representation and analysis concepts using Fourier Analysis tools, Z-transform. Mathematical and computational skills needed in application areas like communication, signal processing and control, which will be taught in other courses					
POs	Characterize and analyze the properties of CT and DT signals and systemsAnalyze CT and DT systems in Time domain using convolution. Represent CT and DT systems in the Frequency domain using Fourier Analysis tools like CTFS, CTFT, DTFS and DTFT. Conceptualize the effects of sampling a CT signal Analyze CT and DT systems using Laplace transforms and Z Transforms.					
Semester	**Autumn: Yes**		**Spring: No**			
III	**Lecture**	**Tutorial**	**Practical**		**Credits**	**Total Teaching Hours**
Contact Hours	3	0	2		4	36
Prerequisite course code as per proposed course numbers	None					
Prerequisite Credits	None					
Equivalent course codes as per proposed course and old course	None					
Overlap course codes as per proposed course numbers	None					
Text Books:						
1.	Title	Signals and Systems				
	Author	Alan V. Oppenheim, Alan S. Willsky with S. Hamid Nawab				
	Publisher	PHI Publications				
	Edition					
2.	Title	Principles of Linear Systems and Signals				
	Author	B.P. Lathi				
	Publisher	Oxford University Press Publications				
	Edition					

3.	Title	Signals and Systems
	Author	Simon Haykin
	Publisher	John Wiley and Sons Publications
	Edition	
Reference Books:		
1.	Title	
	Author	
	Publisher	
	Edition	
2.	Title	
	Author	
	Publisher	
	Edition	
Content	**Unit I:** 06	

Content

Unit I: **06**

What is Signal and System Theory? The black-box approach. Formal definition of 'signal' and 'system'. The domain and range variables, continuous and discrete signals and cont. and discrete systems. Signal operations: folding, Shifting, scaling for Continuous and Discrete Time Signal. Characterization of systems: memory, linearity, causality, time-invariance, stability and Invertibilty. Condition on Impulse response of a system for an LTI system for memory, linearity, causality, time-invariance, stability, Invertibilty.

Unit II: **08**

Periodic signals: definition, periodicity of the sum of two signals, Orthogonal functions, Sinusoidal Fourier Series, Derivation of Fourier coefficient of sinusoidal series, continuous-time complex exponential Fourier Series. Relationship between Fourier coefficient of Sinusoidal and Exponential Fourier Series, Signal approximation using truncated Fourier series. Brief discussion of convergence issues and conditions for existence of the CTFS. Aperiodic signals and their representation: the transition from the CTFS to the Continuous Time Fourier Transform (CTFT). Finite power and finite energy signals. Brief discussion of convergence issues and conditions for existence of the FT. Extension of the FT for finite power signals: frequency domain Dirac impulses. Properties of the FS and FT: particular emphasis on convolution.

Unit III: **08**

A discussion of the discrete-time complex exponential. Discrete time systems and complex exponentials. Periodic discrete signals: sampling periodic continuous time signals. Periodic signal as a sum of complex exponentials. The discrete-time Fourier series: analysis and synthesis equations. The DFT: N-point DFT of an M-point signal. Aperiodic signals and their representation: the transition from the DTFS to the discrete-time Fourier Transform. Finite power and finite energy signals. Brief discussion of convergence issues and conditions for existence of the DTFT. Extension of the DTFT for finite power signals: frequency domain Dirac impulses. Properties of the DTFS and DTFT: particular emphasis on convolution.

Unit IV: **08**

The principle of cont. signal sampling. The primary objective: perfect reconstruction. Ideal sampling and the sampling theorem: over- and under-sampling. Reconstruction theory: finite order interpolators and reconstruction distortion; ideal reconstruction. Non-ideal sampling and

	reconstruction. Sampling of discrete-time signals.
	Unit V: **06**
	Laplace Transform as a generalization of the FT. The region of convergence and its properties. Pole-zero plots. Inverse transformation: role of the ROC in ensuring uniqueness. Properties of the LT. Inference of the FT from the LT. System characterization from the pole-zero plots. One-sided LT. The z-Transform as a generalization of the DTFT. The region of convergence and its properties. Pole-zero plots. Inverse transformation: role of the ROC in ensuring uniqueness. Properties of the ZT. Inference of the DTFT from the LT. System characterization from the pole-zero plot. Cont. to discrete system transformations. One-sided ZT.
	Tentative List of Experiments:
	1. Matlab Basics, Independent and dependent variable and function generation
	2. Signal Generation: Such as unit impulse, unit step, Sinusoidal, exponential and others.
	3. To create user function for performing signal operations: folding, Shifting, scaling, addition for continuous and discrete time signal.
	4. Convolution and its properties for continuous and discrete time signal.
	5.Implementation of Continuous Time Fourier Series (CTFS) of continuous periodic time signals.
	6. Properties of CTFS and mplementation of Discrete Time Fourier Series (DTFS) of Discrete periodic time signals.
	7.Properties of DTFS.
	8. mplementation of Discrete Time Fourier Transform (DTFT) of discrete time aperiodic signals.
	9. Properties of DTFT.
	10. Implementation of Discrete Fourier Transform (DFT) of discrete time signals.
Course Assessment	Continuous Evaluation 25%
	Mid Semester 25%
	End Semester 50%

Course no: ECB 257	Open course (YES/NO)		HM Course (Y/N)	DC (Y/N)	DE (Y/N)
	NO		NO	NO	NO
Type of course	Other Engineering Courses				
Course Title	DIGITAL ELECTRONICS & LOGIC DESIGN				
Course Coordinator					
Course objectives:	This course is aimed to provide an introduction to digital logic design and its ability to understand number system representations, binary codes, binary arithmetic and Boolean algebra, its axioms and theorems, and its relevance to digital logic design. It also introduces combinational circuits, synchronous sequential logic and Asynchronous sequential logic.				
POs					
Semester	Autumn:		Spring: Yes		
IV	Lecture	Tutorial	Practical	Credits	Total teaching hours
Contact Hours	3	0	2	4	36
Prerequisite course code as per proposed course numbers	NIL				
Prerequisite credits	NIL				
Equivalent course codes as per proposed course and old course	NIL				
Overlap course codes as per proposed course numbers	NIL				
Text Books:					
1	Title	Digital Design			
	Author	Mano, M. Morris			
	Publisher	Pearson Education			
	Edition	Third Edition, 2002			
Reference Book:					
1	Title	Digital Fundamentals			
	Author	Floyd, Thomas L.			
	Publisher	Pearson Education, Singapore			
	Edition	Seventh Edition, 2002			
2	Title	Digital Electronics			
	Author	Gothmann, William H.			
	Publisher	PHI, New Delhi			
	Edition	Second Edition 2000			
3	Title	Jain, R.P.			
	Author	Modern Digital Electronics			
	Publisher	TMH, New Delhi			
	Edition	Third Edition 2003			
4	Title	Digital Logic Design			

		Author	B Holdsworth
		Publisher	TMH, New Delhi
		Edition	Second Edition 1991
5		Title	Logic Design Theory
		Author	Nripendran N. Biswas
		Publisher	PHI, New Delhi
		Edition	1993
6		Title	Leach, D. P., Albert P. Malvino
		Author	Digital Principles and Applications
		Publisher	TMH, New Delhi
		Edition	Fifth Edition 1995
Content	**Unit** – 1 (5 Hours) Binary systems: Digital Systems, Binary Numbers, Number Base Conversions, Octal And Hexadecimal Numbers, Complements, Signed Binary Numbers, Binary Codes, Binary Storage Registers And Binary Logic. **Unit** – 2 (7 Hours) Basic Theorems And Properties Of Boolean Algebra , Boolean Functions, Canonical And Standard Forms, Other Logical Operations , Digital Logic Gates, Integrated Circuits. **Unit** – 3 (8 Hours) Gate level minimization: The Karnaugh-Map Method, Four-Variable Map, Five-Variable Map, prime cubes, Minimum sum of Products and Product Of Sums Simplification, Don't –Care Conditions, NAND And NOR Implementation, prime implicant chart, cyclic prime implicant chart. LOGIC FAMILIES **Unit** – 4 (8 Hours) Combinational Logic: Combinational Circuits, Analysis Procedure, Design Procedure, Binary Adder-Subtractor, Decimal Adder, Binary Multiplier, parallel adders and look-ahead adders, Magnitude Comparator, Decoders, Encoders, multiplexers and demultiplexers, parity generators and checkers. **Unit** – 5 (8 Hours) Programmable Logic Devices, Introduction to sequential circuits, memory elements, latches. Flip-flops, analysis of sequential circuits, state tables, state diagrams, design of sequential circuits, excitation tables, registers, shift registers, counters.		
Course Assessment	Continuous Evaluation 25%		
	Mid Semester 25%		
	End Semester 50%		

Course no: MAL 241	Open course (YES/NO)	HM Course (Y/N)	DC (Y/N)	DE (Y/N)
	NO	NO	NO	NO
Type of course	**Theory**			
Course Title	**PROBABILITY AND STATISTICS**			
Course Coordinator				
Course objectives:	Students will learn fundamental rules of Probability, discrete and continuous distributions, and statistical methods most commonly used in Computer Science and & Engineering. They will be introduced to stochastic processes, Markov chains, statistical inference, and Monte Carlo methods and will apply the theory and methods to the evaluation of queuing systems and computation of their vital characteristics.			
POs				

Semester	**Autumn: Yes**		**Spring:**		
III	**Lecture**	**Tutorial**	**Practical**	**Credits**	**Total teaching hours**
Contact Hours	3	1	0	4	36
Prerequisite course code as per proposed course numbers	NIL				
Prerequisite credits	NIL				
Equivalent course codes as per proposed course and old course	NIL				
Overlap course codes as per proposed course numbers	NIL				

Text Books:		
1	Title	Introduction to Probability and Statistics for Engineers and Scientists
	Author	Sheldon M Ross
	Publisher	Elsevier
	Edition	Fifth Edition

Reference Book:		
1	Title	Probability and Statistics with Reliability, Queuing, and Computer Science Applications
	Author	K. Trivedi
	Publisher	Wiley
	Edition	Second edition (2002)
2	Title	Probability, random variables, and stochastic processes.
	Author	Papoulis, Athanasios, and S. Unnikrishna Pillai
	Publisher	Tata McGraw-Hill Education
	Edition	2002
3	Title	Introduction to Mathematical Statistics

		Author	Robert V Hogg, Joseph McKean, Allen T Craig
		Publisher	Pearson
		Edition	Seventh Edition
4.		Title	Probability and Computing: Randomized Algorithms and Probabilistic Analysis
		Author	Michael Mitzenmacher, Eli Upfal
		Publisher	Cambridge University Press
		Edition	
Content	**Unit** – 1 (7 Hours) Events and outcomes. Probability rules Sample space and events, The axioms of probability. Conditional probability, Independence, Bayes' Rule, Law of Total Probability Elementary theorems of probability **Unit** – 2 (7 Hours) Random variables, Joint and marginal distributions. Expectation and variance. Discrete distributions: Bernoulli, Binomial, Geometric, and Poisson. **Unit** – 3 (7 Hours) Continuous distributions and densities: Uniform, Exponential, Gamma, Normal Central Limit Theorem and Normal approximations, Law of Large Numbers. **Unit** – 4 (7 Hours) Statistical Inference: Introduction of sampling, Sampling distributions of mean and variance, Point and interval estimation,. **Unit** – 5 (8 Hours) Stochastic processes: concepts and classifications. Bernoulli process. Poisson process. Markov chains. Transition probabilities. Steady-state distribution		
Course Assessment	Continuous Evaluation 25%		
	Mid Semester 25%		
	End Semester 50%		

Course no: CSB 253	Open course (YES/NO)	HM Course (Y/N)	DC (Y/N)	DE (Y/N)
	NO	NO	NO	NO
Type of course	**Core**			
Course Title	**SOFTWARE ENGINEERING**			
Course Coordinator				
Course objectives:	The course will cover topics regarding the software development other than programming, including testing, bug finding, verification, and validation for constructing robust code. The emphasis is on modern technology for developing reliable software at reasonable cost.			
POs				

Semester		**Autumn:**		**Spring: Yes**		
IV	**Lecture**	**Tutorial**	**Practical**	**Credits**	**Total teaching hours**	
Contact Hours	3	0	2	4	36	
Prerequisite course code as per proposed course numbers	NIL					
Prerequisite credits	NIL					
Equivalent course codes as per proposed course and old course	NIL					
Overlap course codes as per proposed course numbers	NIL					

Text Books:			
1	Title	Software Engineering: A Practitioner's Approach	
	Author	R. S. Pressman	
	Publisher	McGraw Hill	
	Edition	Seventh Edition, 2010	

Reference Book:		
1	Title	Zero Defect Software
	Author	G. G. Schulmeyer
	Publisher	McGraw-Hill
	Edition	1992
2	Title	Object Oriented Modeling and Design
	Author	J. Rumbaugh
	Publisher	Prentice Hall
	Edition	1991
3	Title	Software Engineering
	Author	K.K. Aggarwal, Yogesh Singh
	Publisher	New Age International Publishers
	Edition	Third Edition, 2007

4		Title	Software Engineering
		Author	Ian Sommerville
		Publisher	Addison Wesley
		Edition	Ninth Edition
5		Title	An Integrated Approach to Software Engineering
		Author	Pankaj Jalote
		Publisher	Narosa Publishing House
		Edition	3rd Edition
Content	**Unit** – 1 (8 Hours) Introduction: What is Software Engineering and its history, software crisis, Evolution of a Programming System Product, Characteristics of Software, Brooks' No Silver Bullet, and Software Myths, Software Development Life Cycles: Software Development Process, The Code-and-Fix model, The Waterfall model, The Evolutionary Model, The Incremental Implementation, Prototyping, The Spiral Model, Software Reuse, Critical Comparisons of SDLC models, An Introduction to Non-Traditional Software Development Process: Rational Unified Process, Rapid Application Development, Agile Development Process. **Unit** – 2 (8 Hours) Requirements: Importance of Requirement Analysis, User Needs, Software Features and Software Requirements, Classes of User Requirements: Enduring and Volatile, Sub phases of Requirement Analysis, Functional and Nonfunctional requirements, Barriers to Eliciting User requirements, The software requirements document and SRS standards, Requirements Engineering, Case Study of SRS for a Real Time System. Tools for Requirements Gathering: Document Flow Chart, Decision Table, Decision Tree, Introduction to nontraditional Requirements. **Unit** – 3 (8 Hours) Software Design: Goals of good software design, Design strategies and methodologies, Data oriented software design, Structured Design: Structure chart, Coupling, Cohesion, Modular structure, Packaging, Object oriented design, Topdown and bottom-up approach, Design patterns, Structured Analysis: DFD, Data Dictionary, Software Measurement and Metrics: Various Size Oriented Measures: Halstead's software science, Function Point (FP) based measures, Cyclomatic Complexity Measures: Control flow graphs. Development: Selecting a language, Coding guidelines, Writing code, Code documentation. **Unit** – 4 (7 Hours) Software Testing: Testing process, Design of test cases, Functional Testing: Boundary value analysis, Equivalence class testing, Decision table testing, Cause effect graphing, Structural testing, Path testing, Data flow and mutation testing, Unit testing, Integration and system testing, Debugging, Alpha & beta testing, testing tools & standards. **Unit** – 5 (5 Hours) Software Maintenance: Management of maintenance, Maintenance process, Maintenance models, Regression testing, Reverse engineering, Software

	reengineering, Configuration management, documentation.
Course Assessment	Continuous Evaluation 25% Mid Semester 25% End Semester 50%

Course no: CSB 252	**Open course (YES/NO)**		**HM Course (Y/N)**	**DC (Y/N)**	**DE (Y/N)**
	NO		NO	NO	NO
Type of course	**Core**				
Course Title	**DESIGN AND ANALYSIS OF ALGORITHMS**				
Course Coordinator					
Course objectives:	The main objective is to provide a solid foundation in algorithm design and analysis. Other objectives include: Getting familiar with basics of graphs, matching algorithms and data structures. Understanding and designing algorithms using greedy strategy, divide and conquer approach, dynamic programming, and max flow - min cut theory. Analyzing asymptotic performance of algorithms including formulating recurrence relations. Learning about computational complexity, approximation and randomized algorithms. Learning to provide correctness proofs for algorithms. Synthesizing efficient algorithms in common engineering design situations.				
POs					
Semester	**Autumn:**		**Spring: Yes**		
IV	**Lecture**	**Tutorial**	**Practical**	**Credits**	**Total teaching hours**
Contact Hours	3	0	2	4	36
Prerequisite course code as per proposed course numbers	NIL				
Prerequisite credits	NIL				
Equivalent course codes as per proposed course and old course	NIL				
Overlap course codes as per proposed course numbers	NIL				
Text Books:					
1	Title	Introduction to Algorithms			
	Author	Cormen, Leiserson, Rivest			
	Publisher	Prentice Hall of India			
	Edition	3rd Edition 2010			
Reference Book:					
1	Title	Fundamental of Computer algorithms.			
	Author	Horowitz and Sahani			

		Publisher	Universities Press
		Edition	Second edition 2008
2		Title	Computer Algorithms : Introduction to Design and Analysis
		Author	Sara Baase and Allen Van Gelder
		Publisher	Pearson Education
		Edition	3rd Edition 1999
3		Title	Fundamental of Algorithms
		Author	Brassard Bratley
		Publisher	PHI
		Edition	1st Edition 1996
4		Title	Algorithms Design
		Author	M T Goodrich etal
		Publisher	John Wiley
		Edition	
5		Title	The Design and analysis of Algorithms
		Author	A V Aho et al
		Publisher	Pearson Education
		Edition	1st Edition 2002
7		Title	Algorithm Design
		Author	Jon. Kleinberg and E Tardos
		Publisher	Pearson Education
		Edition	1st Edition 2013

Content	
Content	**Unit** – 1 (5 Hours) Introduction: Algorithms, Analysis of Algorithms, Design of Algorithms, Complexity of Algorithms, Asymptotic Notations, Growth of function, Recurrences and their solution methods. Sorting in polynomial Time: Insertion sort, Merge sort, Heap sort, and Quick sort Sorting in Linear Time: Counting sort, Radix Sort, Bucket Sort, Medians and order statistics. **Unit** – 2 (7 Hours) Advanced Data Structure: Red Black Trees, Augmenting Data Structure, Binomial Heap, B-Tree, Fibonacci Heap, and Data Structure for Disjoint Sets, All kinds of Algorithms on these data structures, Dictionaries and priority Queues, mergeable heaps, concatenable queues. **Unit** – 3 (10 Hours) Advanced Design and Analysis Techniques: Dynamic programming, Greedy Algorithm, Backtracking, Branch-and-Bound, Amortized Analysis. Graph Algorithms: Elementary Graph Algorithms, Breadth First Search, Depth First Search, Minimum Spanning Tree, Kruskal's Algorithms, Prim's Algorithms, Single Source Shortest Path, All pair Shortest Path, Maximum flow and Traveling Salesman Problem. **Unit** – 4 (8 Hours) Dynamic Programming: Chained matrix multiplication, longest common

	subsequence. Divide and Conquer: Order Statistics – finding the median, exponentiation, matrix multiplication, LCS. Computational Geometry: Line segments, Optimal polygon triangulation. Approximate Algorithm: Travelling Salesman Problem, vertex-cover problem. **Unit** – 5 (6 Hours) Primality testing, Integer factorization, Randomized algorithms, Probabilistic algorithms. String Matching algorithms: Rabin Karp, KMP, Boyer Moore. Introduction to problem classes – NP, NPC, NP-Hard.
Course Assessment	Continuous Evaluation 25% Mid Semester 25% End Semester 50%

Course no: CSL 203	Open course (YES/NO)	HM Course (Y/N)	DC (Y/N)	DE (Y/N)
	NO	NO	NO	NO
Type of course	Core			
Course Title	SYSTEM PROGRAMMING			
Course Coordinator				
Course objectives:	The purpose of this course is to provide the students with the knowledge of system-level programming. It aims to enable the students to understand the design of various system-level programs related to assembler, loader, macro, compiler and operating system.			
POs				
Semester	Autumn: Yes	Spring:		

III	Lecture	Tutorial	Practical	Credits	Total teaching hours
Contact Hours	3	1	0	4	36
Prerequisite course code as per proposed course numbers	NIL				
Prerequisite credits	NIL				
Equivalent course codes as per proposed course and old course	NIL				
Overlap course codes as per proposed course numbers	NIL				

Text Books:

1	Title	Systems Programming
	Author	John J. Donovan
	Publisher	Tata McGraw Hill
	Edition	2014

Reference Book:

1	Title	System Software-An Introduction to Systems Programming
	Author	L.L. Beck
	Publisher	Addition Wesley
	Edition	3rd Edition, 1996.

Content	
	Unit – 1 (5 Hours) Introduction: Evolution of the Components of a Programming System, Evolution of Operating systems. Machine Structure, Machine Language, and Assembly Language. **Unit** – 2 (7 Hours) Assemblers: Design of Assembler. Table Processing: searching and sorting. Macro Language and the Macro Processor : Macro Instructions, Features of Macro facility, Implementation. **Unit** – 3 (8 Hours) Loaders: Loader Schemes, Design of an Absolute Loader, Design of a Direct-

	Linking Loader.
	Unit – 4 (8 Hours) Compilers: Statement of problem, Phases of the compiler, Data Structures, Recursion, Call and Return statements, Storage Classes – Use, Implementation, Block Structure, Nonlocal Go To's, Interrupts, Pointers. **Unit** – 5 (8 Hours) Operating Systems: I/O Programming, Memory Management, Processor Management, Device Management, Information Management.
Course Assessment	Continuous Evaluation 25%
	Mid Semester 25%
	End Semester 50%

Course no: CSL 251	Open course (YES/NO)		HM Course (Y/N)	DC (Y/N)	DE (Y/N)
	NO		NO	NO	NO
Type of course	Core				
Course Title	THEORY OF COMPUTATION				
Course Coordinator					
Course objectives:	The objective of the course is to provide an exposition first to the notion of computability, then to the notion of computational feasibility or tractability.				
	We first convince ourselves that for our purpose it suffices to consider only language recognition problems instead of general computational problems.				
	We then provide a thorough account of finite state automata and regular languages, not only because these capture the simplest language class of interest and are useful in many diverse domains.				
	But also because many fundamental notions like nondeterminism, proofs of impossibility, etc. get discussed at a conceptually very simple level. We then consider context grammars and languages, and their properties.				
	Next, we consider Turing machines (TMs), show that as a model it is very robust, and the reasonableness of the Church-Turing hypothesis. After we realize TMs can work with (codes of) TMs as inputs, we obtain a universal TM.				
	We then obtain the separation of the classes r.e., and recursive. A number of TM related problems are shown to be undecidable. Next,Post's correspondence problem (PCP) is shown undecidable.				
	Finally, we introduce the notion of feasible or tractable computation. Classes NP, co-NP are defined and we discuss why these are important. We discuss the extended Church-Turing hypothesis.				
	After we discuss polynomial time many-one reducibility and prove Cook-Levin theorem, a number of natural problems from different domains are shown NP-complete.				
	The treatment is informal but rigorous. Emphasis is on appreciating that the naturalness and the connectedness of all the different notions and the results that we see in the course.				
POs					

Semester		Autumn:		Spring: Yes		
IV	Lecture	Tutorial	Practical	Credits	Total teaching hours	
Contact Hours	3	1	0	4	36	
Prerequisite course code as per proposed course numbers	NIL					
Prerequisite credits	NIL					
Equivalent course codes as per proposed course and old course	NIL					
Overlap course codes as per proposed course numbers	NIL					

Text Books:

1		Title	Introduction to Automata Theory, Languages and Computation
		Author	J. E. Hopcroft R. Motwani and J. D. Ullman
		Publisher	Addison Wesley
		Edition	3rd Edition, 2006

Reference Book:

1		Title	Introduction to the Theory of Computation
		Author	M. Sipser
		Publisher	Thomson
		Edition	2001
2		Title	Computational Complexity
		Author	C. H. Papadimitriou.
		Publisher	Addison Wesley
		Edition	1994
3		Title	Mathematical Logic and Computability
		Author	Jerome Keisler H. Joel Robbin
		Publisher	McGraw-Hill International Editions
		Edition	2000
4		Title	Elements of Theory of Computation
		Author	C. H. Papadimitriou, H. Lewis
		Publisher	Prentice Hall
		Edition	1981
5		Title	Introduction to Languages and the Theory of Computation
		Author	J. C. Martin
		Publisher	Mc Graw Hill
		Edition	2002
6		Title	Computers & Intractability
		Author	M. R. Garey and D. S. Johnson
		Publisher	W. H. Freeman & Co., San Francisco
		Edition	1979
7		Title	A Course on Mathematical Logic
		Author	S. M. Srivastava
		Publisher	Springer
		Edition	2008
Content	**Unit** – 1 (8 Hours) **Regular languages**		
	Introduction: Scope of study as limits to compubality and tractability. Why it suffices to consider only decision problems, equivalently, set membership problems. Notion of a formal language. DFAs and notion for their acceptance, informal and then formal definitions. Class of regular languages.		
	Closure of the class under complementation, union and intersection. Strategy for designing DFAs.		
	Pumping lemma for regular languages. Its use as an adversarial game.		
	Generalized version. Converses of lemmas do not hold.		

	NFAs. Notion of computation trees. Definition of languages accepted. Construction of equivalent DFAs of NFAs. NFAs with epsilon transitions. Guess and check paradigm for design of NFAs.
	Regular expressions. Proof that they capture precisely class of regular languages. Closure properties of and decision problems for regular languages.
	Myhill-Nerode theorem as characterization of regular languages.States minimization of DFAs.
	Unit – 2 (8 Hours) **Context free languages**
	Notion of grammars and languages generated by grammars. Equivalence of regular grammars and finite automata. Context free grammars and their parse trees. Context free languages. Ambiguity.
	Pushdown automata (PDAs): deterministic and nondeterministic. Instantaneous descriptions of PDAs.Language acceptance by final states and by empty stack. Equivalence of these two.
	PDAs and CFGs capture precisely the same language class.
	Elimination of useless symbols, epsilon productions, **unit** productions from CFGs. Chomsky normal form.
	Pumping lemma for CFLs and its use. Closure properties of CFLs. Decision problems for CFLs.
	Unit – 3 (8 Hours)
	Turing machines, r.e. languages
	Informal proofs that some computational problems cannot be solved.
	Turing machines (TMs), their instantaneous descriptions. Language acceptance by TMs. Hennie convention for TM transition diagrams.Robustness of the model-- equivalence of natural generalizations as well as restrictions equivalent to basic model. Church-Turing hypothesis and its foundational implications.
	Codes for TMs. Recursively enumerable (r.e.) and recursive languages. Existence of non-r.e. languages. **Unit** – 4 (7 Hours) **Undecidability** Notion of undecidable problems. Universal language and universal TM. Separation of recursive and r.e. classes. Notion of reduction. Some undecidable problems of TMs. Rice's theorem. Undecidability of Post's correspondence problem (PCP), some simple applications of undecidability of PCP. **Unit** – 5 (5 Hours) **Intractability**
	Notion of tractability/feasibility. The classes NP and co-NP, their importance. Polynomial time many-one reduction. Completeness under this reduction. Cook-Levin theorem: NP-completeness of propositional satisfiability, other variants of satisfiability. NP-complete problems from other domains: graphs (clique, vertex cover, independent sets, Hamiltonian cycle), number problem (partition), set cover.
Course Assessment	Continuous Evaluation 25%
	Mid Semester 25%
	End Semester 50%

Course no: ECB 256	Open course (YES/NO)		HM Course (Y/N)	DC (Y/N)	DE (Y/N)
	NO		NO	NO	NO
Type of course	Other Engineering				
Course Title	**Communication Systems**				
Course Coordinator					
Course objectives:	To understand the area of communication				
	To teach the physical layer of the network				
	Understanding the mathematical analysis of the communication system.				
POs					

Semester	Autumn:		Spring: Yes		
IV	Lecture	Tutorial	Practical	Credits	Total teaching hours
Contact Hours	3	0	2	4	36
Prerequisite course code as per proposed course numbers	NIL				
Prerequisite credits	NIL				
Equivalent course codes as per proposed course and old course	NIL				
Overlap course codes as per proposed course numbers	NIL				

Text Books:

1		Title	Communication Systems
		Author	Simon Haykin,
		Publisher	John Wily & Sons Asia Pte. Ltd.,
		Edition	4th Edition, 2001

Reference Book:

1		Title	Modern Digital and Analog Communication Systems
		Author	B. P. Lathi and Z. Ding
		Publisher	OUP, India
		Edition	4th Edition 2010
2		Title	Electronic Communication System
		Author	R. Blake
		Publisher	Thomson Asia Pte. Ltd
		Edition	2002
3		Title	Principles of Communication Systems
		Author	Taub & Schilling
		Publisher	Tata McGraw-Hill International Editions
		Edition	1998

Content	**Unit 1 (9 Hours)**
	Overview of Communication System; Channels and Their Characteristics; Modulation and its Benefits; Amplitude Modulations: AM, DSBSC, SSB, and VSB modulation; Frequency and Phase Modulation; Frequency Division Multiplexing (FDM), Radio Receiver Principle.
	Unit 2 (9 Hours)
	Introduction to Pulse Modulation; Digital Pulse Modulations: Pulse Code Modulation (PCM), Differential PCM, and Delta Modulation (DM); Time Division Multiplexing (TDM); Overview of Baseband Communication.
	Unit 3 (9 Hours)
	Overview of Digital Modulation; Modulation Techniques: Amplitude Shift Keying (ASK), Phase Shift Keying (PSK), Frequency Shift Keying, Quaternary PSK (QPSK); Quadrature Amplitude Modulation (QAM); Comparison of Different Modulation Techniques.
	Unit 4 (9 Hours)
	Source Coding and Data Compression; Channel Capacity; Error Detection and Correction; Cyclic Redundancy Check (CRC) Codes; Overview of Spread Spectrum Communication and Code Division Multiple Access (CDMA); Introduction to Mobile Communication.
Course Assessment	Continuous Evaluation 25%
	Mid Semester 25%
	End Semester 50%

Course no: CSL 461	Open course (YES/NO)	HM Course (Y/N)		DC (Y/N)	DE (Y/N)
Type of course	PE				
Course Title	COMPUTATIONAL COMPLEXITY				
Course Coordinator					
Course objectives:	1.This course deals with some of the computational complexity theory aspects. 2.Try to answer the following questions: Why some problems are impossible to solve by computers? Why some problems are difficult to solve? What degree of difficulty are there? 3.Try to identify at what extent we need randomness in computation.				
POs	1. Complete understanding on the main computational complexity classes, their underlying models of computation, and relationships. 2. Have understanding on the concept of reductions and its role in classifying problems by their computational complexity. 3. Show that a problem is NP-complete using reductions. Get familiar with the concepts of randomised, approximation and parallel algorithms.				
Semester	Autumn:		Spring		
VII/VIII	Lecture	Tutorial	Practical	Credits	Total teaching hours
Contact Hours	3	0	0	3	36
Prerequisite course code as per proposed course numbers					
Prerequisite credits					
Equivalent course codes as per proposed course and old course					
Overlap course codes as per proposed course numbers					
Text Books:					

1	Title	Computational Complexity: A Modern Approach
	Author	Sanjeev Arora and Boaz Barak
	Publisher	Cambridge University Press
	Edition	2009

Reference Book:

1	Title	Computational Complexity
	Author	Papadimtriou C. H.
	Publisher	Addison Wesley

	Edition	First Edition, 1993
2	Title	Randomized Algorithms
	Author	Motwani R
	Publisher	Cambridge University Press
	Edition	1995
3	Title	Approximation Algorithms
	Author	Vazirani V.
	Publisher	Springer
	Edition	First Edition, 2004

Content	Unit - 1 Review of Complexity Classes, NP and NP Completeness, Space Complexity, Hierarchies, Circuit satisfiability, Savitch and Immerman-Szelepcsényi Theorems, Karp Lipton Theorem. Unit-2 Randomized Complexity classes, Randomized Polynomial Time (RP), Bounded Probabilistic Polynomial Time (BPP), Zero-error Probabilistic Polynomial (ZPP), Adleman's theorem, Sipser Gacs theorem, Randomized Reductions, Counting Complexity, Permanent's and Valiant's Theorem Unit-3 Parallel complexity, P-completeness, Sup-liner space classes, Renegold's theorem. Unit-4 Polynomial hierarchy, Toda's theorem, Arthur Merlin games. Unit-5 Graph Isomorphism problem, Goldwasser-Sipser theorem, Interactive Proofs, Shamir's theorem.
Course Assessment	Continuous Evaluation 25%
	Mid Semester 25%
	End Semester 50%

Course no: CSB 301	Open course (YES/NO)		HM Course (Y/N)	DC (Y/N)	DE (Y/N)
Type of course	PC				
Course Title	COMPUTER ORGANIZATION				
Course Coordinator					
Course objectives:	To have a thorough understanding of the basic structure and operation of a digital computer.				
POs	At the end of the course student will be able to understand the computer organization i.e. the overall basic computer hardware structure, including the peripheral devices.				
Semester	**Autumn:**		**Spring**		
V	**Lecture**	**Tutorial**	**Practical**	**Credits**	**Total teaching hours**
Contact Hours	3	0	2	4	36
Prerequisite course code as per proposed course numbers					
Prerequisite credits					
Equivalent course codes as per proposed course and old course					
Overlap course codes as per proposed course numbers					

Text Books:

1	Title	Computer Organization and Design - The Hardware/Software Interface
	Author	D. A. Patterson and J. L. Hennessy
	Publisher	Morgan Kaufmann
	Edition	2014

Reference Book:

1	Title	Computer System Architecture
	Author	M. Morris Mano
	Publisher	Prentice Hall of India Pvt Ltd
	Edition	Third edition, 2002
2	Title	Computer Organization and Architecture - Designing for Performance
	Author	W. Stallings
	Publisher	Prentice Hall of India
	Edition	2002
3	Title	Computer Organization
	Author	C. Hamacher, Z. Vranesic and S. Zaky
	Publishe	McGrawHill

		r	
		Edition	2002
4		Title	Computer Architecture and Organization
		Author	J .P. Hayes
		Publishe r	McGraw-Hill
		Edition	1998
Content	Unit - 1 Introduction: Function and structure of a computer Functional components of a : Function and structure of a computer, Functional components of a computer, Interconnection of components, Performance of a computer. Unit - 2 Representation of Instructions Representation of Instructions: Machine instructions, Operands, Addressing : Machine instructions, Operands, Addressing modes, Instruction formats, Instruction sets, Instruction set architectures - CISC and RISC architectures.		

	Unit - 3 Processing Unit: Organization of a processor - Registers, ALU and Control unit, Data path in a CPU, Instruction cycle, Organization of a control unit - Operations of a control unit, Hardwired control unit, Microprogrammed control unit. Unit - 4 Memory Subsystem: Semiconductor memories, Memory cells - SRAM and DRAM cells, Internal Organization of a memory chip, Organization of a memory unit, Error correction memories, Interleaved memories, Cache memory unit - Concept of cache memory, Mapping methods, Organization of a cache memory unit, Fetch and write mechanisms, Memory management unit - Concept of virtual memory, Hardware support for memory management. Unit - 5 Input/Output Subsystem: Access of I/O devices, I/O ports, I/O control mechanisms - Program controlled I/O Interrupt controlled I/O and DMA controlled I/O I/O interfaces Program controlled I/O, Interrupt controlled I/O, and DMA controlled I/O, I/O interfaces - Serial port, Parallel port, PCI bus, SCSI bus, USB bus, I/O peripherals - Input devices, Output devices, Secondary storage devices.
Course Assessmen t	Continuous Evaluation 25% Mid Semester 25% End Semester 50%

Course no: CSB 353	Open course (YES/NO)		HM Course (Y/N)	DC (Y/N)	DE (Y/N)
Type of course	PC				
Course Title	COMPILER DESIGN				
Course Coordinator					
Course objectives:	To understand the theory and practice of compiler implementation. To learn finite state machines and lexical scanning. To learn context free grammars, compiler parsing techniques, construction of abstract syntax trees, symbol tables, intermediate machine representations and actual code generation				
POs	**Knowledge and understanding** ● Understand the structure of compilers ● Understand the basic techniques used in compiler construction such as lexical analysis, ● top-down, bottom-up parsing, context-sensitive analysis, and intermediate code generation ● Understand the basic data structures used in compiler construction such as abstract syntax ● trees, symbol tables, three-address code, and stack machines **Cognitive skills (thinking and analysis)** ● Design and implement a compiler using a software engineering approach **Practical and subject specific skills** Use generators (e.g. Lex and Yacc)				

Semester	Autumn:		Spring		
VI	**Lecture**	**Tutorial**	**Practical**	**Credits**	**Total teaching hours**
Contact Hours	3	0	2	4	36
Prerequisite course code as per proposed course numbers					
Prerequisite credits					
Equivalent course codes as per proposed course and old course					
Overlap course codes as per proposed course numbers					

Text Books:		
1.	Title	Compilers Principles, Techniques and Tools
	Author	Alfred Aho, Ravi Sethi, Jeffrey D Ullman
	Publisher	Pearson Education Asia
	Edition	2014

Reference Book:		
1	Title	The Theory and Practice of Compiler Writing
	Author	Tremblay, Sorenson

		Publisher	BSP
		Edition	
2		Title	Compiler Design in C
		Author	Holub
		Publisher	PHI
		Edition	
Content	Unit - 1 **Introduction:** Compilers Analysis of the source program, Phases of a compiler, Cousins of the Compiler, Grouping of Phases, Bootstrapping and Compiler construction tools, Symbol Table **Lexical Analysis:** Role of Lexical Analyzer, Input Buffering, Specification of Tokens, Recognition of Tokens, From Regular expression to Automata and Design of Lexical Analysis generator.		
	Unit - 2 **Syntax Analysis:** Role of the parse, Writing Grammars, Context-Free Grammars, Ambiguous Grammars, Top Down parsing, Recursive Descent Parsing, Predictive Parsing, Bottom-up parsing, Shift Reduce Parsing, Operator Precedence Parsing, LR Parsers, SLR Parser, Canonical LR Parser, LALR Parser.		
	Unit - 3 **Syntax Directed Translation:** Syntax Directed Definitions, Application of SDT and SDT schemes.		
	Unit - 4 **Intermediate Code Generation:** Directed acyclic graphs, three-address code Intermediate languages - Declarations, Assignment Statements, Boolean Expressions, Array references, Back patching.		
	Unit - 5 **Code generation and Optimization:** Issues, Basic Blocks and Flow Graphs, DAG representation of Basic Blocks, Optimization of basic Blocks, Peephole Optimization, Principal Sources of Optimization, Loop Optimization, Global Data Flow Analysis.		
Course Assessment	Continuous Evaluation 25% Mid Semester 25% End Semester 50%		

Course no: CSB 302	Open course (YES/NO)		HM Course (Y/N)	DC (Y/N)	DE (Y/N)
Type of course	PC				
Course Title	OPERATING SYSTEM				
Course Coordinator					
Course objectives:	The learning objective of this course is to provide an introduction to the internal operation of modern operating systems. In particular, the course will cover processes and threads, mutual exclusion, CPU scheduling, deadlock, memory management, and file systems. If time permits, we may briefly examine networking and distributed computing, and perhaps other topics. Students will use the Nachos (Not Another Completely Heuristic Operating System) instructional operating system for several programming projects.				
POs	By the end of the course you should be able to ● describe the general architecture of computers ● describe, contrast and compare differing structures for operating systems ● Understand and analyse theory and implementation of: processes, resource control (concurrency etc.), physical and virtual memory, scheduling, I/O and files				

Semester	**Autumn:**		**Spring**		
V	**Lecture**	**Tutorial**	**Practical**	**Credits**	**Total teaching hours**
Contact Hours	3	0	2	4	36
Prerequisite course code as per proposed course numbers					
Prerequisite credits					
Equivalent course codes as per proposed course and old course					
Overlap course codes as per proposed course numbers					

Text Books:		
1	Title	Operating System Concepts
	Author	Abraham Silberschatz, Peter B. Galvin, Greg Gagne
	Publisher	Addison-Wesley
	Edition	Sixth edition, 2003

Reference Book:		
2.	Title	Modern Operating Systems
	Author	Andrew Tanenbaum
	Publisher	Prentice Hall
	Edition	
3.	Title	Operating Systems
	Author	William Stallings

		Publisher	Prentice Hall
		Edition	
4.		Title	An introduction to operating systems
		Author	Harvey M. Deitel
		Publisher	Addison-Wesley
		Edition	

		Title	Operating Systems: Design and Implementation
5.		Author	Andrew Tanenbaum & Albert Woodhull
		Publisher	Prentice-Hall
		Edition	
6.		Title	Operating System Design - The XINU Approach
		Author	Douglas Comer
		Publisher	Prentice-Hall
		Edition	
7.		Title	Fundamentals of Operating Systems
		Author	A.M. Lister
		Publisher	Macmillan
		Edition	1979
Content	Unit - 1 Basics: Operating System Functionalities, Types of Operating Systems, Computer Architecture support to Operating Systems. Unit - 2 Process Management: Threads, Process Scheduling - Uniprocessor scheduling algorithms, Multiprocessor and Real-time scheduling algorithms, Process Synchronization - Peterson's Solution, Bakery. Algorithm, Hardware Support to Process Synchronization, Semaphores, Critical Regions, Monitors - Deadlock prevention, deadlock avoidance and Deadlock Detection and Recovery - Bankers Algorithm,. Unit - 3 Memory Management: Segmentation and space allocation, Basics of linking and loading, Demand Paging, Page replacement algorithms, Analysis of page allocation policies, Thrashing- Working Set. Unit - 4 File Systems: Contiguous, Sequential and Indexed Allocation, File system interface, File System implementation, Case study of Unix File system, Mounting and Unmounting files systems, Network File systems. I/O System: Unit - 5 Disk Scheduling, Device drivers - block and character devices, streams, Character and Block device switch tables. Protection and Security - Accessibility and Capability Lists.		
Course Assessment	Continuous Evaluation 25%		
	Mid Semester 25%		
	End Semester 50%		

Course no: CSL 303	Open course (YES/NO)		HM Course (Y/N)	DC (Y/N)	DE (Y/N)
Type of course	PE				
Course Title	ARTIFICIAL INTELLIGENCE				
Course Coordinator					
Course objectives:	It aims to give understanding of the main abstractions and reasoning techniques used in artificial intelligence including representation and inference in first-order logic; modern deterministic, decision-theoretic, planning techniques, and basic machine learning methods.				
POs	Program learning outcomes are to apply various AI search algorithms, knowledge representation, reasoning, and machine learning techniques to real-world problems.				
Semester	Autumn:		Spring		
V	**Lecture**	**Tutorial**	**Practical**	**Credits**	**Total teaching hours**
Contact Hours	3	1	0	4	36
Prerequisite course code as per proposed course numbers					
Prerequisite credits					
Equivalent course codes as per proposed course and old course					
Overlap course codes as per proposed course numbers					

Text Books:

1.	Title	*Artificial Intelligence*
	Author	*Elaine Rich, Kevin Knight and Shivashankar B Nair*
	Publisher	*Tata McGraw Hill*
	Edition	3rd Edition 2009

Reference Book:

1	Title	*Introduction to Artificial Intelligence and Expert Systems*
	Author	*Dan W. Patterson*
	Publisher	*Pearson Education*
	Edition	1st Edition, 2015
2.	Title	*Artificial Intelligence: A Modern Approach*
	Author	*S. Russell and P. Norvig.*
	Publisher	*Prentice Hall*
	Edition	3rd Edition 2009

Content	Unit - 1 Introduction: Overview of AI problems, examples of successful recent AI applications. The Turing test, Rational versus non-rational reasoning.
	Search Strategies: Problem spaces (states, goals and operators), problem solving by search. Uninformed search (breadth-first, depth-first, depth-first with iterative deepening). Heuristics and informed search (hill-climbing, generic best-first, A*). Minimax Search, Alpha-beta pruning . Space and time efficiency of search. Two-player games (introduction to minimax search). Constraint satisfaction (backtracking and local search methods). Unit - 2 Knowledge representation and reasoning: Review of propositional and predicate logic, First order logic, Resolution and theorem proving, Forward chaining, Backward chaining ,Temporal and spatial reasoning. Review of probabilistic reasoning, Bayes theorem. Totally-ordered and partially-ordered Planning Unit - 3 Planning-The blocks world, Components of Planning Systems, Goal stack planning, Nonlinear planning, Hierarchical planning. Learning-Learning from example, Learning by advice, Explanation based learning, Learning in problem solving, Definition and examples of broad variety of machine learning tasks, Classification, Inductive learning, Simple statistical-based learning such as Naive Bayesian Classifier, decision trees. Unit - 4 Natural Language Processing: Language models, n-grams, Vector space models, Bag of words, Text classification, Information retrieval, Pagerank, Information extraction, Question-answering Unit - 5 Agents: Definition of agents, Agent architectures (e.g., reactive, layered, cognitive), Multi-agent systems- Collaborating agents, Competitive agents, Swarm systems and biologically inspired models. Expert Systems: Representing and Using Domain Knowledge, Expert System Shells, Explanation, Knowledge Acquisition.
Course Assessment	Continuous Evaluation 25% Mid Semester 25% End Semester 50%

Course no: HML 351	Open course (YES/NO)	HM Course (Y/N)	DC (Y/N)	DE (Y/N)
	No			
Type of course	Theory			
Course Title	Engineering Economics and Accountancy			
Course Coordinator	Dr. Shakira Khan			
Course objectives:	The subject will provide the knowledge of economics, finance and accountancy for the better decision making of the economic alternatives and investment alternatives in the field of engineering and anywhere else.			
POs	To enhance the students with the knowledge of Economic, Market, Accountancy and Engineering for future development and practical implication in the professional wellbeing.			
Syllabus outcome:	Engineering economics is a subset of economics for application to engineering projects. Engineers seek solutions to problems, and the economic viability of each potential solution is normally considered along with the technical aspects. Fundamentally, engineering economics involves formulating, estimating, and evaluating the economic outcomes when alternatives to accomplish a defined purpose are available. Engineering economics is a field that addresses the dynamic environment of economic calculations and principles through the prism of engineering. It is a fundamental skill that all successful engineering firms employ in order to retain competitive advantage and market share.			

Semester	Autumn:		Spring		
V	Lecture	Tutorial	Practical	Credits	Total Teaching Hours
Contact Hours	3	0	0	3	36
Prerequisite course code as per proposed course numbers	Nil				
Prerequisite credits	Nil				
Equivalent course codes as per proposed course and old course	Nil				
Overlap course codes as per proposed course numbers	Nil				
Text Books:					
1.	Title	Engineering Economics Principles,			
	Author	Henry Malcom Steiner			
	Publisher	McGraw Hill Publications			

			Edition	
2.		Title	Dewett K.K.,	
		Author	Modern Economic Theory	
		Publisher	Sultan Chand & Co.	
		Edition		
3		Title	Indian Economy	
		Author	Agrawal AN	
		Publisher	Wiley Estern Ltd, New Delhi	
		Edition		
4		Title	Accounting Part-1	
		Author	Jain and Narang	
		Publisher	Kalyani Publisher	
		Edition		
5		Title	Fundamentals of Engineering Economics	
		Author	Kumar P.	
		Publisher	Wiley India Pvt. Ltd. New Delhi.	
		Edition	2012	
Reference Book:				
1		Title	Engineering Economics	
		Author	Panneerselvam R	
		Publisher	PHI Learning Pvt. Ltd., New Delhi.	
		Edition	2013	
2		Title	Financial Management	
		Author	Tulsian P.C.	
		Publisher	S. Chand and Company Pvt. Ltd.	
		Edition	2009	
Content	**Course Content**			

Course Content

Unit I: Engineering Economics

Introduction to Engineering Economics – Fundamental concepts-Time value of money – Cash flow and Time Diagrams – Choosing between alternative investment proposals. (6 hours)

Unit II: Capital Budgeting

Methods of Economic analysis (Pay back, ARR, NPV, IRR and B/C ratio). Depreciation and methods of calculating depreciation (Straight line, Sum of the years digit method, Declining Balance Method, Annuity Method, Sinking Fund method.) (7 hours)

Unit III: Indian economy and Economic Development

National Income Accounting – Methods of Estimation – Various Concepts of National Income – Significance of National Income Estimation and its limitations. Inflation: Definition- Measures to Control (Monetary and Fiscal policy). New Economic Policy 1991 Breakeven Analysis – Meaning and its application, Limitation. (8 hours)

Unit IV: Financial Accounting:

Accounting Principles, procedure-Double entry system – Journal, ledger, Trial balance – Cash Book – Preparation of Trading and Profit and Loss account – Balance Sheet. Cost Accounting - Introduction-Classification of costs – Methods of Costing-Techniques of Costing. E-commerce: Importance and Need.
(8 hours)

	Unit V: Managerial Economics Scope of Managerial Economics: Theory of Demand and Theory of Supply. Law of demand and Law of Supply. Techniques of Managerial Economics; Theory of firm, Theory of Market Structure. Applications of Managerial Economics. (7 hours)
Curse Assessment	Continuous Evaluation: 20% Mid Semester: 30% End Semester: 50%

Course no: CSB 304	Open course (YES/NO)		HM Course (Y/N)	DC (Y/N)	DE (Y/N)	
Type of course	PC					
Course Title	COMPUTER NETWORKS					
Course Coordinator						
Course objectives:	To build a strong understanding of the fundamental concepts of computer networking. Fiber optics and wireless communication are introduced to the students since these are technologies of the future. Modern routing algorithms are introduced in this course. Deep understanding on Data link, Network and Transport Layer providing more focus on Internet and network performance.					
POs	At the end of the course student will be able 1. Select the most appropriate networking architecture and technologies for a given organizational structure. 2. Identify the lacunae in the existing protocols of various layers of the protocol stack and propose					
Semester	**Autumn:**		**Spring**			
V	**Lecture**	**Tutorial**	**Practical**	**Credits**	**Total Teaching Hours**	
Contact Hours	3	0	2	4	36	
Prerequisite course code as per proposed course numbers	Probability Theory					
Prerequisite credits						
Equivalent course codes as per proposed course and old course						
Overlap course codes as per proposed course numbers						
Text Books:						
1	Title		Computer Networks			
	Author		AS Tanenbaum, DJ Wetherall			
	Publisher		Prentice-Hall			
	Edition		5th Edition, 2010			
Reference Book:						
2.	Title		Computer Networks: A Systems Approach			
	Author		LL Peterson, BS Davie,			
	Publisher		Morgan-Kauffman			
	Edition		5th Edition, 2011			
3.	Title		Computer Networking: A Top-Down Approach			

		Author	JF Kurose, KW Ross
		Publisher	Addison-Wesley
		Edition	5th Edition, 2009
4.		Title	Data Communication and Network
		Author	Behrouz A. Forouzan
		Publisher	*McGraw Hill*
		Edition	5th Edition, 2012
5.		Title	Data and Computer Communications
		Author	William Stallings
		Publisher	Pearson
		Edition	8th Edition, 2007
Content	Unit - 1 Introduction: history and development of computer networks, Basic Network Architectures: OSI reference model, TCP/IP reference model, and Networks topologies, types of networks (LAN, MAN, WAN, circuit switched, packet switched, message switched, extranet, intranet, Internet, wired, wireless)		
	Unit - 2 Physical layer: line encoding, block encoding, scrambling, modulation demodulation (both analog and digital),errors in transmission, multiplexing (FDM, TDM, WDM, OFDM, DSSS), Different types of transmission media. Data Link Layer services: framing, error control, flow control, medium access control. Error & Flow control mechanisms: stop and wait, Go back N and selective repeat. MAC protocols: Aloha, slotted aloha, CSMA, CSMA/CD, CSMA/CA, polling, token passing, scheduling.		
	Unit - 3 Local Area Network Technology: Token Ring. Error detection (Parity, CRC), Ethernet, Fast Ethernet, Gigabit Ethernet, Personal Area Network: Bluetooth and Wireless Communications Standard: Wi-Fi (802.11) and WiMAX,		
	Unit - 4 Network layer: Internet Protocol, IPv6, ARP, DHCP, ICMP, Routing algorithms: Distance vector, Link state, Metrics, Inter-domain routing. Subnetting, Supernetting, Classless addressing, Network Address Translation.		
	Unit - 5 Transport layer: UDP, TCP. Connection establishment and termination, sliding window, flow and congestion control, timers, retransmission, TCP extensions, Queuing theory, Single and multiple server queuing models, Little's formula. Application Layer. Network Application services and protocols including e-mail, www, DNS, SMTP, IMAP, FTP, TFTP, Telnet, BOOTP, HTTP, IPSec, Firewalls.		
Course Assessment	Continuous Evaluation 25% Mid Semester 25% End Semester 50%		

Course no: HML 451	Open course (YES/NO)	HM Course (Y/N)	DC (Y/N)	DE (Y/N)
	No			
Type of course	Theory			
Course Title	**Industrial Management**			
Course Coordinator	Dr. Shakira Khan			
Course objectives:	To provide the knowledge of the industry and the managerial economics and skills.			
POs	To enhance the students with the knowledge of theory of management for future development and practical implication in the professional wellbeing.			
Syllabus outcome:	Industrial Management teaches students about the design, planning and optimization of production and manufacturing processes. It is a study that integrates methods and techniques from the engineering as well as management science.			

Semester	Autumn:		Spring		
	Lecture	Tutorial	Practical	Credits	Total Teaching Hours
Contact Hours	3	0	0	3	36
Prerequisite course code as per proposed course numbers	Nil				
Prerequisite credits	Nil				
Equivalent course codes as per proposed course and old course	Nil				
Overlap course codes as per proposed course numbers	Nil				
Text Books:					

1.	Title	Introduction to Management
	Author	John R. Schermerhorn
	Publisher	Wiley Student Edition.
	Edition	10
2	Title	Human Resource Management
	Author	Gupta C. B
	Publisher	Sultan Chand & Sons New Delhi
	Edition	2006

Reference Book:		
1.	Title	Organizational Behaviour
	Author	Dubey, C.H
	Publisher	Prentice Hall in India (PHI)
	Edition	2015

Content	**Course Content** **Unit I: General Management** Evolution of Management thought; Schools of Management Thought; Scientific Management; Management Concepts; Characteristics of Management; Basic functions of Management; Management and Administration. (8 hours) **Unit II: Production Management** Production Management; Production Process; Plant Location and Layout. Market; Marketing Management, Marketing Management Concepts; Market mix, Market Segmentation. (8 hours) **Unit III: Principle and Practice of Management** Leadership; Meaning of Leadership, The principal task of Leadership, Approach to Leadership. Communication: Meaning and Importance of Communication, Process of communication. Motivation; Needs, Theories of motivation. Coordination; Concept and Nature of Coordination, need for coordinating, types of coordination, methods of coordination. (12 hours) **Unit IV: Inventory Management** Classifications of Inventories, Functions of Inventories, Costs of Inventories, Economic Order Quantity. Project Management; Total Quality Management, Quality circles, Statistical Quality control. (8 hours)
Curse Assessment	Continuous Evaluation: 20% Mid Semester: 30% End Semester: 50%

Course no: CSB 451	Open course (YES/NO)		HM Course (Y/N)	DC (Y/N)	DE (Y/N)
Type of course	PC				
Course Title	NETWORK SECURITY AND CRYPTOGRAPHY				
Course Coordinator					
Course objectives:	This course aims at training students to master the basic principles, knowledge, and skills about network security. They will learn how to apply cryptography as a tool for maintaining confidentiality along with hash functions and digital signatures helping in message integrity and authentication. They will learn how to apply these principles in various scenarios in real life by using appropriate hardware and software tools to design solutions for network management and security problems, and to evaluating its performance.				
Pos	Upon completion of the subject, students will be able to ● Acquire professional/academic knowledge and skills ● Describe some common problems or attacks on network security ● Describe some network security services and mechanisms ● Study and analyze some cryptographic algorithms with their relation with real life.				

Semester	Autumn:		Spring		
VIII	**Lecture**	**Tutorial**	**Practical**	**Credits**	**Total Teaching Hours**
Contact Hours	3	0	2	4	36
Prerequisite course code as per proposed course numbers					
Prerequisite credits					
Equivalent course codes as per proposed course and old course					
Overlap course codes as per proposed course numbers					

Text Books:		
1	Title	Cryptography and Network Security, Principles and Practice
	Author	William Stallings
	Publisher	Pearson
	Edition	

Reference Book:		
2.	Title	Computer Networks
	Author	A. S. Tanenbaum
	Publisher	Prentice Hall
	Edition	
3.	Title	Cryptography, Theory and Practice

		Author	D. Stinson
		Publisher	CRC Press
		Edition	
4.		Title	Cryptography and Network Security
		Author	AtulKahate,
		Publisher	McGraw Hill
		Edition	

Content	Unit - 1 Network Security, Attacks on network security- passive and active attacks, Services used to handle these attacks and related Mechanisms, A model for network security.
	Conventional Encryption , Classical Techniques- substitution and transposition ciphers, study of basic cryptanalysis possible on classical ciphers, Modern Techniques- block and stream ciphers, Block cipher Design Principles, Feistel structure, Shannon's principles of diffusion and confusion, Encryption algorithms, The Data Encryption Standard (DES) block cipher algorithm with its strength and weaknesses.
	Unit - 2 Introduction to Number Theory: Divisibility theory in integers. Extended Euclid's algorithm. Modular Arithmetic – exponentiation and inversion. Fermat's Little Theorem, Euler's Theorem. Solution to congruence's, Chinese Remainder Theorem. Review of abstract algebra – Study of Ring Zn, multiplicative group Zn* and finite field Zp – Gauss Theorem (cyclicity of Zp*) - Quadratic Reciprocity. Primality Testing – Fermat test, Carmichael numbers, SolovayStrassen Test, Miller Rabin Test - analysis
	Unit – 3 Asymmetric cryptography: Public Key Encryption, The RSA algorithm, its strengths, possible cryptanalysis attacks possible on RSA such as timing attacks and CCA, Diffie – Hellman Key Exchange algorithm, Introduction to cryptographic hash algorithms.
	Unit – 4 Message Authentication: Authentication Requirements, Authentication Functions, Message Authentication Codes, Digital Signatures and Authentication Protocols, Digital Signature Standard (DSS), Key distribution and Management using symmetric and asymmetric encryption, X. 509 certificates.
	Unit – 5 Network security: Electronic Mail Security-PGP and S/MIME, IP Security, IP security Overview, IP Security Architecture, Authentication Header (AH), Encapsulating Security Payload (ESP), Firewalls, Firewall Design Principles, Trusted Systems.

Course Assessment	Continuous Evaluation 25% Mid Semester 25% End Semester 50%

Course no: CSL 376	Open course (YES/NO)		HM Course (Y/N)	DC (Y/N)	DE (Y/N)
Type of course	PE				
Course Title	CLOUD COMPUTING				
Course Coordinator					
Course objectives:	To impart basic concepts in the area of cloud computing. Bring in-depth understanding on architectures and models for Cloud Computing with Internet of Things. To impart knowledge in web-based applications of cloud computing				
POs	At the end of the course student will be able 1. Have an overall understanding on various hardware and software necessary for cloud computing. 2. Design and develop various cloud computing applications.				

Semester	**Autumn:**		**Spring**		
VI	**Lecture**	**Tutorial**	**Practical**	**Credits**	**Total Teaching Hours**
Contact Hours	3	0	0	3	36
Prerequisite course code as per proposed course numbers					
Prerequisite credits					
Equivalent course codes as per proposed course and old course					
Overlap course codes as per proposed course numbers					

Text Books:		
1	Title	Cloud Computing: Principles and Paradigms,
	Author	Edited By Raj Kumar Buyya, JemesBroberg, Andrzej M.Goscinski
	Publisher	John Wiley
	Edition	1st Edition, 2011

Reference Book:		
2.	Title	Distributed and Cloud Computing
	Author	Kai Hawang, Geoffrey C. Fox, Jack J. Dongarra
	Publisher	Elservier
	Edition	1st Edition, 2011
3.	Title	Cloud Computing: Web-Based Applications That Change the Way You Work and Collaborate Online
	Author	Michael Miller
	Publisher	Que Publishing,

	Edition	2008
4.	Title	Cloud Computing – Insights into New Era Infrastructure
	Author	Kumar Saurabh,
	Publisher	Wiley Indian Edition
	Edition	2011

5.	Title	Cloud Computing Best Practices for Managing and Measuring Processes for On demand Computing, Applications and Data Centers in the Cloud with SLAs
	Author	Haley Beard
	Publisher	Emereo Pty Limited
	Edition	2008
6.	Title	Cloud Computing- A Practical Approach
	Author	Toby Velte, Anthony Velte, Robert Elsenpeter
	Publisher	McGraw Hill
	Edition	2009
Content	Unit – 1 Introduction to Cloud Computing: Nutshell of cloud computing, feature Characteristics and components of Cloud Computing. Challenges, Risks and Approaches of Migration into Cloud. Evaluating the Cloud's Business Impact and economics, Future of the cloud.	
	Unit –2 Networking Support for Cloud Computing. Ubiquitous Cloud and the Internet of Things. Cloud Computing Architecture: Cloud Reference Model, Layer and Types of Clouds, Services models, Data center Design and interconnection Network, Architectural design of Computer and Storage Clouds.	
	Unit – 3 Cloud Programming and Software: Fractures of cloud programming, Parallel and distributed programming paradigms, High level Language for Cloud. Introduction to Map Reduce, GFS, HDFS, Hadoop Framework.	
	Unit – 4 Virtualization Technology: Definition, Understanding and Benefits of Virtualization. Implementation Level of Virtualization, Virtualization Structure/Tools and Mechanisms, Hypervisor, VMware, KVM, Xen. Virtualization of CPU, Memory, I/O Devices, Virtual Cluster and Resources Management, Virtualization of Server, Desktop, Network, and Virtualization of data-center.	

	Unit – 5 Web-Based Application, Pros and Cons of Cloud Service Development, Types of Cloud Service Development, Software as a Service, Platform as a Service, Web Services, On-Demand Computing, Discovering Cloud Services, Development Services and Tools, Amazon Ec2, GoogleApp Engine, IBM Clouds.
Course Assessment	Continuous Evaluation 25% Mid Semester 25% End Semester 50%

Course no: CSL 374	Open course (YES/NO)		HM Course (Y/N)	DC (Y/N)	DE (Y/N)
Type of course	PE				
Course Title	ADVANCED COMPUTER NETWORKS				
Course Coordinator					
Course objectives:	Discussion on advanced concepts of physical layer transmission media.				
	To acquire knowledge of implementation concepts in congestion control and error detections				
	Introduction of general issues behind wireless LANs and provide more emphasis on characteristics of wireless networks and the way access is controlled in these types of networks.				
	This course deals with advanced routing concepts and Quality of Service mechanism.				
	To become familiar with the basics of network programming.				
	To gain the knowledge of internetworking concepts and its various applications.				
POs	At the end of the course student will be able 1. Gain knowledge of recent protocols of the application layer. 2. Comprehensive understanding on key Internet applications and their protocols, and ability to develop their own applications using the sockets API.				

Semester		**Autumn:**		**Spring**		
VI	**Lecture**	**Tutorial**	**Practical**	**Credits**	**Total Teaching Hours**
Contact Hours	3	0	0	3	36
Prerequisite course code as per proposed course numbers					
Prerequisite credits					
Equivalent course codes as per proposed course and old course					
Overlap course codes as per proposed course numbers					

Text Books:			
1	Title	Internetworking with TCP/IP: Principles, Protocols, and Architecture
	Author	Douglas E. Commer
	Publisher	Prentice Hall
	Edition	6th Edition, 2013

Reference Book:			
2.	Title	Computer Networks
	Author	Andrew S. Tanenbaum, David J.Wetherall

		Publisher	Prentice-Hall,
		Edition	5th Edition, 2010
3.		Title	SDN: Software Defined Networks
		Author	Thomas D. Nadeau, Ken Gray
		Publisher	Kindle Ed., O'Reilly
		Edition	2013
4.		Title	Data Communication and Network
		Author	Behrouz A. Forouzan
		Publisher	*McGraw Hill,*
		Edition	5th Edition 2012

Content	Unit – 1 Introduction: Internet architecture and performance modeling: Review of Basic Network Architectures: OSI reference model, TCP/IP reference model, ATM reference model. Physical Layer: Different types of transmission media, and errors in transmission: attenuation, noise. Repeaters. Traffic Characterization (CBR, VBR);
	Unit – 2 Switching Paradigms; Multiplexing. Error Control, Flow Control, FTH, DTH, PON, ISDN, DSL, CATV, SONET, Optical Networks. Link layer: switching, multiple access, error recovery: Data Link Layer MAC Layer: Local Area Network Technologies: Fast Ethernet, Gigabit Ethernet, IEEE 802.11 WLAN, Bluetooth, Connecting LANs, VLANS, STP.
	Unit – 3 Network Device, Routing algorithms, BGP, Advanced routing concepts, Router architectures, internetworking: Interdomain Routing, BGP, IPv6, Multicast Routing Protocols, Multi Protocol Label Switching, and Virtual Networks. Transport layer Transport protocols, TCP mechanics, congestion control, resource allocation UDP mechanics. Socket Programming.
	Unit – 4 High speed transport protocols, Quality of Service Mechanisms, Improving QoS in Internet, DiffServ and IntServ Architectures, RSVP. Distributed Systems: Naming, DNS, DDNS, Paradigms for Communication in Internet, Caching, Issues of Scaling in Internet and Distributed Systems, Caching Techniques for Web, Protocols to Support Streaming Media, Multimedia Transport Protocols, Content Delivery Networks, Overlay and P2P Networks.
	Unit – 5 Applications: architectures and examples. Network virtualization, software defined networking Applications and Other Networking Technologies: RTP, RTSP, SIP, VoIP, Security Systems, SSH, PGP, TLS, IPSEC, DoS Attack, Mitigation in Internet, Security in MPLS.
Course Assessment	Continuous Evaluation 25% Mid Semester 25% End Semester 50%

Course no: CSL 468	Open course (YES/NO)		HM Course (Y/N)	DC (Y/N)	DE (Y/N)
Type of course	PE				
Course Title	MOBILE COMPUTING				
Course Coordinator					
Course objectives:	Introduction of various important concepts such as location management and mobility management in mobile environments. To understand the use of database systems in mobile environments. To build strong understanding on the concepts of mobile agents used in mobile communication. A detailed study of the routing and transport layer protocols in Mobile and Ad Hoc Networks.				
Pos	At the end of the course student will be able . A working understanding of the characteristics and limitations of various network and transport layer protocols. The ability to develop a new set of improved protocols in mobile and Ad Hoc networks. 3. The ability to develop mobile-device specific applications.				
Semester	**Autumn:**		**Spring**		
VII/VIII	**Lecture**	**Tutorial**	**Practical**	**Credits**	**Total Teaching Hours**
Contact Hours	3	0	0	3	36
Prerequisite course code as per proposed course numbers					
Prerequisite credits					
Equivalent course codes as per proposed course and old course					
Overlap course codes as per proposed course numbers					
Text Books:					
1	Title		*Fundamentals of Mobile and Pervasive Computing*		
	Author		*Frank Adelstein, Sandeep K.S. Gupta, Golden Richard III, Loren Schwiebert*		
	Publisher		*McGraw Hill*		
	Edition		2005		
Reference Book:					
2.	Title		*Principles of mobile computing*		
	Author		*Uwe Hansmann, Lothar Merk, Martin S. Nicklous, Thomas Stober*		
	Publisher		*Springer*		

		Edition	2006
3.		Title	*Mobile Communications Handbook*
		Author	*Edited by Jerry D. Gibson*
		Publisher	*CRC Press*
		Edition	3rd Edition, 2012
4.		Title	802.11 Wireless Networks: The Definitive Guide
		Author	Matthew S.Gast
		Publisher	O'Reilly
		Edition	2nd Edition, 2005
Content	Unit – 1 Mobile computing: Definitions, adaptability issues (transparency, Environmental Constraints, application aware adaptation), mechanisms for adaptation and incorporating adaptations. Mobility management: mobility management, location management principle and techniques, PCS location management Scheme. Unit –2 Data dissemination and management: challenges, Data dissemination, bandwidth allocation for publishing, broadcast disk scheduling, mobile cache maintenance schemes, Mobile Web Caching. Unit – 3 Introduction to mobile middleware. Middleware for application development: adaptation, Mobile agents. Service Discovery Middleware: Service Discovery & standardization Methods (universally Unique Identifiers, Textual Description & using interfaces), unicast Discovery, Multicast Discovery & advertisement, service catalogs, Garbage Collection, Eventing. Unit – 4 Mobile IP, Mobile TCP, Database systems in mobile environments, World Wide Web and mobility. Unit – 5 Mobile Ad Hoc Networks: localization, MAC issues, Routing protocols, global state routing (GSR), Destination sequenced distance vector routing (DSDV), Dynamic source routing (DSR), Ad Hoc on demand distance vector routing (AODV), Temporary ordered routing algorithm (TORA), QoS in Ad Hoc Networks, applications.		
Course Assessment	Continuous Evaluation 25% Mid Semester 25% End Semester 50%		

Course no: CSL 469	Open course (YES/NO)	HM Course (Y/N)	DC (Y/N)	DE (Y/N)

Type of course	PE				
Course Title	COMPLEX NETWORKS				
Course Coordinator					
Course objectives	Students who successfully complete this course will gain: a broad conceptual introduction to the modern theory and applications of complex networks, experience critiquing scientific papers, experience working with large, complex data sets, experience with technical writing and in class presentations.				
POs	After the course , students will be interested in contemporary complex network research. This foundation will be both analytical and computational. After taking the course the students will be able to investigate specific research tasks and real world applications that require a complex network approach or knowledge of the fundamentals of complex network science. Specifically the students will •learn techniques for analyzing real world networks empirically, •learn how to construct networks from real world data, •learn fundamentals of graph theory and network mathematics as well as the statistical physics approach to large scale networks, •learn the fundamentals for generating random network models on a computer, and •learn to investigate dynamical processes that evolve on networks.				

Semester		**Autumn:**		**Spring**		
VII/VIII		**Lecture**	**Tutorial**	**Practical**	**Credits**	**Total Teaching Hours**
Contact Hours		3	0	0	3	36
Prerequisite course code as per proposed course numbers						
Prerequisite credits						
Equivalent course codes as per proposed course and old course						
Overlap course codes as per proposed course numbers						
Text Books:						
1		Title	Networks: An Introduction			
		Author	Mark Newman			
		Publisher	Oxford University Press			
		Edition	20-May-10			
2		Title	Network Scince			

		Author	Albert Laszlo Barabasi
		Publisher	Cambridge University Press
		Edition	2016
3..		Title	Networks, Crowds, and Markets: Reasoning About a Highly Connected World
		Author	David Easley and Jon Kleinberg
		Publisher	Cambridge University Press
		Edition	Sep-10
Reference Book:			
1.		Title	The Structure of Complex Networks Theory and Applications
		Author	Ernesto Estrada
		Publisher	Oxford University Press
		Edition	17-Dec-11
2.		Title	Dynamical Processes on Complex Networks
		Author	Alain Barrat, Marc Barthelemy, and Alessandro Vespignani
		Publisher	Cambridge University Press
		Edition	24-Nov-08

3.		Title	The Structure and Dynamics of Networks
		Author	Mark Newman, Albert-Laszlo Barabasi, & Duncan J. Watts
		Publisher	Princeton University Press
		Edition	April 17, 2006
4.		Title	Exploratory Social Network Analysis with Pajek
		Author	Nooy, Wouter de, Andrej Mrvar, and Vladimir Batagelj
		Publisher	Cambridge University Press
		Edition	10-Jan-05
Content	Unit – 1 **Basic Network Properties:** Empirical Study of Networks: Technological networks, Information networks, Social networks, Biological networks, Economic networks		
	Fundamentals of Network Theory: Mathematics of networks, Measures and metrics, Structural properties of networks: Diameter, Clustering Coefficient, Degree distribution.		
	Unit – 2 **Network Models**: Random graphs, Random graphs with general degree distributions, Small world, Power-law, Decentralized centrality in Small world.		
	Node Centralities: Degree centrality, Closeness centrality, Betweennes centrality, Centralizaton , eigenvector centrality.		

	Unit – 3
	Network communities and Link analysis: Graph Partitioning, Edge betweenness, Modularity optimization and Spectral Clustering, Community Detection Algorithms, Overlapping communities in networks. Link Analysis: HITS and Page Rank.
	Unit – 4
	Diffusion and Epidemics on Networks: Physical diffusion, Diffusion equation, Random walks on graph. Epidemics models SI, SIS, SIR. Modeling of infection propagation.
	Unit – 5
	Network Visualization: Network X, UCINET, Gephi, Pajek, Graphviz.
Course Assessment	Continuous Evaluation 25% Mid Semester 25% End Semester 50%

Course no: CSL 361	Open course (YES/NO)		HM Course (Y/N)	DC (Y/N)	DE (Y/N)
Type of course	PE				
Course Title	ADVANCED DATABASE MANAGEMENT SYSTEMS				
Course Coordinator					
Course objectives:	This course provides in depth exploratory skills in distributed and parallel databases. It covers a number of advanced topics like query optimization including online query and adaptive query processing. The specific topics include advanced transaction models and models of spatial data.				
Pos	At the end of the course student will be able 1. Evaluate and apply advanced database development techniques. 2. Design conceptual and logical data models. 3. Identify, describe and categorize transaction.				

Semester		**Autumn:**		**Spring**		
V		**Lecture**	**Tutorial**	**Practical**	**Credits**	**Total Teaching Hours**
Contact Hours		3	0	0	3	36
Prerequisite course code as per proposed course numbers						
Prerequisite credits						
Equivalent course codes as per proposed course and old course						
Overlap course codes as per proposed course numbers						

Text Books:			
1		Title	Database System Concepts
		Author	Avi Silberschatz, Hank Korth, and S. Sudarshan
		Publisher	McGraw Hill
		Edition	5th Edition, 2005
Reference Book:			
2.		Title	Spatial Databases: A Tour
		Author	S. Shekhar and S. Chawla
		Publisher	Prentice Hall,
		Edition	2003
3.		Title	Fundamentals of Database Systems
		Author	R. Elmasri and S. Navathe
		Publisher	Benjamin- Cummings

		Edition	5th Edition, 2007.
4		Title	Database Systems
		Author	Hector Garcia-Molina, Jeff Ullman, and Jennifer Widom
		Publisher	Pearson
		Edition	2nd Edition
Content	Unit – 1 Distributed database concepts – overview of client – server architecture and its relationship to distributed databases, Concurrency control Heterogeneity issues, Persistent Programming Languages, Object Identity and its implementation, Clustering, Indexing, Client Server Object Bases, Cache Coherence. Unit – 2 Parallel Databases: Parallel Architectures, performance measures, shared nothing/shared disk/shared memory based architectures, Data partitioning, Intra-operator parallelism, Pipelining, Scheduling, Load balancing. Unit – 3 Query processing: Index based, cost estimation, Query optimization: algorithms, Online query processing and optimization, XML, DTD, Xpath, XML indexing, Adaptive query processing. Unit – 4 Advanced Transaction Models: Savepoints, Sagas, Nested Transactions, Multi Level Transactions. Recovery: Multilevel recovery, Shared disk systems, Distributed systems 2PC, 3PC, replication and hot spares, Data storage, security and privacy-Multidimensional K- Anonymity, Data stream management. Unit – 5 Models of Spatial Data: Conceptual Data Models for spatial databases (e.g. pictogram enhanced ERDs), Logical data models for spatial databases: raster model (map algebra), vector model, Spatial query languages, Need for spatial operators and relations, SQL3 and ADT. Spatial operators, OGIS queries		
Course Assessment	Continuous Evaluation 25% Mid Semester 25% End Semester 50%		

Course no: CSL 467	Open course (YES/NO)		HM Course (Y/N)	DC (Y/N)	DE (Y/N)
Type of course	PE				
Course Title	WIRELESS MOBILE COMMUNICATIONS				
Course Coordinator					
Course objectives:	Explain the limitations of fixed networks and discuss the concepts portability and mobility. Describe and analyze the network infrastructure requirements to support mobile devices and users. Discuss the concepts, techniques and protocols employed in wireless local area networks, cellular networks. Illustrate the concepts, architecture behind 2G and 3G mobile networks. Explain the different techniques for developing applications for mobile devices.				
Pos	At the end of the course student will be able 1. Design and develop the interesting applications based on a network of wireless mobile devices. 2. Propose the improved solutions than the existing Access Scheduling Techniques in Cellular Systems.				

Semester		Autumn:		Spring		
VII/VIII		Lecture	Tutorial	Practical	Credits	Total Teaching Hours
Contact Hours		3	0	0	3	36
Prerequisite course code as per proposed course numbers						
Prerequisite credits						
Equivalent course codes as per proposed course and old course						
Overlap course codes as per proposed course numbers						

Text Books:			
1	Title	Wireless and Mobile Networks Architectures	
	Author	Yi-Bing Lin and Imrich Chlamtac	
	Publisher	John Wiley & Sons	
	Edition	2001	

Reference Book:

2.	Title	Mobile Wireless Communications
	Author	Mischa Schwartz
	Publisher	Cambridge University Press, UK
	Edition	2005

Content	Unit – 1 Mobile environments and communications systems, Mobile operating system, Personal Communications Services (PCS).
	Unit – 2 Global System for Mobile Communication (GSM) system, Performance Analysis, 2.5/3G Mobile Wireless systems, 3G CDMA cellular standards.
	Unit – 3 Wideband Code Division Multiple Access (W-CDMA), and CDMA 2000, General Packet Radio Services (GPRS) and EDGE.
	Unit – 4 Access Scheduling techniques in cellular systems Slotted Aloha access, integrated access.
	Unit – 5 Wireless Application Protocol (WAP), Wireless Local Loop(WLL).
Course Assessment	Continuous Evaluation 25% Mid Semester 25% End Semester 50%

Course no: CSL 365	Open course (YES/NO)	HM Course (Y/N)	DC (Y/N)	DE (Y/N)
Type of course	PE			
Course Title	SOFTWARE METRICS AND SOFTWARE PROJECT MANAGEMENT			
Course Coordinator				
Course objectives:	To understand the basic metrics and measurement theory To gain knowledge of the overall project activities and techniques for planning, organizing, scheduling, and controlling software projects To examine the software project management principles in real life scenarios To identify project risks, monitor and track project deadlines To use current SPM tools and obtain practical management skills To improve writing and presentation skills			
POs	*At the end of the course student will be able* · understand the objectives and general principles of measurement and project management · improve processes and products during various stages of software development life cycle using software metrics · execute the project development in a systematic manner using tools and techniques · assess different software products with a critical decision process based on a rigorous mathematical and deductive approach.			

Semester	**Autumn:**		**Spring**		
V	**Lecture**	**Tutorial**	**Practical**	**Credits**	**Total Teaching Hours**
Contact Hours	3	0	0	3	36
Prerequisite course code as per proposed course numbers					
Prerequisite credits					
Equivalent course codes as per proposed course and old course					
Overlap course codes as per proposed course numbers					

Text Books:			
1		Title	*Software Project Management in Practice*
		Author	*Pankaj Jalote*
		Publisher	*Addison-Wesley*
		Edition	*First Edition, 2002*

Reference Book:

2.	Title	*Software Metrics: A Rigorous and Practical Approach,*
	Author	*N.E. Fenton and James Bieman*
	Publisher	*CRC Press*
	Edition	*Third Edition, 2015*
3.	Title	*The Handbook of Program Management: How to Facilitate Project Success with Optimal Program Management,*
	Author	*James T Brown*
	Publisher	*McGraw-Hill*
	Edition	*Second Edition, 2014*
4.	Title	*Software Project Management*
	Author	*Bob Hughes and Mike Cotterell*
	Publisher	*McGraw-Hill*
	Edition	*Fifth Edition, 2009*
5.	Title	Metrics and Models in Software Quality Engineering
	Author	*Stephen H. Kan*
	Publisher	*Addison-Wesley*
	Edition	*Second Edition,2004*
6.	Title	*Project Management: The Managerial Process*
	Author	*Clifford F. Gray and Erik W. Lawson*
	Publisher	*McGraw-Hill*
	Edition	*Fifth Edition, 2010*
7.	Title	*Program Management (Fundamentals of Project Management),*
	Author	*Michel Thiry*
	Publisher	*MPG Book Group*
	Edition	*First Edition, 2010*
Content	Unit – 1	Theoretical foundations for software metrics, Introduction to the measurement theory, Data collection and analysis, Classification of software measures, Application of software metrics
	Unit – 2	Software reliability measures and models, Measuring the software development and maintenance processes, Experimental design and analysis, Software metrics validation, Predication systems
	Unit – 3	Calibration and validation of prediction systems, Overview of mature software processes and project management, Role of TQM in software project management, cost and effort estimates, Overall and detailed scheduling

	Unit – 4
	Quality management, Defect estimation and prevention, Risk management , logging and tracking defects, project management plans, configuration management, project reviews for better project execution, Overcoming the Not Around Here (NAH) syndrome
	Unit – 5
	Project tracking (including defect tracking, status reports, milestone analysis), defect analysis and prevention (plus Pareto and causal analysis), Process monitoring and audit, Project closure analysis
Course Assessment	Continuous Evaluation 25% Mid Semester 25% End Semester 50%

Course no: CSL 364	Open course (YES/NO)		HM Course (Y/N)	DC (Y/N)	DE (Y/N)
Type of course	PE				
Course Title	SOFTWARE QUALITY AND TESTING				
Course Coordinator					
Course objectives:	The main objective of the course is to impart students the knowledge and learning about software quality and software testing. This course introduces the concepts and methods required for effective and efficient SQA. It aims to develop a broad understanding of SQA processes from planning until execution. Students will learn in detail about various quality assurance models and understand the audit and assessment procedures to achieve quality. It goes further to underline testing mechanisms that can be applied throughout the software development life cycle to reduce defects and resolve root-cause problems in the development process to prevent defects from occurring. Software testing principles, strategies and techniques will be explained to students in detail.				
POs	At the end of the course student will be able • to understand software quality process and SQA • to understand how to detect, classify, prevent and remove defects • to perform various testing techniques to improve software quality • to conduct formal inspections, record and evaluate results of inspections • to distinguish between the various activities of quality assurance, quality planning and quality control and understand quality models • to identify risks for quality improvement				

Semester		Autumn:		Spring		
V		Lecture	Tutorial	Practical	Credits	Total Teaching Hours
Contact Hours		3	0	0	3	36
Prerequisite course code as per proposed course numbers						
Prerequisite credits						
Equivalent course codes as per proposed course and old course						
Overlap course codes as per proposed course numbers						
Text Books:						

1		Title	*Software Quality Engineering: Testing, Quality Assurance, and Quantifiable Improvement,*
		Author	*Jeff Tian*
		Publisher	*Wiley-IEEE Computer Society Press*
		Edition	*First Edition, 2005*
Reference Book:			
2.		Title	*Software Quality Assurance from theory to implementation*
		Author	*Daniel Galin*
		Publisher	*Pearson Education,*
		Edition	1st Edition, 2004
3.		Title	*Software Testing Techniques*
		Author	*Boris Beizer*
		Publisher	*Dreamtech Press,*
		Edition	*Second Edition, 2014*

4.		Title	*Effective Methods for Software Testing,*
		Author	*William E. Perry*
		Publisher	*John Wiley & Sons*
		Edition	*Third Edition, 2006*
5.		Title	*Software Testing and Quality Assurance Theory and practice*
		Author	*K Naik, P Tripathi*
		Publisher	*John Wiley & Sons,*
		Edition	*First Edition, 2008*
6.		Title	*Software Testing A Craftsman's approach*
		Author	*Paul C. Jorgensen*
		Publisher	*CRC Press*
		Edition	*Second Edition, 1997*
Content	Unit – 1 Software Quality, Software Quality Factors, Quality Frameworks and ISO-9126, Quality Assurance, QA Activities in Software Processes, Components of SQA system, Verification and Validation Perspectives of QA, Need of Testing, Fundamentals of Testing Process, Principles of Testing, V&V Techniques, ISO/IEC/IEEE Software Testing Standards		
	Unit – 2 Testing Techniques, Functional Testing, Boundary Value Analysis, Decision Table Based Testing, Structural Testing, Path Testing, Dataflow Testing, Mutation Testing, Slice based Testing, Static and Dynamic Testing Tools, Test Metrics and test reports		

	Unit – 3
	Levels of Testing, Debugging, Regression Testing, Prioritizing the Test-cases, Domain Testing, Object Oriented Testing, Testing Web Applications, Agile Testing, Scrum Testing, Mobile Application Testing
	Unit – 4
	Quality Engineering Activities and Process, Quality Planning Goal Setting and Strategy Formation, Quality Assessment and Improvement, Quality Assurance beyond testing, Defect Prevention and Process Improvement, Fault Tolerance, Failure Containment, Comparing Quality Assurance Techniques and Activities
	Unit – 5
	Feedback Loop and Activities for Quantifiable Quality Improvement, Quality Models and Measurements, Risk Identification for Quantifiable Quality Improvement, Software Reliability Engineering
Course Assessment	Continuous Evaluation 25% Mid Semester 25% End Semester 50%

Course no: CSL 375	Open course (YES/NO)		HM Course (Y/N)	DC (Y/N)	DE (Y/N)
Type of course	PE				
Course Title	SOFT COMPUTING				
Course Coordinator					
Course objectives:	The main objective of the course is to expose the ideas of Neural networks, fuzzy logic and concepts of Genetic algorithm and its applications to soft computing.				
Pos	By the end of the course a student is expected to become able to apply Artificial Neural Network, Fuzzy Logic, and Genetic Algorithms as computational tools to solve a variety of problems in various area of interest ranging from Optimization problems to Text Analytics.				

Semester		**Autumn:**		**Spring**		
VI		Lecture	Tutorial	Practical	Credits	Total Teaching Hours
Contact Hours		3	0	0	3	36
Prerequisite course code as per proposed course numbers						
Prerequisite credits						
Equivalent course codes as per proposed course and old course						
Overlap course codes as per proposed course numbers						

Text Books:			
1		Title	A comprehensive foundation. Neural Networks
		Author	Simon Haykin,
		Publisher	pearson
		Edition	2nd Edition, 2001.

Reference Book:			
2.		Title	*Fuzzy logic with engineering applications*
		Author	Timothy J. Ross
		Publisher	John Wiley & Sons
		Edition	3rd Edition,2009
3.		Title	An Introduction to Genetic Algorithms
		Author	Melanie Mitchell
		Publisher	Prentice-Hall
		Edition	1998
4.		Title	Genetic Algorithms in Search, Optimization, and Machine Learning
		Author	D. E. Goldberg

	Publisher	Addison-Wesley
	Edition	1989

5.	Title	Understanding Neural Networks and Fuzzy Logic: Basic Concepts and Applications
	Author	S. V. Kartalopoulos
	Publisher	IEEE Press
	Edition	PHI, 2014
6.	Title	Neural Networks, Fuzzy Logic and Genetic Algorithms: Synthesis & Applications
	Author	S. Rajasekaran & G. A. Vijayalakshmi Pai
	Publisher	PHI
	Edition	2003
7.	Title	Principles of Soft Computing
	Author	S. N. Sivanandam & S. N. Deepa
	Publisher	Wiley – India
	Edition	2nd Edition, 2007
Content	Unit-1	**Artificial Neural Networks:** Basic concepts of artificial neural networks, Earlier neural networks: ADALINE, MADALINE. ***Neural Network Architectures***:Single layer feedforward network, Multi layer feedforward network, Recurrent network.
	Unit-2	***Supervised Learning Network:***Perceptron network,Back propagation network,Radial basis function network. ***Unsupervised Learning Network:***Fixed weight competitive nets, Kohonen self organizing feature maps, Counter propagation network, Adaptive reasoning theory. ***Associative memory:***Autoassociative memory network, Hetroassociative memory network, Bidirectional associative memory, Hopfield networks.
	Unit-3	**Fuzzy Logic**: Crisp set and Fuzzy set, Basic concepts of fuzzy sets, Fuzzy set operations, Fuzzy Arithmetic-fuzzy numbers, Fuzzy ordering,Fuzzy vectors. Fuzzy measures-belief and plausibility measure. Probability measure- Measure of fuzziness, Fuzzy integrals. ***Membership functions***: Features of membership function, Fuzzification. ***Fuzzy Rule Based Systems:*** Fuzzy proposition, Formation and decomposition of rules, Fuzzy reasoning, Fuzzy inference systems, Fuzzy expert system. ***Defuzzification***: Max-membership, Centroid method, Weighted average, Mean max.
	Unit-4	**Genetic Algorithms**: Traditional optimization and search techniques, Genetic algorithms. ***Operators***: Encoding, Selection, Crossover, Mutation. ***Classification***: Adaptive genetic algorithms, Hybrid genetic algorithms, Parallel genetic algorithms, Real coded genetic algorithm.

| | Unit-5
Hybrid Systems: Neuro fuzzy hybrid systems, Adaptive neuro-fuzzy inference systems, Fuzzy backpropagation network, Genetic neuro hybrid system, Genetic algorithm based backpropagation network, Genetic-fuzzy hybrid systems. |
| **Course Assessment** | Continuous Evaluation 25%
Mid Semester 25%
End Semester 50% |

Course no: CSB 352	Open course (YES/NO)		HM Course (Y/N)	DC (Y/N)	DE (Y/N)	
	NO		NO	YES	NO	
Type of course	Core					
Course Title	DATA MINING					
Course Coordinator						
Course objectives:	The course aims to provide a comprehensive introduction to data mining techniques and knowledge discovery. It covers supervised and unsupervised techniques for uncovering hidden patterns in large data sets including recommendation system. Also, it covers advanced data mining topics like web mining, text mining, spatial and temporal mining.					
Pos	At the end of the course student will be able ● To discover patterns from raw data and make predictions of the outcomes. ● To apply data mining techniques for solving practical problems.					
Semester		**Autumn: Yes**		**Spring**		
VI		**Lecture**	**Tutorial**	**Practical**	**Credits**	**Total Teaching Hours**
Contact Hours		3	0	2	4	36
Prerequisite course code as per proposed course numbers		NIL				
Prerequisite credits		NIL				
Equivalent course codes as per proposed course and old course		NIL				
Overlap course codes as per proposed course numbers		NIL				
Text Books:						
1		Title	Data Mining: Concepts and Techniques,			
		Author	J. Han, M. Kamber			
		Publisher	Morgan Kaufman			
		Edition	3rd Edition, 2012			
Reference Book:						
2.		Title	Data Warehousing, Data Mining, & OLAP			
		Author	Alex Berson, Stephen J. Smith			
		Publisher	Tata McGraw Hill			
		Edition	2004			
3.		Title	Data Mining: Introductory and Advanced Topics			
		Author	M. H. Dunham			
		Publisher	Pearson Education			
		Edition	2001			

Content	Unit-1 (5 Hrs) Introduction to Data Mining and Knowledge Discovery, Data Mining Applications, Pattern Analysis, Cluster Analysis, Outlier Analysis, Predictive Analysis, Data Visualization, Proximity measures, Data Preprocessing, Data Cleaning, Data Integration, Data Reduction, Data Transformation and Data Discretization. Unit-2 (7 Hrs) Association Rules: Association Rule Mining, Apriori Algorithm,Frequent Itemsets, Closed Itemsets, Pattern Evaluation Method, Advanced Association Rule Techniques, Measuring the quality of rules. Unit-3(8 Hrs) Supervised Techniques: Classification, Decision Tree Induction, Bayes Classification Method, Rule-Based Classification, Model Evaluation and Selection, Discriminant Analysis, Logistic Regression. Unit-4 (6 Hrs) Unsupervised Techniques: Cluster Analysis, Partitioning Methods, Hierarchical Methods, Density-based Methods, Grid-based Methods, Evaluation of Clustering, Outlier Detection. Unit-5 (10 Hrs) Recommendation System, Advanced Techniques, Text Mining: Extracting attributes (Keywords), structural approaches (parsing, soft parsing), Bayesian approach to classifying text, Web Mining: Classifying web pages, extracting knowledge from the web, Mining Spatial Databases, Temporal Data Mining.
Course Assessment	Continuous Evaluation 25% Mid Semester 25% End Semester 50%

Course no: CSL 462	Open course (YES/NO)		HM Course (Y/N)	DC (Y/N)	DE (Y/N)
Type of course	PE				
Course Title	DIGITAL IMAGE PROCESSING				
Course Coordinator					
Course objectives:	The course aims to cover techniques and tools for digital image processing, image transformation in spatial and frequency domains. It introduces image analysis techniques in the form of image segmentation. The course also aims to cover the processing of colored images. The course also aims to cover techniques and tools for digital image processing, and to provide hands-on experience in applying these tools to process images. The students would be encouraged to develop the image processing tools from scratch, rather than using any image processing library functions. Students will also get an opportunity to familiarize with image processing platforms such as Open CV, MATLAB etc..				
Pos	At the end of the course student will be able - describe the fundamental concepts and process flow of digital image processing - appropriately apply digital image processing techniques to real world applications - design and implement various algorithms for digital image processing - enhance their critical thinking skills				

Semester		**Autumn:**		**Spring**		
VII/VIII		**Lecture**	**Tutorial**	**Practical**	**Credits**	**Total Teaching Hours**
Contact Hours		3	0	0	3	36
Prerequisite course code as per proposed course numbers						
Prerequisite credits						
Equivalent course codes as per proposed course and old course						
Overlap course codes as per proposed course numbers						

Text Books:			
1		Title	Digital Image Processing
		Author	R.C. Gonzalez, R.E Woods
		Publisher	Pearson Education
		Edition	3rd Edition, 2008
Reference Book:			

2.	Title	Digital Image Processing
	Author	W.K. Pratt
	Publisher	Wiley-Interscience
	Edition	4th Edition, 2007
3	Title	Digital Image Processing Using MATLAB
	Author	R.C. Gonzalez, R.E Woods, S. L. Eddins
	Publisher	PHI
	Edition	2003

4	Title	Image Processing, Analysis, and Machine Vision
	Author	M. Sonka, V. Hlavac, R. Boyle
	Publisher	Brooks/Cole
	Edition	3rd edition, 2007

Content	Unit-1 Introduction: Digital image representation, Fundamental steps in image processing, Components of Digital Image processing systems, Elements of visual perception, Image Formation model, Image Sampling and quantization, Relationship between pixels – neighbourhood, adjacency connectivity, regions, boundaries and distance measures. Unit-2 Image Enhancement: Enhancement by point processing, Sample intensity transformation, Histogram processing, Image subtraction, Image averaging, Spatial filtering- Smoothing Spatial filters, Sharpening Spatial filters, Frequency domain- Fourier Transform, Low-Pass, High-Pass, Laplacian, Homomorphic filtering. Unit-3 Image Segmentation: Detection of discontinuities – point, line and edge detection, Edge linking and boundary detection, Thresholding, Region-based segmentation – region growing, region splitting and merging, Use of motion in segmentation- Spatial techniques and Frequency domain techniques. Unit-4 Image Compression: Coding redundancy, Interpixel redundancy, fidelity criteria, Image compression models, Error-free compression, Variable length coding, Bit-plane coding, Lossless predictive coding, Lossy compression, Image compression standards, Real-Time image transmission, JPEG and MPEG. Unit-5 Color Image Processing: Color Models, Pseudo color Image Processing, Color Transformations, Smoothing and sharpening, Image Segmentation based on color.
Course Assessment	Continuous Evaluation 25% Mid Semester 25% End Semester 50%

Course no: CSB 271	Open course (YES/NO)	HM Course (Y/N)	DC (Y/N)	DE (Y/N)
Type of course	PE			
Course Title	JAVA TECHNOLOGIES			
Course Coordinator				
Course objectives:	1 Illustrate the basic concepts and building blocks of Java language programming using a module's approach which gives emphasize to small programs. 2. Learn how to write moderately complex Java programs efficiently			
Pos	1. Knowing essential concepts, principles and theories of Java technology relating to the web applications. 2. Develop real-world programming problems and applications efficiently using the advanced JAVA library.			

Semester	Autumn:		Spring		
IV	Lecture	Tutorial	Practical	Credits	Total Teaching Hours
Contact Hours	2	0	2	3	24
Prerequisite course code as per proposed course numbers	OBJECT ORIENTED PROGRAMMING				
Prerequisite credits					
Equivalent course codes as per proposed course and old course					
Overlap course codes as per proposed course numbers					
Text Books:					

1.	Title	Java: The Complete Reference
	Author	Herbert Schildt
	Publisher	McGraw-Hill Education
	Edition	9th Edition, 2014

Reference Book:

2	Title	Java: How to Program
	Author	Paul Deitel, Harvey Deitel
	Publisher	Prentice Hall
	Edition	9th Edition, 2011

Content	Unit-1
	Introduction to Java: Overview and characteristics of Java, Java Programming Environment, Fundamental Programming, Java program Compilation and Execution.
	Unit-2
	Structures in Java, Objects and Classes in Java, Inheritance, Interfaces and Inner Classes, Exceptions and Exception Handling in Java. Streams and Files.
	Unit-3
	Applets and Swing: Applet design, AWT packages, Applet event handling, parameters to applets.
	Unit-4
	AWT controls, layout manager, Frames, container classes, Introduction to Java Beans, Swing and Servlets.
	Unit-5
	Graphical User Interface Components, Threads, Multithreading, Java Database Connectivity, Networking, Collections
Course Assessment	Continuous Evaluation 25% Mid Semester 25% End Semester 50%

Course no: CSB 351	Open course (YES/NO)	HM Course (Y/N)	DC (Y/N)	DE (Y/N)
Type of course	PC			
Course Title	NETWORK PROGRAMMING			
Course Coordinator				
Course objectives:	1. Learn how to write our own network programs using an application program interface (or API). 2. Have in-depth understanding on advanced sockets API, sometimes called, Berkeley Sockets, acknowledging their heritage from Berkeley Unix.			
Pos	At the end of the course student will be able to modify and enhance the existing network programs to reinforce the concepts and techniques.			

Semester	Autumn:		Spring		
VI	Lecture	Tutorial	Practical	Credits	Total Teaching Hours
Contact Hours	3	0	0	3	36
Prerequisite course code as per proposed course numbers					
Prerequisite credits					
Equivalent course codes as per proposed course and old course					
Overlap course codes as per proposed course numbers					

Text Book:			
1.		Title	Unix Network Programming Volume 1
		Author	W.Richard Stevens
		Publisher	PHI
		Edition	2005
2.		Title	Unix Network Programming Volume 2
		Author	W.Richard Stevens
		Publisher	PHI
		Edition	2005

Content	Unit-1 Introduction to Sockets, Elementary TCP Sockets, Elementary UDP Sockets, Reserved Ports – Well-known ports, registered ports, dynamic or private ports, Stream Pipes, I/O Multiplexing: The select and poll functions, I/O models. Advanced Socket System Calls: Asynchronous I/O: Introduction, Nonblocking *reads* and *writes*, *connect*, and *accept*. Unit-2 Advanced I/O Functions: Socket Timeouts, recv and send functions, readv

	and writev functions,
	Unit-3
	Unix domain protocols: Unix domain socket address structure, socketpair function, socket functions, Passing file descriptors.
	Unit-4
	Routing Sockets: Introduction, Datalink socket address structure, Reading and Writing, Broadcasting: Introduction, Broadcast addresses, Unicast versus broadcast, Multicasting: Introduction, Multicast addresses, Multicasting versus broadcasting on a LAN, Sending and Receiving, Signal driven I/O Introduction, Signal-Driven I/O for Sockets, UDP Echo Server using SIGIO.
	Unit-5
	Raw Sockets: Raw socket creation, Raw socket input, Raw socket output, Data link access: libpcap:
	packet capture library, STREAMS: ioctl function, getmsg and putmsg functions.
	Remote procedure calls: Doors: Different door functions, Descriptor passing, Sun RPC: Introduction,
	Multithreading, Server binding.
Course Assessment	Continuous Evaluation 25% Mid Semester 25% End Semester 50%

Course no: CSL 378	Open course (YES/NO)	HM Course (Y/N)	DC (Y/N)	DE (Y/N)
Type of course	PE			
Course Title	DISTRIBUTED COMPUTING			
Course Coordinator				
Course objectives:	This course aims to provide the students with ● basic knowledge in parallel and distributed computing. ● skills to design and analyze parallel and distributed applications ● ability to describe the various design issues in a parallel or distributed computing			
Pos	At the end of the course students will be able to ● Identify models of distributed computing ● Analyze algorithms for coordination, communication, security and synchronization in distributed systems ● Classify distributed shared memory models ● Design and Implement distributed file systems ● Design distributed algorithms for deadlocks			

Semester	**Autumn:**		**Spring**		
VI	**Lecture**	**Tutorial**	**Practical**	**Credits**	**Total Teaching Hours**
Contact Hours	3	0	0	3	36
Prerequisite course code as per proposed course numbers					
Prerequisite credits					
Equivalent course codes as per proposed course and old course					
Overlap course codes as per proposed course numbers					

Text Books:

1.	Title	Distributed Systems Concepts and Design
	Author	George Coulouris, Jean Dollimore, and Tim Kindberg
	Publisher	Pearson Education Asia
	Edition	3rd Edition, 2002.

Reference Book:

2.	Title	Distributed Computing: Fundamentals, Simulations and Advanced Topics
	Author	Hagit Attiya and Jennifer Welch
	Publisher	Wiley
	Edition	2004
3.	Title	Advanced Concepts in Operating Systems
	Author	Mukesh Singh
	Publisher	McGraw Hill Series in Computer Science
	Edition	1994
4.	Title	Distributed Systems
	Author	A.S.Tanenbaum and M.Van Steen
	Publisher	Pearson Education
	Edition	2004
5.	Title	Distributed Computing: Principles and Applications

	Author	M.L.Liu
	Publisher	Pearson Education
	Edition	1st Edition, 2003

Content	Unit-1
	Introduction – Various Paradigms in Distributed Applications, Remote Procedure Call, Remote Object Invocation, Message-Oriented Communication, Unicasting, Multicasting and Broadcasting, Group Communication.
	Unit-2
	Issues in Distributed Operating System – Threads in Distributed Systems, Clock Synchronization, Causal Ordering, Global States, Election Algorithms, Distributed Mutual Exclusion, Distributed Transactions, Distributed Deadlock, Agreement Protocols.
	Unit-3
	Distributed Shared Memory – Data-Centric Consistency Models, Client-Centric Consistency Models, Ivy, Munin, Distributed Scheduling, Distributed File Systems, Sun NFS.
	Unit-4
	Introduction to Fault Tolerance – Distributed Commit Protocols, Byzantine Fault Tolerance, Impossibilities in Fault Tolerance.
	Unit-5 Case Studies: Distributed Object-Based System, CORBA, COM+, Distributed Coordination-Based System, JINI.
Course Assessment	Continuous Evaluation 25% Mid Semester 25% End Semester 50%

Course no: CSL 473	Open course (YES/NO)	HM (Y/N)	Course	DC (Y/N)	DE (Y/N)
Type of course	PE				
Course Title	PATTERN RECOGNITION				
Course Coordinator					
Course objectives:	The objective of the course is to understand the algorithms for Pattern Recognition. The representation of patterns and classes and the similarity measures are an important aspect of pattern recognition. Pattern recognition involves classification and clustering of patterns. The two well-known paradigms of machine learning namely, learning from examples or supervised learning and learning from observations or clustering covered in this course. When the data sets are very large it is meaningful to reduce the data and use this reduced data for pattern classification. The details of feature extraction and feature selection are also covered in this course.				
Pos	**At the end of the course student will be able to** - design systems and algorithms for pattern recognition - analyze a given pattern recognition problem, and determine which algorithm to use - modify existing algorithms to engineer new algorithms - solve a particular problem at hand from a wide variety of application domains gain a working knowledge of some of the most recent developments in pattern recognition, such as incremental learning and learning in nonstationary environments				

Semester	**Autumn:**		**Spring**		
VII/VIII	**Lecture**	**Tutorial**	**Practical**	**Credits**	**Total Teaching Hours**
Contact Hours	3	0	0	3	36
Prerequisite course code as per proposed course numbers					
Prerequisite credits					
Equivalent course codes as per proposed course and old course					
Overlap course codes as per proposed course numbers					

Text Books:

1.	Title	Pattern Recognition and Machine Learning
	Author	C. M. Bishop
	Publisher	Springer
	Edition	2013

Reference Book:

2.	Title	Pattern Classification
	Author	R. O. Duda, P. E. Hart, D. G. Stork

		Publisher	Wiley Interscience
		Edition	2nd Edition, 2007
3.		Title	Pattern Recognition
		Author	S. Theodoridis, K. Koutroumbas
		Publisher	Academic Press
		Edition	4th Edition, 2008

		Title	Pattern Recognition: Statistical, Structural and Neural Approaches
4.		Author	R. Schalkoff
		Publisher	Wiley
		Edition	2012
Content	Unit-1		

Content

Unit-1

Introduction: Basics of Probability and Statistics, Linear Algebra, Linear Transformations, Components of Pattern Recognition System, Learning and adaptation, Supervised Learning (Classification) and Unsupervised Learning (Clustering)

Unit-2

Bayesian Decision Theory: classifiers, discriminant functions, decision surfaces, Discriminant functions for Normal density, Error bounds for Normal density, Maximum Likelihood and Bayesian Parameter Estimation, Principal Component Analysis, Fisher Linear Discriminant, Hidden Markov Models.

Unit-3

Non-parametric Techniques: Parzen window estimation, k-nearest neighbour classification, Perceptron classifier, Support Vector Machines, Decision Tree based classifiers

Unit-4

Feature Extraction and Feature Selection: Feature extraction – discrete cosine and sine transform, Discrete Fourier transform, Principal Component analysis, Kernel Principal Component Analysis. Feature selection – class separability measures, Feature Selection Algorithms - Branch and bound algorithm, sequential forward / backward selection algorithms.

Unit-5

Unsupervised Learning/Clustering: distance/similarity measures, K-means clustering, single linkage and complete linkage clustering, MST, medoids, DBSCAN. Recent advances in Pattern Recognition : Structural PR, SVMs, FCM, Soft-computing and Neuro-fuzzy techniques, and real-life examples

Course Assessment	Continuous Evaluation 25%
	Mid Semester 25%
	End Semester 50%

Course no: CSL 377	Open course (YES/NO)	HM Course (Y/N)	DC (Y/N)	DE (Y/N)
Type of course	PE			
Course Title	Natural Language Processing			
Course Coordinator				
Course objectives:	To provides a broad introduction to NLP with a particular emphasis on core algorithms, data structures, and machine learning for NLP.			
POs	By the end of the course, the student should be able to identify and discuss the characteristics of different NLP techniques including various machine learning techniques used in NLP, understand what constitutes a probabilistic language model and understand the difference in assumptions between different types of such models.			

Semester		**Autumn:**		**Spring**		
VI		**Lecture**	**Tutorial**	**Practical**	**Credits**	**Total Teaching Hours**
Contact Hours		3	0	0	3	36
Prerequisite course code as per proposed course numbers						
Prerequisite credits						
Equivalent course codes as per proposed course and old course						
Overlap course codes as per proposed course numbers						

Text Books:			
1.	Title	J. H. *Speech and Language Processing*	
	Author	Jurafsky, D. and Martin	
	Publisher	Prentice Hall	
	Edition	2nd Edition, 2014	

Reference Book:			
2.	Title	C. D. and H. Schütze: *Foundations of Statistical Natural Language Processing*	
	Author	Manning	
	Publisher	The MIT Press	
	Edition	1st Edition,1999	

| **Content** | Unit-1

Introduction: Human languages, Formal language and Natural Language, Finite state transducer, Introduction to corpus, elements in balanced corpus, |
|---|---|

	TreeBank, WordNet. Unit-2 *Morphology*: Inflectional morphology, Derivational morphology, Finite state morphological parsing, Morphology and Indian languages. *N-Grams*: Simple N-grams, Smoothing, Backoff, Entropy. Unit-3 *Part-of-Speech Tagging*: Stochastic POS tagging, HMM, Transformation based tagging (TBL), Handling of unknown words, Named entities, Multi word expressions. *Speech Processing:* Speech and phonetics, Vocal organ, Phonological rules, Probabilistic models- Spelling error, Bayesian method to spelling, Minimum edit distance, Bayesian method of pronunciation variation, Viterbi algorithm, HMM and Speech recognition. Unit-4 *Parsing*- Unification, Statistical Parsing, Probabilistic parsing, TreeBank. Unit-5 **Application: S**entiment analysis, Spelling correction, Word sense disambiguation, Machine translation, Text Classification, Question answering system.
Course Assessment	Continuous Evaluation 25% Mid Semester 25% End Semester 50%

Course no: CSL 465	Open course (YES/NO)	HM Course (Y/N)	DC (Y/N)	DE (Y/N)
Type of course	PE			
Course Title	NEURAL NETWORKS			
Course Coordinator				
Course objectives:	The objectives of this course are to understand the role of neural networks in engineering, artificial intelligence, and cognitive modeling.			
POs	At the end of the course, students should be able to understand the concepts and techniques of neural networks and sufficient theoretical background to be able to reason about the behaviour of neural networks. They will be able to evaluate whether neural networks are appropriate to a particular application and can apply neural networks to particular applications to know what steps to take to improve performance.			

Semester	Autumn:		Spring		
VII/VIII	**Lecture**	**Tutorial**	**Practical**	**Credits**	**Total Teaching Hours**
Contact Hours	3	0	0	3	36
Prerequisite course code as per proposed course numbers					
Prerequisite credits					
Equivalent course codes as per proposed course and old course					
Overlap course codes as per proposed course numbers					

Text Books:		
1.	Title	Network N. A comprehensive foundation. Neural Networks
	Author	Simon Haykin
	Publisher	pearson
	Edition	2nd Edition, 2001

Reference Book:		
2.	Title	Neural Network in Computer Intelligence
	Author	Limin Fu
	Publisher	Tata McGraw-Hill
	Edition	2003 Edition, 2003
3.	Title	Fundamentals of Neural Networks: Architectures, Algorithms, and Applications

		Author	Laurene Fausett
		Publisher	Prentice Hall International
		Edition	1994
4.		Title	*Fuzzy logic with engineering applications*
		Author	Timothy J. Ross
		Publisher	John Wiley & Sons
		Edition	3rd Edition,2009
5.		Title	Understanding Neural Networks and Fuzzy Logic: Basic Concepts and Applications
		Author	S. V. Kartalopoulos
		Publisher	IEEE Press
		Edition	PHI, 2004
Content	Unit-1 **Introduction to neural networks**: Biological and Artificial neurons, Learning in ANNs, Perceptrons – classification and linear separability, XOR problem, Network architectures, Multilayer feedforward networks and recurrent networks, Generalized delta rule. Unit-2 **Multilayer networks:** Back propagation (BP) network, BP training algorithm, Radial basis function (RBF) networks, Applications of BP and RBF networks. Recurrent networks and unsupervised learning, Hopfield network – energy; stability; capacity; Application to optimization problems, Counter back propagation network, Boltzmann machine, Kohonen's self organizing feature maps, Adaptive resonance theory. Unit-3 **Associative memory:** Matrix associative memory, Auto associative memories, Hetero associative memories, Bi-directional associative memory, Applications of associative memories. Unit-4 **Fuzzy Systems and Neuro fuzzy systems:** Relevance of Integration between fuzzy sets and neural network, Fuzzy neural network, Neuro fuzzy systems, Fuzzy associative memories. Unit-4 **Application of Fuzzy sets and Neural networks:** Application in pattern recognition, Image processing and computer vision, Application in control: Fuzzy controllers, neuro controllers and fuzzy neuro controllers, Applications in expert systems and decision making systems, application in real world computing.		

Course Assessment	Continuous Evaluation 25% Mid Semester 25% End Semester 50%

Course no: CSL 474	Open course (YES/NO)	HM Course (Y/N)	DC (Y/N)	DE (Y/N)
Type of course	PE			
Course Title	MACHINE LEARNING			
Course Coordinator				
Course objectives:	With the increased availability of data from varied sources there has been increasing attention paid to the various data driven disciplines such as analytics and machine learning. This course aims to provide students with the knowledge of key concepts of machine learning from a mathematically well motivated perspective. The course aims to familiarize the students with the two broad categories of machine learning algorithms – supervised and unsupervised.			
Pos	At the end of the course students will be able to: ● identify potential applications of machine learning in practice ● describe the differences in approaches and applicability of regression, classification, and clustering ● select the suitable machine learning task for a given application ● implement feature extraction and selection to represent data as features to serve as input to machine learning models build an application that is based on machine learning			

Semester	**Autumn:**		**Spring**		
VII/VIII	**Lecture**	**Tutorial**	**Practical**	**Credits**	**Total Teaching Hours**
Contact Hours	3	0	0	3	36
Prerequisite course code as per proposed course numbers					
Prerequisite credits					
Equivalent course codes as per proposed course and old course					
Overlap course codes as per proposed course numbers					

Text Books:

1.	Title	Introduction to Machine Learning
	Author	E. Alpaydin
	Publisher	MIT Press
	Edition	2nd Edition, 2009

Reference Book:

2.	Title	Machine Learning
	Author	T. M. Mitchell
	Publisher	McGraw-Hill
	Edition	1997
3.	Title	Machine learning in action
	Author	P. Harrington
	Publisher	Manning Publications Co
	Edition	2012
4.	Title	Pattern recognition and Machine Learning
	Author	C. M. Bishop
	Publisher	Springer

		Edition	2007
5.		Title	Machine Learning for Big Data
		Author	J. Bell
		Publisher	Wiley
		Edition	2014
Content	Unit-1 Introduction, Machine learning basics, Supervised Learning: Artificial Neural Network, Classifying with *k*-Nearest Neighbour classifier, Support vector machine classifier, Decision Tree classifier, Naive Bayes classifier, Bagging, Boosting, Improving classification with the AdaBoost meta algorithm. Unit-2 Forecasting and Learning Theory: Predicting numeric values: regression, Linear Regression, Logistic regression, Tree-based regression. Bias/variance tradeoff, Union and Chernoff/Hoeffding bounds, Vapnik–Chervonenkis (VC) dimension, Worst case (online) learning. Unit-3 Unsupervised Learning: Grouping unlabeled items using *k*-means clustering, Association analysis with the Apriori algorithm, efficiently finding frequent itemsets with FP-growth. Unit-4 Reinforcement learning: Markov decision process (MDP), Bellman equations, Value iteration and policy iteration, Linear quadratic regulation, Linear Quadratic Gaussian, Q-learning, Value function approximation, Policy search, Reinforce, POMDPs. Unit-5 Dimensionality reduction: Feature extraction - Principal component analysis, Singular value decomposition. Feature selection – feature ranking and subset selection, filter, wrapper and embedded methods. Machine Learning for Big data: Big Data and MapReduce.		
Course Assessment	Continuous Evaluation 25% Mid Semester 25% End Semester 50%		

Course no: CSL 463	Open course (YES/NO)	HM Course (Y/N)	DC (Y/N)	DE (Y/N)
Type of course	PE			
Course Title	COMPUTER VISION			
Course Coordinator				
Course objectives:	This course aims to provide students with a basic understanding of the fundamentals and applications computer vision techniques including 2D and 3D paradigms to solve real world applications.			
POs	At the end of the course students will be able to: ● understand the image formation process ● design and implement algorithms to perform image processing and feature extraction. ● design and implement algorithms for image segmentation.			

	● design and implement algorithms for representation of shape ● understand the basic techniques and issues in 3-D computer vision. design and build a real computer vision-based system				
Semester	**Autumn:**		**Spring**		
VII/VIII	**Lecture**	**Tutorial**	**Practical**	**Credits**	**Total Teaching Hours**
Contact Hours	3	0	0	3	36
Prerequisite course code as per proposed course numbers					
Prerequisite credits					
Equivalent course codes as per proposed course and old course					
Overlap course codes as per proposed course numbers					
Text Books:					
1.	Title	Digital Image Processing			
	Author	R.C. Gonzalez, R.E Woods			
	Publisher	Pearson Education			
	Edition	3rd Edition, 2008			
Reference Book:					
2.	Title	Computer Vision: A Modern Approach			
	Author	D. A. Forsyth, J. Ponce			
	Publisher	Prentice Hall			
	Edition	2nd Edition, 2011			
3.	Title	Digital Image Processing and Computer Vision			
	Author	R. J. Schalkoff			
	Publisher	John Wiley & Sons Australia			
	Edition	1989			
4.	Title	Computer Vision			
	Author	L. Shapiro, G. Stockman			
	Publisher	Prentice-Hall			
	Edition	2001			
5.	Title	Introductory Techniques for 3D Computer Vision			
	Author	E. Trucco, A. Verri			
	Publisher	Prentice Hall			
	Edition	1998			

Content	Unit-1 Image Formation Models: Monocular imaging system, Orthographic & Perspective Projection, Cameras – lenses, projections, sensors, Representation – color spaces, Camera model and Camera calibration, Binocular imaging systems, Sources, Shadows and Shading. Unit-2 2D/3D Vision: Filters, Binary Images, Features, Edge Detection, Texture, Shape, Segmentation, Clustering, Model Fitting, Probabilistic Models, 3D Vision: Multi view geometry, Stereo, Shape from X, 3D data.

	Unit-3 Image Processing and Feature Extraction: Image representations (continuous and discrete), Linear Filters, Texture, Edge detection. Motion Estimation: Regularization theory, Optical computation, Stereo Vision, Motion estimation, Structure from motion. Unit-4 Shape Representation and Segmentation: Deformable curves and surfaces, Snakes and active contours, Level set representations, Fourier and wavelet descriptors, Medial representations, Multi-resolution analysis. Object recognition: Hough transforms and other simple object recognition methods, Shape correspondence and shape matching, Principal Component analysis, Shape priors for recognition Unit-5 Latest trends in computer vision: Computer Vision Interaction For People With Severe Movement Restrictions, DARWIN: A Framework for Machine Learning and Computer Vision Research and Development, Computer Vision Face Tracking For Use in a Perceptual User Interface.
Course Assessment	Continuous Evaluation 25% Mid Semester 25% End Semester 50%

Course no: CSB 273	Open course (YES/NO)	HM Course (Y/N)	DC (Y/N)	DE (Y/N)	
	No	No	No	Yes	
Type of course	PE				
Course Title	OBJECT ORIENTED PROGRAMMING				
Course Coordinator					
Course objectives:	Understand object oriented programming and advanced C++ concepts. Be able to explain the difference between object oriented programming and procedural programming. Be able to program using more advanced C++ features such as composition of objects, operator overloads, dynamic memory allocation, inheritance and polymorphism, file I/O, exception handling, etc. Be able to build C++ classes using appropriate encapsulation and design principles. Improve your problem solving skills® Be able to apply object oriented or non-object oriented techniques to solve® bigger computing problems.				
POs	At the end of the course student will be able ● to prepare object-oriented design for small/medium scale problems , to demonstrate the differences between traditional imperative design and object-oriented design ● to explain class structures as fundamental, modular building blocks, to understand the role of inheritance, polymorphism, dynamic binding and generic structures in building reusable code to write small/medium scale C++ programs with simple graphical user interface and to use classes written by other programmers when constructing their systems .				

Semester	Autumn:		Spring		
VI	Lecture	Tutorial	Practical	Credits	Total contact Hours
Contact Hours	2	0	2	3	24
Prerequisite course code as per proposed course numbers					
Prerequisite credits					
Equivalent course codes as per proposed course and old course					
Overlap course codes as per proposed course numbers					

Text Books:

1	Title	Object Oriented Programming with C++
	Author	E. Balagurusamy
	Publisher	Mc Graw Hill
	Edition	5th edition

Reference Book:

2	Title	Object Oriented Programming in Turbo C++
	Author	Robert Lafore
	Publisher	Sams Publishing
	Edition	4th edition
3.	Title	The C++ Programming language

		Author	B. Stroustrup
		Publisher	Pearson Education
		Edition	Third edition, 2004
4.		Title	Object Oriented Programming using C++
		Author	Ira Pohl
		Publisher	Pearson Education
		Edition	Second Edition Reprint 2004
Content	Unit-1 Introduction to C++ and Object oriented Concepts (7 hrs) Introduction to Objects and Object Oriented Programming, Encapsulation (Information Hiding), Access Modifiers: Controlling access to a class, method, or variable (public, protected, private, package), Other Modifiers, Polymorphism: Overloading, Inheritance, Overriding Methods, Abstract Classes, Reusability, Class's Behaviors. Basics of a Typical C++ Environment, Pre-processors Directives, illustrative Simple C++ Programs. Header Files and Namespaces, library files Unit-2 Classes and Data Abstraction (8 hrs) Introduction, Structure Definitions, Accessing Members of Structures, Class Scope and accessing Class Members, Separating Interface from Implementation, Controlling Access Function And Utility Functions, Initializing Class Objects: Constructors, Using Default Arguments With Constructors, Using Destructors, Classes : Const(Constant) Object And Const Member Functions, Object as Member of Classes, Friend Function and Friend Classes, Using This Pointer, Dynamic Memory Allocation with New and Delete, Static Class Members, Container Classes And Integrators, Proxy Classes, Function overloading. Unit-3 Operator Overloading and Inheritance (8 hrs) Fundamentals of Operator Overloading, Restrictions On Operators Overloading, Operator Functions as Class Members vs. as Friend Functions, Overloading, Overloading Unary Operators, Overloading Binary Operators. Introduction to Inheritance, Base Classes And Derived Classes, Protected Members, Casting Base-Class Pointers to Derived- Class Pointers, Using Member Functions, Overriding Base – Class Members in a Derived Class, Public, Protected and Private Inheritance Unit-4 Virtual Functions, Polymorphism, files and I/O stream(6 hrs) Introduction to Virtual Functions, Abstract Base Classes And Concrete Classes, virtual base class, Polymorphism, pure virtual functions. Streams and formatted I/O, I/O manipulators , file handling, random access, object serialization, namespaces, std namespace, ANSI String Objects , standard template library. Unit-5 Templates and Exception Handling (7 hrs) Function Templates, Overloading Template Functions, Class Template, Class Templates and Non-Type Parameters. Basics of C++ Exception Handling: Try Throw, Catch, Throwing an Exception, Catching an Exception, Rethrowing an Exception, Exception specifications, Processing Unexpected Exceptions, Stack Unwinding, Constructors, Destructors and Exception Handling, Exceptions and Inheritance.
Course Assessment	Continuous Evaluation 25% Mid Semester 25% End Semester 50%

Course no: CSL 481	Open course (YES/NO)	HM Course (Y/N)	DC (Y/N)	DE (Y/N)
Type of course	PE			
Course Title	BIOMEDICAL IMAGE PROCESSING			
Course Coordinator				
Course objectives:	This course aims to provide students with broad theoretical and practical skills in biomedical image processing, including skills relevant to general image processing. The fundamentals of computational medical image processing will be explored, starting from basic acquisition and leading to current trends in applying geometry and statistics to segmentation, registration, visualization, and image understanding.			
POs	At the end of the course students will be able to · explain the basic principles and medical applications of the major biomedical imaging techniques · design and implement programs to enhance / denoise biomedical images, segment them into meaningful parts · design and implement programs to extract meaningful information from biomedical image data for various medical applications			

Semester	Autumn:		Spring		
VII/VIII	Lecture	Tutorial	Practical	Credits	Total Teaching Hours
Contact Hours	3	0	0	3	36
Prerequisite course code as per proposed course numbers					
Prerequisite credits					
Equivalent course codes as per proposed course and old course					
Overlap course codes as per proposed course numbers					

Text Books:		
1.	Title	Fundamentals of Medical Imaging
	Author	P. Suetens
	Publisher	Cambridge University Press
	Edition	2nd edition, 2009

Reference Book:		
2.	Title	Introduction to Biomedical Imaging
	Author	A.G. Webb
	Publisher	Wiley-IEEE Press
	Edition	2002
3.	Title	Biosignal and Medical Image Processing

		Author	J.L. Semmlow, B. Griffel
		Publisher	CRC Press
		Edition	3rd Edition, 2014

		Title	Handbook of Medical Image Processing and Analysis
4.		Author	I. Bankman
		Publisher	Academic Press Inc
		Edition	2nd Edition, 2008.
5.		Title	Digital Image Processing
		Author	R.C. Gonzalez, R.E Woods
		Publisher	Pearson Education
		Edition	3rd Edition, 2008
Content	Unit-1 Introduction to digital Image Processing - images, image quality and basic operations. Introduction to biomedical images. Fundamentals and principles of acquisition of various modalities of biomedical images - ultrasound, X-ray, computed tomography (CT), magnetic resonance imaging (MRI), nuclear imaging. Unit-2 Image characteristics: spatial resolution, signal-to-noise ratio, contrast-to-noise ratio, image filtering, receiver operating curve. Unit-3 Image Processing: 2-D Fourier Transform, Linear filtering, Spatial transformations, Image Registration. Wavelet Analysis: Continuous wavelet transform, Discrete wavelet transform, Feature detection – wavelet packets. Unit-4 Image Segmentation: Pixel-based methods, Continuity-based methods, Multithresholding, Morphological operations, Edge-based segmentation. Unit-5 Multivariate Analysis: Principal Component Analysis, Independent Component Analysis. Biomedical image analysis: Manual and automated analysis, computation strategies for automated medical image analysis, pixel classification.		
Course Assessment	Continuous Evaluation 25% Mid Semester 25% End Semester 50%		

Course no: CSL 363	Open course (YES/NO)	HM Course (Y/N)	DC (Y/N)	DE (Y/N)
Type of course	PE			
Course Title	GRAPH THEORY AND COMBINATORICS			
Course Coordinator				
Course objectives:	The course aims to - provide students with basic knowledge about graphs, their properties and applications as models of networks - formulate problems in terms of graphs, solve problems, and apply algorithms - be familiar with a wide variety of graph theoretic ideas, notation, algorithms, and useful proof techniques			
POs	At the end of the course student will be able to - develop problem solving skills in the field of graph - apply pigeonhole principle and rules for counting, permutations, and combinations problems			

Semester	**Autumn:**		**Spring**		
V	**Lecture**	**Tutorial**	**Practical**	**Credits**	**Total Teaching Hours**
Contact Hours	3	0	0	3	36
Prerequisite course code as per proposed course numbers					
Prerequisite credits					
Equivalent course codes as per proposed course and old course					
Overlap course codes as per proposed course numbers					

Text Books:

1.	Title	An Introduction to Computational Combinatorics
	Author	E. S. Page, L. B. Wilson
	Publisher	Cambridge University Press
	Edition	1979

Reference Book:

2.	Title	Concrete Mathematics
	Author	D. E. Knuth, O. Patashuk, R. L. Graham
	Publisher	Addison-Wesley
	Edition	1994
3.	Title	Discrete and Combinatorial Mathematics
	Author	R. P. Grimaldi
	Publisher	Addison Wesley
	Edition	1998
4.	Title	Enumerative Combinatorics
	Author	R. P. Stanley
	Publisher	Cambridge University Press
	Edition	2001

5.		Title	Combinatorics: Topics, Techniques and Algorithms
		Author	P. J. Cameron
		Publisher	Cambridge University Press
		Edition	1995
6		Title	Graph Theory
		Author	Narsingh Deo
		Publisher	PHI
		Edition	1979
Content	Unit-1 Permutations and Combinations - Distribution of distinct / non-distinct objects - Generating functions for combinations - Portion of integers - Ferrers graph. Unit-2 Recurrence Relations - Linear recurrence relations with constant coefficients - Solution by the technique of generating functions - Permutations with restrictions on relative positions. Unit-3 Basic Definitions - Trees and fundamental circuits - Cut-sets and Cut-vertices - Connectivity and Separability - Network flows - 1 and 2 isomorphism. Unit-4 Planar and Dual Graphs - Kuratowski's graphs - Representations of a planar graph - Vector space associated with a graph - Subspaces - Orthogonal vectors and spaces. Unit-5 Matrix Representation of Graphs - Circuit matrix - Cutset matrix - Path matrix - Adjacency matrix - Coloring problems - Algorithms for fundamental circuits, cut vertices and separability.		
Course Assessment	Continuous Evaluation 25% Mid Semester 25% End Semester 50%		

Course no: CSL 480	Open course (YES/NO)	HM Course (Y/N)	DC (Y/N)	DE (Y/N)
Type of course	PE			
Course Title	BIO-INFORMATICS			
Course Coordinator				
Course objectives:	The unprecedented increase in the amount of available biological data ranging from protein sequences to biomedical images have rendered the use of computers and computational techniques for analysing and managing the biological data inevitable. This course aims to provide students with the basics of bioinformatics algorithms that have been applied over various types of biological data.			
POs	At the end of the course students will be able to ● have a basic knowledge of modern molecular biology and genomics ● design and implement computer science algorithms to solve biological problems			

Semester	Autumn:		Spring		
VII/VIII	**Lecture**	**Tutorial**	**Practical**	**Credits**	**Total Teaching Hours**
Contact Hours	3	0	0	3	36
Prerequisite course code as per proposed course numbers					
Prerequisite credits					
Equivalent course codes as per proposed course and old course					
Overlap course codes as per proposed course numbers					

Text Books:

1.	Title	An Introduction to Bioinformatics Algorithms
	Author	N.C. Jones, P.A. Pevzner
	Publisher	MIT Press
	Edition	2004

Reference Book:

2.	Title	Introduction to Bioinformatics
	Author	T. Attwood, D. Parry-Smith
	Publisher	Prentice Hall
	Edition	1999
3.	Title	Biological Sequence Analysis
	Author	R. Durbin, S. Eddy, A. Krogh, G. Mitchison
	Publisher	Cambridge University Press

		Edition	1998

4.		Title	Trees and Sequences
		Author	D. Gusfield, Algorithms on Strings
		Publisher	Cambridge University Press
		Edition	1997
5		Title	Bioinformatics- Genes, Proteins and Computers
		Author	C.A. Orengo, D.T. Jones, J.M. Thornton
		Publisher	BIOS Scientific Publishers
		Edition	2003
Content	Unit-1 Basics: Basics of Biology Unit-2 Sequences: Problem statement, Edit distance and substitution matrices, HMMs and pairwise HMMs, Global and local alignments, Spliced alignment, Space-efficient sequence alignment, Multiple alignment, Database searching tools, Sequence by hybridization, Profile HMMs Unit-3 Structures: Protein structure alignment, Protein Structure Prediction: Methods for predicting the secondary and tertiary structure of proteins. Techniques: neural networks, SVMs, genetic algorithms and stochastic global optimization. Unit-4 Transcriptomics: Methods for 141nalyzing gene expression and microarray data. Techniques: clustering, SVMs. Agent-based Genome Analysis: Automation of genome analysis using intelligent software agents. Drug Discovery Informatics: Approaches to drug discovery using bioinformatics techniques Unit-5 Phylogenetic trees: Large parsimony and small parsimony problems, Probabilistic approaches, Grammar-based approaches. Miscellaneous topics: Pathways and networks, Microarrays, Biomedical images		
Course Assessme nt	Continuous Evaluation 25% Mid Semester 25% End Semester 50%		

Course no: CSL 478	Open course (YES/NO)	HM Course (Y/N)	DC (Y/N)	DE (Y/N)
Type of course	PE			
Course Title	**Multi Agent Systems**			
Course Coordinator				
Course objectives:				
Pos				

Semester	Autumn:		Spring		
VII/VIII	**Lecture**	**Tutorial**	**Practical**	**Credits**	**Total Teaching Hours**
Contact Hours	3	0	0	3	36
Prerequisite course code as per proposed course numbers					
Prerequisite credits					
Equivalent course codes as per proposed course and old course					
Overlap course codes as per proposed course numbers					

Text Books:

1.		Title	Multiagent Systems: Algorithmic, Game-Theoretic,and Logical Foundations
		Author	Shoham, Y. and K. Leyton Brown
		Publisher	Cambridge University Press
		Edition	2011

Reference Book:

2.		Title	An Introduction to Multi-agent systems
		Author	M. Wooldrige
		Publisher	Wiley
		Edition	2009

Content	Unit-1
	Introduction to agent and multi-agent systems, Applications, Environments, Events, Actions. Different types of agents, Intelligent Autonomous Agents , Agents and Expert Systems.

Unit-2
Distributed Constraint Satisfaction: Defining distributed constraint satisfaction problems, Domain-pruning algorithms, Heuristic search algorithms- Asynchronous backtracking algorithm, Four queens problem.

Unit-3
Communication and Cooperation: Ontology Fundamentals, Ontology Languages, XML, OWL. Agent Communication Languages, KQML , FIPA, JADE. Cooperative Distributed Problem Solving , Task Sharing and Result Sharing , |

	Combining Task and Result Sharing ,
	Unit-4 Coordination - Coordination through partial global planning , Coordination through joint intentions , Coordination by mutual modelling , Coordination by norms and social laws , Multiagent Planning and Synchronization . Unit-5 **Decision Making:** Multiagent Interactions-Utilities and Preferences ,Dominant Strategies,Nash Equilibria,Pareto Efficiency,Competitive and Zero-Sum Interactions., Making Group Decisions- Voting Procedures , Plurality , Arrow's Theorem , Coalitions-Cooperative Games, Coalitional Games with Goals, Coalition Structure Formation.
Course Assessment	Continuous Evaluation 25% Mid Semester 25% End Semester 50%

Course no: CSL 274	Open course (YES/NO)	HM Course (Y/N)	DC (Y/N)	DE (Y/N)
Type of course	PE			
Course Title	WEB PROGRAMMING			
Course Coordinator				
Course objectives:	This course will introduce students to base material needed to create and deploy secure, usable database driven web applications including topics selected from programming, networking, database, security and usability. Technologies and languages like HTML,Javascript, Document Object Model(DOM), PHP, MySQL, Ruby on Rails, XML, Ajax and Flash will be covered in syllabus.			
POs	At the end of the course students will be able to ● create dynamic web documents and implement and execute program scripts ● setup and administer database servers ● implement an appropriate planning strategy for developing websites ● locate, evaluate and critically assess current & emerging technologies for developing websites use current techniques, skills, and tools appropriate for immediate employment in computing technology and application fields			

Semester	Autumn:		Spring		
IV	Lecture	Tutorial	Practical	Credits	Total Teaching Hours
Contact Hours	2	0	2	3	24
Prerequisite course code as per proposed course numbers					
Prerequisite credits					
Equivalent course codes as per proposed course and old course					
Overlap course codes as per proposed course numbers					

Text Books:

1.	Title	Programming Ruby: The Pragmatic Programmer's Guide
	Author	Dave Thomas, Chad Fowler and Andy Hunt
	Publisher	Pragmatic Programmers
	Edition	3rd Edition, 2008

Reference Book:

2.	Title	Web Application Design and Implementation:Apache2, PHP5, MYSQL, Javascript, and LINUX/UNIX
	Author	Steven A. Gabarro

		Publisher	John Wiley and Sons
		Edition	2006
3.		Title	Web Protocols and Practice: HTTP/1.1, Networking Protocols, Caching, and Traffic Measurement
		Author	Balachander Krishnamurthy and Jennifer Rexford
		Publisher	Addison Wesley Professional
		Edition	1st Edition, 2001
4.		Title	Programming the World Wide Web
		Author	R. W. Sebesta
		Publisher	Addison Wesley
		Edition	7th Edition, 2013
5.		Title	Web Application Design and Implementation:Apache2, PHP5, MYSQL, Javascript, and LINUX/UNIX
		Author	Steven A. Gabarro
		Publisher	John Wiley and Sons
		Edition	2006
Content	Unit-1 Web fundamentals, Programming Languages for Web, Internet and its architecture, Client Server Networking – Creating an Internet Client, Application Protocols and http,Presentation aspects html, CSS and Javascript Unit-2 Javascript Event driven Programming, Creating a web server, Serving Dynamic Content- CGI – overview of technologies like PHP – applets – JSP. Implementation examples. Unit-3 Web server architecture, Programming threads in C, Shared memory synchronization, Performance measurement and workload models. Comparison using existing benchmarks Unit-4 Web development frameworks – Detailed study of one open source web framework – Ruby Scripting, Ruby on rails –Design, Implementation and Maintenance aspects. Unit-5 Service Oriented Architecture – SOAP. Web 2.0 technologies. – AJAX. Development using Web2.0 technologies, Introduction to semantic web.		
Course Assessment	Continuous Evaluation 25% Mid Semester 25% End Semester 50%		

Course no: CSL 476	Open course (YES/NO)	HM Course (Y/N)	DC (Y/N)	DE (Y/N)
Type of course	PE			
Course Title	Information Theory and Coding			
Course Coordinator				
Course objectives:	This course covers information theory and coding within the context of modern digital communications applications. Main objective is to understand the fundamental limits of communication systems. Information theoretic concepts underlie virtually all modern communication systems, and some exposure to information theory is definitely required for students who want to pursue research in communications			
Pos	At the end of the course student will be able to ● evaluate the information rate of various information sources ● select and design simple convolutional codes ● evaluate the information capacity of discrete memoryless channels and determine possible code rates to achievable on such channels ● design lossless data compression codes for discrete memoryless sources ● understand information theoretic security issues			

Semester	Autumn:		Spring		
VII/VIII	**Lecture**	**Tutorial**	**Practical**	**Credits**	**Total Teaching Hours**
Contact Hours	3	0	0	3	36
Prerequisite course code as per proposed course numbers					
Prerequisite credits					
Equivalent course codes as per proposed course and old course					
Overlap course codes as per proposed course numbers					

Text Books:

1.	Title	Elements of Information Theory
	Author	T. M. Cover and J. A. Thomas
	Publisher	Wiley-Interscience
	Edition	2nd Edition, 2006

Reference Book:

2.	Title	Information Theory, Inference and Learning Algorithms
	Author	D. J. Mackay
	Publisher	Cambridge University Press

3.		Title	Error Control Coding
		Author	Shu Lin, Daniel J Costello
		Publisher	Pearson
		Edition	2nd Edition, 2011

4.		Title	Introduction to Cryptography
		Author	H. Delfs and H. Knebl
		Publisher	Springer
		Edition	2nd Edition, 2010
5.		Title	Information-Spectrum Methods in Information Theory
		Author	T. S. Han,
		Publisher	Springer
		Edition	2002
6.		Title	Introduction to Data Compression
		Author	K Sayood
		Publisher	Elsevier
		Edition	3rd Edition, 2006
Content			

Unit-1
Probability Theory Review, Entropy, Mutual Information, Random Sources, Stochastic Process, Markov Sources, Discrete Finite State Stationary Markov Sources, Entropy Rate, Conditional Entropy

Unit-2
Asymptotic Equipartition Principle, Data Compression,Prefix and Uniquely Decodable Codes, Kraft's and Macmillan's Inequalities , Shannon's Source Coding Theorem, Shannon Codes, Shannon-Fano-Elias Codes, Huffman Codes, Optimality of Huffman Code

Unit-3
Arithmetic Coding, Lempel Ziv Coding, Optimality for Stationary Ergodic Sources, BSC and BEC Channel Models, Channel Capacity, Shannon's Channel Coding Theorem, Achievability in Channel Coding Theorem, Fano's Inequality, Converse to The Coding Theorem

Unit-4
Differential Entropy, Gaussian Channel, Joint and Conditional Differential Entropy, Rate-Distortion Theory, Rate-Distortion Function, Rate-Distortion Codes, Rate-Distortion Theorem, Converse To The Rate-Distortion Theorem,

	Slepian-Wolf Coding
	Unit-5 Information Theoretic Security, Perfect Secrecy, Shannon's Theorem, Perfectly Secret Codes, Introduction to Computational Security and Pseudo Random Sources
Course Assessment	Continuous Evaluation 25% Mid Semester 25% End Semester 50%

Course no: CSL 362	Open course (YES/NO)	HM Course (Y/N)	DC (Y/N)	DE (Y/N)
Type of course	PE			
Course Title	Middleware Technologies			
Course Coordinator				
Course objectives:	The main objective of the course is to create a practical, wide-ranging discussion on Middleware Technologies to help students understand what is going on so they can pick out the real issues from the imaginary issues and start building complex systems with confidence.			
POs	On completion of the course the student will:			

		• Thoroughly, individually, describe the most important aspects when using middleware technologies • Be able to, in group, develop a component-based application based on middleware technology • Individually, in detail describe differences and similarities in different middleware platforms				
Semester		**Autumn:**		**Spring**		
V		**Lecture**	**Tutorial**	**Practical**	**Credits**	**Total Teaching Hours**
Contact Hours		3	0	0	3	36
Prerequisite course code as per proposed course numbers						
Prerequisite credits						
Equivalent course codes as per proposed course and old course						
Overlap course codes as per proposed course numbers						
Text Books:						
1.		Title	IT Architectures and Middleware			
		Author	Chris Britton and Peter Bye			
		Publisher	Pearson Education			
		Edition	2nd Edition, 2005			
Reference Book:						
2.		Title	Distributed Event Based Systems			
		Author	Gero Muhl, Ludger Fiege, Peter R. Pietzuch			
		Publisher	Springer			
		Edition	2006			
3.		Title	Query Processing for High-Volume XML Message Brokering			
		Author	Yanlei Diao, and Michael J. Franklin			
		Publisher	VLDB			
		Edition	2003			
4.		Title	RE-Tree: An Efficient Index Structure for Regular Expressions			
		Author	Chee-Yong Chan, Minos Garofalakis and Rajeev Rastogi			
		Publisher	VLDB			
		Edition	2002			
5.		Title	A Framework for Event Composition in Distributed Systems			
		Author	Peter R. Pietzuch, Brian Shand, Jean Bacon			
		Publisher	Proc. of the 4th Int. Conf. on Middleware (MW'03)			
		Edition	2003			
Content	Unit-1 Publish/Subscribe matching algorithm, event based systems, notification filtering mechanisms, Composite event processing, content based routing, content based models and matching, matching algorithms, distributed hash tables (DHT) Unit-2 Distributed notification routing, content based routing algorithms, engineering						

	event based systems, Accessing publish/subscribe functionality using APIs.
	Unit-3 Scoping, event based systems with scopes, notification mappings, transmission policies, implementation strategies for scoping. Unit-4 Composite event detection, detection architectures, security, fault tolerance, congestion control, mobility, existing notification standards- JMS, DDS, HLA. Unit-5 Topic based systems, Overlays, P2P systems, overlay routing, Case studies- REBECA, HERMES, Gryphon. Commercial systems- IBM Websphere MQ, TIBCO Rendezvous.
Course Assessment	Continuous Evaluation 25% Mid Semester 25% End Semester 50%

Course no: CSL 366	Open course (YES/NO)		HM Course (Y/N)	DC (Y/N)	DE (Y/N)
	NO		NO	NO	NO
Type of course	**PE**				
Course Title	**ARCHITECTURAL AND DESIGN PATTERNS**				
Course Coordinator					
Course objectives:	This course aims to provide the students with the knowledge of architectural and design patterns that can enable to create large-scale applications and solve recurring design problems by the help of Object-Oriented Software Architecture				
POs					

Semester	Autumn:		Spring:		
V	**Lecture**	**Tutorial**	**Practical**	**Credits**	**Total teaching hours**
Contact Hours	3	0	0	3	36
Prerequisite course code as per proposed course numbers					
Prerequisite credits					
Equivalent course codes as per proposed course and old course					
Overlap course codes as per proposed course numbers					

Text Books:			
1		Title	Pattern-Oriented SoftwareArchitecture - A System of Patterns
		Author	Frank Buschmann, Regine Meunier, Hans Rohnert, Peter Sommerlad, Michael Stal
		Publisher	Wiley
		Edition	First edition
2		Title	Design Patterns: Elements of Reusable Object-Oriented Software
		Author	Erich Gamma, Richard Helm, Ralph Johnson, John Vlissides
		Publisher	Pearson Education
		Edition	First edition

Reference Book:			
1		Title	
		Author	
		Publisher	
		Edition	

Content	**Unit** – 1 (5 Hours) Patterns: What is a Pattern?, What Makes a Pattern?, Pattern Categories, Relationships between Patterns, Pattern Description.

	Unit – 2 (8 Hours) Architectural Patterns: Introduction, From Mud to Structure, Layers, Pipes and Filters, Blackboard, Distributed Systems, Broker, Interactive Systems, Model-View-Controller, Presentation-Abstraction-Control, Adaptable Systems, Microkernel, Reflection **Unit** – 3 (8 Hours) Design Patterns: Introduction, The Catalog of Design Patterns, Organizing the Catalog,How Design Patterns Solve Design Problems, How to Select a Design, How to Use a Design Pattern, Creational Patterns, Structural Patterns, Behavioral Patterns **Unit** – 4 (8 Hours) Design Patterns: Structural Decomposition, Whole-Part, Organization of Work, Management, Command Processor, View Handler, Communication, Forwarder-Receiver, Client-Dispatcher-Server, Publisher-Subscriber **Unit** – 5 (7 Hours) A Case Study: Designing a Document Editor, Design Problems, Document Structure, Formatting, Embellishing the User Interface, Supporting Multiple Look-and-Feel Standards, Supporting Multiple Window, User Operations, Spelling Checking and Hyphenation
Course Assessment	Continuous Evaluation 25% Mid Semester 25% End Semester 50%

Course no: CSB 401	Open course (YES/NO)		HM Course (Y/N)	DC (Y/N)	DE (Y/N)
	NO		NO	NO	NO
Type of course	Core				
Course Title	THEORY OF APP DEVELOPMENT				
Course Coordinator					
Course objectives:	Today's applications are increasingly mobile. Computers are no longer confined to desks and laps butinstead live in our pockets and hands. This course teaches students how to build mobile apps for Android and iOS mobile operating platforms.				
POs					

Semester		Autumn: Yes		Spring:		
VI	Lecture	Tutorial		Practical	Credits	Total teaching hours
Contact Hours	2	0		3	4	24
Prerequisite course code as per proposed course numbers	CSB 101 CSB 271 CSB 273					
Prerequisite credits						
Equivalent course codes as per proposed course and old course						
Overlap course codes as per proposed course numbers						

Text Books:			
1	Title	Android App Development for Dummies	
	Author	Michael Burton	
	Publisher	Wiley	
	Edition	Third edition	
2	Title	IOS App Development for Dummies	
	Author	Jesse Feiler	
	Publisher	Wiley	
	Edition	First edition	
3	Title	Android Application Development - Black Book	
	Author	Pradeep Kothari	
	Publisher	Dreamtech Press	
	Edition	First edition	
Reference Book:			
1	Title	Android Programming: The Big Nerd Ranch Guide	
	Author	Bill Phillips and Brian Hardy	
	Publisher	Big Nerd Ranch Guides	

		Edition	Second edition
2		Title	iOS Programming: The Big Nerd Ranch Guide
		Author	Christian Keur and Aaron Hillegass
		Publisher	Big Nerd Ranch Guides
		Edition	Fifth edition
Content	**Unit** – 1 (4 Hours) Fundamentals of Java for Android Application Development, Overview of Android, Developing Spectacular Android Applications, Your First Android Project, Using Activities, Fragments and Intents in Android, Creating the User Interface, Coding Your Application, Understanding Android Resources, Turning Your Application into an App Widget **Unit** – 2 (5 Hours) Designing the Tasks Application, Creating the Task Detail Page, Handling User Input, Getting Persistent with Data Storage, Updating Status Bar, Handling Pictures and Menus with Views, Emailing and Networking in Android, Working with Location Services and Maps, Working with Graphics and Animation, Audio, Video and Camera **Unit** – 3 (5 Hours) Reminding the User, Working with Android Preferences, Developing for Tablets, Supporting Older Versions of Android. Publishing Your App to the Google Play Store, Monetizing and Distributing Android Applications. Bluetooth, NFC, and Wi-Fi, Telephony and SMS, Hardware Sensors **Unit** – 4 (5 Hours) Introduction, Creating the RoadTrip User Interface, The Runtime, Managing Memory, and Using Properties, Working with the Source Editor, Adding Outlets and Actions to Your RoadTrip Code, Adding Animation and Sound to Your App, **Unit** – 5 (5 Hours) The Trip Model, Implementing the Master View Controller, Working with Split View Controllers and the Master View, Finishing the Basic App Structure, Working with Web Views, Displaying Events Using a Page View Controller, Finding Your Way, Geocoding, Finding a Location, Selecting a Destination		
Course Assessment	Theory: Continuous Evaluation 25% Mid Semester 25% End Semester 50% Lab: Continuous Evaluation 50% End Semester 50% 40% weightage to theory and 60 % weightage to laboratory for overall grading		

Course no: CSL 471	Open course (YES/NO)		HM Course (Y/N)	DC (Y/N)	DE (Y/N)	
Type of course	**PE**					
Course Title	**Next Generation Networks**					
Course Coordinator						
Course objectives:	The objective of this course is to familiarize the students to area of next generation networks (NGN) and introduce them to the basic concepts related to NGN such as their architecture, applications, challenges and opportunities.					
POs						
Semester	**Autumn: Yes**			**Spring:**		
VII/VIII	**Lecture**	**Tutorial**		**Practical**	**Credits**	**Total teaching hours**
Contact Hours	3	0			3	36
Prerequisite course code as per proposed course numbers	Computer Networks					
Prerequisite credits	NIL					
Equivalent course codes as per proposed course and old course	NIL					
Overlap course codes as per proposed course numbers	NIL					

Text Books:

1		Title	Next generation Telecommunication Networks, Services and Management
		Author	Edited by Thomas Plevyak, Veli Sahin
		Publisher	Wiley & IEEE Press Publications
		Edition	2012

Reference Book:

1		Title	Next Generation Network Services
		Author	Neill Wilkinson
		Publisher	John Wiley Publications
		Edition	2002
2		Title	Next Generation Networks
		Author	Monique J. Morrow
		Publisher	CISCO Press
		Edition	2007
3		Title	Next Generation Networks: Perspectives and Potentials

	Author	Jingming Li Salina, Pascal Salina
	Publisher	John Wiley Publications
	Edition	2008

Content	**UNIT I** (6 Hrs.) Convergence: what is convergence and why is it possible now? Network convergence, service convergence, device convergence, convergence in content. From technology push to service pull. Introduction to Next Generation Networks (NGN): what is NGN? Evolution trends in ICT network platform towards NGN. Difference between existing telecommunication environment and next generation converged environment. Factors motivating NGN: economic, technological and social. Building blocks for NGN. NGN services, challenges, opportunities. NGN applications: Internet connectivity, e-commerce, call center, third party application service provision, integrated billing, security and directory enable networks. **UNIT II** (13 Hrs.) NGN: numbering, naming and addressing. Conceptual model for NGN: access layer, transport layer, control layer, service layer. NGN architecture: softswitch based, IMS based and TISPAN. IMS architecture: nodes, S-CSCF, P-CSCF, I-CSCF, application servers, BGCF, PSTN/CS gateway, media resource functions. IMS advantages. NGN protocol stack: fundamental protocols: SIP, SDP, AAA, RTP, RTCP, Megaco/H.248. Supporting protocols: XCAP, SOAP. Fixed mobile convergence (FMC). Convergence using IMS- a case study. IMS based NGN IPTV architecture. **UNIT III** (10 Hrs.) Next generation access network: wireline: fiber to the premises (FTTP), long-haul managed Ethernet. Broadband wireless access: Local area network (Wi-Fi), Wide area network (WiMAX), satellite networks, and mobile networks: 3G, 4G, LTE, and 5G. Next generation core network: role of core network, enabling control and reconfigurability. VoIP: principles, how telephony is provided over IP network, various VoIP scenarios. **UNIT IV** (7 Hrs.) NGN management and provisioning- configuration, accounting, performance and security. Future enhancements- adaptive self healing networks. Software defined networking (SDN): basic concepts, SDN software stack. Applications: network virtualization, data-center traffic management, wide area traffic management. SDN systems challenges: scalability, security, fault tolerance. Future of SDN.
Course Assessment	Continuous Evaluation 25%
	Mid Semester 25%
	End Semester 50%

Course no: CSL 372	Open course (YES/NO)		HM Course (Y/N)	DC (Y/N)	DE (Y/N)
Type of course	PE				
Course Title	Concurrent and Parallel Programming				
Course Coordinator					
Course objectives:	The objective of this course is to provide the principles for designing /developing parallel/concurrent programs and evaluating their performance. To this end, the course will first introduce high performance architectures and will afterwards focus on methodologies for the development of parallel and concurrent programs.				
POs					

Semester	**Autumn:**		**Spring**		
VI	**Lecture**	**Tutorial**	**Practical**	**Credits**	**Total Teaching Hours**
Contact Hours	3	0	0	3	36
Prerequisite course code as per proposed course numbers					
Prerequisite credits					
Equivalent course codes as per proposed course and old course					
Overlap course codes as per proposed course numbers					

Text Books:

1.	Title	Foundations of Multithreaded, Parallel, and Distributed Programming
	Author	G. R. Andrews
	Publisher	Addison Wesley
	Edition	2000

Reference Book:

2.	Title	Introduction to Parallel Computing
	Author	A. Grama, A. Gupta, G. Karypis, V. Kumar
	Publisher	Addison Wesley
	Edition	Second edition, 2003
3.	Title	The Art of Multiprocessor Programming
	Author	M. Herlihy and N. Shavit
	Publisher	Morgan Kauffman
	Edition	2012
4.	Title	Concurrent Programming: Principles and Practice
	Author	G. R. Andrews
	Publisher	Pearson
	Edition	1991
5.	Title	An Introduction to Parallel Programming
	Author	Peter Pacheco
	Publisher	Morgan Kauffman
	Edition	2011

Content	Unit-1 The essence of concurrent programming, Hardware architectures, Processes and Synchronization, Locks and Barriers: The critical section problem, Critical section: Spin Locks, Barrier Synchronization, Data Parallel Algorithms Unit-2 Semaphores: Syntax and Semantics, Basic Problems and Techniques, Dining Philosophers, Readers and Writers, Case Study: Pthreads, Monitors: Syntax and Semantics, Synchronization Techniques, Case Study: Pthreads, Locks and Barriers: The critical section problem, Barrier synchronization. Unit-3 Principle of Parallel algorithm design: Preliminaries, Decomposition Techniques, Characteristics of tasks and interactions, Mapping techniques for load balancing, Basic Communication Operations: One-to-All Broadcast and All-to-one Reduction, All-to-All Broadcast and Reduction, Scatter and Gather. Unit-4 Analytical Modeling of Parallel Programs: Sources of overhead in Parallel Programs, Performance metrics of Parallel Systems, Effect of Granularity and Data Mapping on Performance, Scalability of Parallel Systems. Unit-5 Distributed memory programming with MPI: Getting started, Dealing with IO, Collective communication, MPI derived datatypes, Performance evaluation of MPI programs, Shared Memory programming with OpenMP: Getting started, scope of variables, the reduction clause, the parallel for directive, Parallel program development.
Course Assessment	Continuous Evaluation 25% Mid Semester 25% End Semester 50%

Course no: CSL 483	Open course (YES/NO)		HM Course (Y/N)	DC (Y/N)	DE (Y/N)
	NO		NO	NO	NO
Type of course	PE				
Course Title	Wireless Sensor Networks				
Course Coordinator					
Course objectives:	This course aims to cover the basic principles behind a Wireless Sensor Network. It provides a broad coverage of challenges and latest issues related to the design and management of WSN and aspects like hardware and radio architecture, protocols and their applications.				
POs					

Semester		Autumn:		Spring		
VII/VIII		Lecture	Tutorial	Practical	Credits	Total Teaching Hours
Contact Hours		3	0	0	3	36
Prerequisite course code as per proposed course numbers		NIL				
Prerequisite credits		NIL				
Equivalent course codes as per proposed course and old course		NIL				
Overlap course codes as per proposed course numbers		NIL				

Text Books:			
1.		Title	Protocols and Architectures for Wireless Sensor Networks
		Author	Holger Karl and Andreas Wiling
		Publisher	John Wiley & Sons
		Edition	2005

Reference Book:			
1		Title	Wireless Sensor Actuators and Networks
		Author	Roberto Verdone, Davide Dardari, Gianluca Mazzini and Andrea Conti
		Publisher	Academic Press
		Edition	1st Edition, 2008

Content	Unit – 1 (8 Hrs) Introduction to Wireless sensor networks, Node and Network Architecture, Advantages of ad-hoc/sensor networks, Main features of WSANs, Current and future research on WSANs, Operating Systems and Execution Environments, Optimization Goals and Figures of Merit, Gateway Concepts, Application of WSNs. Unit – 2 (7 Hrs)

	Sensor Deployment Mechanisms, Issues of coverage, Node discovery protocols, Localization schemes, Time Synchronization, Network clustering, Query Models, In-network data aggregation, Robust route setup, Coping with energy constraints, QoS Management, Security Unit – 3 (5 Hrs) Technologies for WSNs-ZigBee technology, Ultrawide bandwidth technology, Bluetooth technology, Comparison among technologies Unit – 4(6 Hrs) Wireless Propagation Models: The Free Space Propagation Model, The Two-Ray Ground Model, The Log-Distance Path Model, Energy Dissipation Model, Error Models: The Independent Error Model, The Two-State Markov Error Model, Sensing Models: The Binary Sensing Model, The Probabilistic Sensing Model Unit – 5(10 Hrs) MAC Protocol Analysis, Asynchronous duty-cycled, X-MAC Analysis(Markov Chain), Routing Protocols, Issues in designing routing protocols, Classification of routing protocols, Flat routing, Flooding and gossiping, Resource-aware routing, Data-centric, Geographic Routing, Broadcast, Multicast, Opportunistic Routing Analysis
Course Assessment	Continuous Evaluation 25% Mid Semester 25% End Semester 50%

Course no: CSL 464	Open course (YES/NO)	HM Course (Y/N)	DC (Y/N)	DE (Y/N)
Type of course	PE			
Course Title	**Simulation and Modeling**			
Course Coordinator				
Course objectives:	This course aims to introduce students to basic simulation methods and tools for modelling and simulation of various systems. The course is intended to enable to students to gain solid foundation and associated experience for computer-based tool set for constructing, simulating and analyzing models of complex systems.			
POs				

Semester	Autumn:		Spring		
VII/VIII	**Lecture**	**Tutorial**	**Practical**	**Credits**	**Total Teaching Hours**
Contact Hours	3	0	0	3	36
Prerequisite course code as per proposed course numbers					
Prerequisite credits					
Equivalent course codes as per proposed course and old course					
Overlap course codes as per proposed course numbers					

Text Books:

1.	Title	System simulation and modeling
	Author	V P Singh
	Publisher	New Age International
	Edition	
2	Title	Modeling and Simulation: The Computer Science of Illusion
	Author	Stanislaw Raczynski

		Publisher	Wiley publication
		Edition	
Reference Book:			
1.		Title	Simulating Computer Systems: Techniques and Tools
		Author	Mh Macdougall
		Publisher	Cambridge, MIT Press
		Edition	
2.		Title	Simulation Modeling and Techniques
		Author	A.M. Law and W.D. Kelton
		Publisher	
		Edition	
3		Title	Network modeling and simulation a practical perspective
		Author	Mohsen Guizani, AmmarRayes, Bilal Khan, Ala Al-Fuqaha
		Publisher	Wiley publication
		Edition	
Content	**Unit 1** System & System Environment, Components of a System, Discrete and Continuous Systems, Model of a System and Types of Models, Discrete Event System Simulation, Advantages and Disadvantages of Simulation, Areas of Application. **Unit 2** Techniques of Simulation: Monte Carlo Method, Types of System Simulations, Real Time Simulation, Stochastic Variables, Discrete Probability Functions. **Unit 3** General Principles: Concepts in Discrete Event Simulation, Event Scheduling /Time Advance Algorithm, List Processing, Using Dynamic Allocation & Linked List. **Unit 4** Simulation Software: History of Simulation Software, Selection of Simulation Software, Simulation in C++, GPSS, Simulations Packages, Trends in simulation Software. **Unit 5** Statistical Models in Simulation: Useful Statistical Models, Discrete Distribution s, Continuous Distributions, Poisson Process, Empirical Distributions		

	Queuing Models:
	Characteristics of Queuing systems, Queuing Notation, Long Run Measures of performance of Queuing Systems, Steady State Behavior of infinite Population Markovian Models, Steady State Behaviour of finite Population Models, Networks of Queues
	Random Number Generation:
	Properties of Random Numbers, Generation of Pseudo-Random Numbers, Techniques for Generating Random Numbers, Tests for Random Numbers, Inverse transform Techniques, Convolution Methods, and Acceptance – Rejection Techniques
	Input Modeling:
	Data Collection, Identifying the Distribution with Data, Parameter Estimation, Chi – Square Test, Selecting Input Models with Data Verification & Validation of simulation Modelling: Model Building, Verification & Validation, Verification of simulation Models, Calibration & Validation of Models.
	Forecasting: Forecasting technique/method based upon key criteria such as: Forecast time horizon
	Amount and relevance of historical data Data patterns (seasonality, trends), Accuracy requirements and purpose of the forecast, Assessment of the potential for forecasting – can the variable be forecasted? Understand the organizational and decision making context of forecasting
	Understand the basic principles for each of the following and be able to apply each using appropriate software:
	Extrapolation and growth models (e.g., the Bass model) Time series models such as smoothing (Holt-Winters, multiplicative and additive), ARIMA, Causal models (e.g., ordinary regression, econometric models)
Curse Assessment	Continuous Evaluation 25% Mid Semester 25% End Semester 50%

Course no: CSL 477	Open course (YES/NO)	HM Course (Y/N)	DC (Y/N)	DE (Y/N)
Type of course	PE			
Course Title	**GAME THEORY**			
Course Coordinator				
Course objectives:	Game theory is a branch of Mathematical Economics that studies strategic interactions amongst rational decision makers. Traditionally, game theoretic tools have been applied to solve problems in Economics, Business, Political Science, Biology, Sociology, Computer Science, Logic, and Ethics. In recent years, applications of game theory have been successfully extended to several areas of engineered / networked system such as wireline and wireless communications, static and dynamic spectrum auction, social and economic networks. This course is intended to provide students with a comprehensive treatment of game theory with specific emphasis on applications in Economics and Engineering. The aim of this course is to introduce students to the novel concepts of Game Theory with special emphasis on its applications in diverse fields and current research.			
Pos				

Semester	Autumn:		Spring		
VII/VIII	Lecture	Tutorial	Practical	Credits	Total Teaching Hours
Contact Hours	3	0	0	3	36
Prerequisite course code as per proposed course numbers					
Prerequisite credits					
Equivalent course codes as per proposed course and old course					
Overlap course codes as per proposed course numbers					

Text Books:			
1.		Title	An Introduction to Game Theory
		Author	Martin Osborne
		Publisher	Oxford University Press
		Edition	2003
2.		Title	A course in Game Theory
		Author	Martin Osborne, Ariel Rubinstein
		Publisher	PHI
		Edition	2016
Reference Book:			
1.		Title	Auction Theory
		Author	(AT) Vijay Krishna
		Publisher	Academic Press
		Edition	
2		Title	Strategies and Games
		Author	(SG) Prajit Dutta
		Publisher	MIT Press
		Edition	
3		Title	Game Theory for Wireless Engineers
		Author	(GTWE) Allan MacKenzie
		Publisher	Synthesis lectures on Communications
		Edition	2006
Content	**Unit 1** Introduction: What is game theory, The theory of rational Choice. Games with Perfect Information **Strategic Games:** Examples of strategic games, Nash Equilibrium and Existence, Best Response functions, Dominated actions, Cournot's model, Bertrand's model,Electoral Competition: Median Voter Theorem , Auctions: Definitions and The role of Knowledge **Unit-2** **Mixed Strategy Equilibrium:** Decision Making and Utility Theory, Mixed Strategy Equilibrium , Pure equilibria.		

	Extensive Form Game with Perfect Information: Theory, Stackelberg Model of Duopoly, Buying Votes, Committee Decision-Making, Repeated games, The Prisoner's Dilemma, General Result **Unit-3** **Supermodular Game and Potential Game:** Supermodular Game and Potential Game, Wireless Networks: Resource Allocations, Admission Control, Routing in Sensor and Ad-Hoc Networks, Modeling Network Traffic and Strategic Network Formation. a. CDMA Power Control b. Network Admission Control **Strategic Games With Imperfect Information:** Bayesian Games, Cournot's Duopoly with Imperfect Information, Radio Spectrum, With Arbitrary Distribution of Valuations Extensive Games With Imperfect Information, Theory, Signaling Games **Unit-4** **Bargaining Rubinstein Bargaining Model with Alternating Offers:** Nash Bargaining Solution, Relation of Axiomatic and Strategic Model Two Illustrations: a. Trade in market b. Bargaining in Networks **Unit-5** **Auction and Mechanism Design with Applications:** Revenue Equivalence, Risk Averse Bidders, Asymmetries among Bidders, Mechanism, Optimal Mechanism, Auction and Mechanism Design with Applications - II, Efficient Mechanism
Curse Assessme nt	Continuous Evaluation 25% Mid Semester 25% End Semester 50%

Course no: CSB 272	Open course (YES/NO)	HM Course (Y/N)	DC (Y/N)	DE (Y/N)	
	No	No	No	Yes	
Type of course	PE				
Course Title	Foundation of Programming				
Course Coordinator					
Course objectives:	To provide an understanding of formal models of programming language syntax and semantics, in order to provide a deeper understanding of the processes of programming (the construction of correct programs and the formal verification of programs) and programming language definition, design, and implementation.				
POs	1. To be able to express computational solutions in the main programming idioms. 2. To be able to select an appropriate programming language for solving a computational problem, with justification 3. To know and understand the principal programming abstractions. 4. To know and understand the functional programming language				

Semester	Autumn:		Spring		
IV	Lecture	Tutorial	Practical	Credits	Total contact Hours
Contact Hours	2	0	2	3	24
Prerequisite course code as per proposed course numbers					
Prerequisite credits					
Equivalent course codes as per proposed course and old course					
Overlap course codes as per proposed course numbers					

Text Books:

1	Title	Programming languages Design & implementation
	Author	T.W. .Pratt
	Publisher	Prentice Hall Pub
	Edition	3rd edition

Reference Book:

2	Title	Concepts in Programming Languages
	Author	John C. Mitchell
	Publisher	Cambridge University Press
	Edition	2nd edition
3.	Title	Programming Languages – Principles and Paradigms by Allen Tucker & Robert Noonan, 2002, TMH,
	Author	Allen Tucker & Robert Noonan
	Publisher	McGraw-Hill
	Edition	2nd edition
4.	Title	Programming Languages
	Author	Ravi Sethi
	Publisher	Pearson Education India
	Edition	2nd edition

Content	**Unit-1 Introduction (8 hrs)** Syntactic and semantic rules of a Programming language, Characteristics of a good programming language, Programming language translators compiler & interpreters , Elementary data types – data objects, variable & constants, data types, Specification & implementation of elementary data types, Declarations ,type checking & type conversions , Assignment & initialization, Numeric data types, enumerations, Booleans & characters. **Unit-2 Structured data objects, Subprograms and Programmer Defined Data Type (9 hrs)** Structured data objects & data types , specification & implementation of structured data types, Declaration & type checking of data structure ,vector & arrays, records Character strings, variable size data structures , Union, pointer & programmer defined data objects, sets, files. Evolution of data type concept, modularity, procedural abstraction, data abstraction, metalinguistic abstraction, encapsulation & information hiding, Subprograms, concurrency, type definitions, abstract data types. **Unit-3 Sequence Control and Data Control (8 hrs)** Implicit & explicit sequence control, sequence control within expressions, sequence control within statement, Subprogram sequence control: simple call return, recursive subprograms, lazy evaluation, Exception & exception handlers, co routines, sequence control. Names & referencing environment, static & dynamic scope, block structure, Local data & local referencing environment, Shared data: dynamic & static scope. Parameter & parameter transmission schemes. **Unit-4 Storage Management, Programming languages (7 hrs)** Major run time elements requiring storage ,programmer and system controlled storage management & phases , Static storage management , Stack based storage management, Heap storage management ,variable & fixed size elements **Unit-5 Programming Paradigms (4 hrs)** Introduction to procedural, non-procedural, structured, functional, object oriented, imperative, declarative, event driven programming language.
Course Assessment	Continuous Evaluation 25% Mid Semester 25% End Semester 50%

Course no: **HMP 352**	Open course (YES/NO)	HM Course (Y/N)	DC (Y/N)		DE (Y/N)
	YES	**YES**	**YES**		**YES**
Type of Course	Practical				
Course Title	**TECHNICAL COMMUNICATION**				
Course Coordinator					
Course objectives:	The course aims to inculcate soft skills and technical writing in students. The practical sessions will prepare students to face job interviews and Group Discussion.				
Pos	To prepare students for placement drive and orient them for corporate culture.				
Syllabus Outcome	Technical Communication aims to prepare engineering students to perform well in technical writing and presentation skills. The core engineering skills need to be performed through soft skills. The course will equip students to writing, presentation, discussion and interview skills.				
Semester	**Autumn:** No		**Spring:** Yes		
VI	**Lecture**	**Tutorial**	**Practical**	**Credits**	**Total Teaching Hours**
Contact Hours	**0**	**0**	**2**	1	-
Prerequisite course code as per proposed course numbers	Nil				
Prerequisite Credits	Nil				
Equivalent course codes as per proposed course and old course	Nil				
Overlap course codes as per proposed course numbers	Nil				
Text Books:					
1.	Title		New International Business English,		
	Author		Jones, L &R. Alexander		
	Publisher		UK: CUP		
	Edition		2006		
2.	Title		Effective Technical Communication		
	Author		Rizvi, M. A.		
	Publisher		New Delhi: McGraw Hills Education		
	Edition		2005		
Content	**Unit I: WRITTEN COMMUNICATION** Writing Resume, Curriculum Vitae, and Bio-data (Design, Style); Writing Cover letter, Job Applications, Statement of Purpose (SoPs), Life Essay etc. Writing Technical Correspondences: Report Writing, Process Writing, Technical Description: Instructions, manuals etc.Proposals writing,				

| | Journal Articles and Conference Papers, Review and Research Articles. (Focus would be given to Grammar, Foreign Words &Phrases, Appropriate use of Prepositions and other aspects).

Unit II: ORGANISATIONAL COMMUNICATION

Samples of technical letters (Letter of Inquiry, Replies to Inquiry Letters, Letters Placing Orders, Instruction Letters, Letters Urging Action, Complaint Letters, and Adjustment Letters), E-mail Correspondences: Format, Standard Practices and Strategies

Unit III: PRESENTATION SKILLS
Oral presentation Skills: How to make presentation (Focus on Paralinguistic features of speech: Pause, Voice, Stress, and Intonation etc. and Non-verbal cues: Body-languageetc.).
Preparing the Presentation: Develop the central idea, main ideas and supporting materials, visual aids.
Rehearsing the presentation: Improving Delivery and handling stage Fright

Unit IV: Group Discussion Skills
Techniques for Group Discussion
Subject Knowledge, Communication Skills, Leadership Skills, Group Behaviour
Group Contribution: Contributing Systematically; Creating Cooperative Environment, Optimal Participation, Handling Conflict, Effective Closure
Individual Contribution: Topic analysis; Discussing Opinion, Problems, Case Studies
Exchanging Opinions, Suggestions and Proposals

Unit V: Job Interviews
Pre-interview Presentation Techniques
Self-Analysis, Research the Organisation
Job Analysis, Revise your Subject Knowledge, Develop your Interview file.
Interview questions: types, Answering Strategies
Good manners and Positive Behaviour |
| **Course Assessment** | Laboratory: Continuous Evaluation 50% End Semester 50% |

Course no: CSL 373	Open course (YES/NO)		HM Course (Y/N)	DC (Y/N)	DE (Y/N)
Type of course	PC				
Course Title	COMPUTER GRAPHICS				
Course Coordinator					
Course objectives:	Emphasize basic principles needed to design, use, and understand computer graphics systems. Discuss both hardware and software components of graphics systems. Implementation of Graphics Algorithms.				
POs	At the end of the course student will be able 1. Digitally synthesize and manipulate visual content. 2. Determine effectiveness of the theories and programs related to the computer graphics.				

Semester	Autumn:		Spring		
VI	Lecture	Tutorial	Practical	Credits	Total Teaching Hours
Contact Hours	3	0	0	3	36
Prerequisite course code as per proposed course numbers					
Prerequisite credits					
Equivalent course codes as per proposed course and old course					
Overlap course codes as per proposed course numbers					

Text Books:			
1	Title	Computer graphics C Version	
	Author	Donald Hearn and M. Pauline Baker	
	Publisher	Pearson	
	Edition	2nd Edition 2014	
Reference Book:			
2.	Title	Computer Graphics-Principles and Practice	
	Author	J. D. Foley, A. Van Dam, S. K. Feiner and J. F. Hughes	
	Publisher	Pearson Education	
	Edition	2nd Edition, 2003	
3.	Title	Procedural Elements of Computer graphics	
	Author	David F. Rogers	
	Publishe	McGraw Hill	

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		Edition	2nd Edition, 1998
4.		Title	Computer Graphics: A programming approach
		Author	Steven Harringtons
		Publisher	McGraw Hill
		Edition	2nd Edition, 1987
5.		Title	Schaum's outline of Computer Graphics
		Author	Zhigang Xiang, Roy A. Plastock
		Publisher	McGraw Hill
		Edition	2nd Edition, 2000

Content	Unit - 1 OVERVIEW OF GRAPHICS SYSTEM:Input devices, Output primitives, Video display devices, Raster and vector graphics, line-circle-ellipse generating algorithm, filled area primitives.
	Unit - 2 TRANSFORMATIONS AND PROJECTIONS: 2D Transformation, 3D transformation, Parallel projection, Perspective projection.
	Unit - 3 LINE CLIPPING: Cohen-Sutherland, Liang Barsky, Polygon clipping: Sutherland Hodgeman &Weiler-Atherton polygon clipping.
	Unit - 4 CURVES & SURFACES: Conics-Parametric forms for circle, ellipse, parabola; Bezier Curves, Bernstein polynomials, Convex Hull property, B-Spline Curves: Knot vectors uniform and open uniform curves, Periodic B-splines, Uniform B-splines, Non-uniform, rational B-splines, subdividing curves.
	Unit - 5 HIDDEN SURFACE REMOVAL: Hidden Surface Removal: Back face removal, Floating Horizon method for curved objects, Z-Buffer or depth buffer algorithm, Painter's algorithm(Depth sorting method), Binary space partitioning trees, Scan line algorithm, Warnock's algorithm (Area subdivision method).
Course Assessment	Continuous Evaluation 25% Mid Semester 25% End Semester 50%

Course no: MAP 281	Open course (YES/NO)		HM Course (Y/N)	DC (Y/N)	DE (Y/N)
Type of course	PC				
Course Title	**NUMERICAL METHODS LAB**				
Course Coordinator					
Course objectives:					
POs					

Semester	Autumn:		Spring		
IV	Lecture	Tutorial	Practical	Credits	Total Teaching Hours
Contact Hours	0	0	3	2	
Prerequisite course code as per proposed course numbers					
Prerequisite credits					
Equivalent course codes as per proposed course and old course					
Overlap course codes as per proposed course numbers					

Text Books:		
1	Title	Numerical Methods for Engineers
	Author	Steven C. Chapra and Raymond P. Canale
	Publisher	Tata McGraw Hill
	Edition	1995
2	Title	Introductory methods of Numerical analysis
	Author	S.S.Sastry
	Publisher	Prentice - Hall of India
	Edition	

Reference Book:		
2.	Title	
	Author	
	Publisher	
	Edition	

Content	Errors - Rounding off error - Solution of Algebraic and Transcendental equations - Bisection method - Regula-Falsi Method - Newton-Rephson's Method - Muller's Method - Interpolation formulae using differences - Difference Schemes - Lagrange's interpolation formula
Course Assessment	Continuous Evaluation 25% Mid Semester 25% End Semester 50%

Course no: CSL371	Open course (YES/NO)		HM Course (Y/N)	DC (Y/N)	DE (Y/N)
Type of course	Open elective				
Course Title	**Advances in algorithm**				
Course Coordinator					
Course objectives:	Algorithm design and analysis is a fundamental and important part of computer science. The development of a sound theoretical understanding of advanced algorithms and practical problem solving skills using them. The emphasis will be on approximation algorithms.				
POs					

Semester		Autumn:		Spring		
		Lecture	Tutorial	Practical	Credits	Total Teaching Hours
Contact Hours		3	0	0	3	3
Prerequisite course code as per proposed course numbers						
Prerequisite credits						
Equivalent course codes as per proposed course and old course						
Overlap course codes as per proposed course numbers						

Text Books:			
1		Title	Introduction to Algorithms
		Author	Thomas H. Cormen, Charles E. Leiserson, Ronald L. Rivest and Clifford Stein
		Publisher	MIT Press
		Edition	Third
Reference Book:			
2.		Title	Algorithm Design
		Author	Jon Kleinberg and Éva Tardos
		Publisher	Addison-Wesley
		Edition	
3.		Title	Approximation Algorithms
		Author	Vijay Vazirani
		Publisher	Springer
		Edition	2002 edition

Content	**Unit 1: Introduction of algorithms:** Analysis of Algorithm, Asymptotic Notations, Analyzing control statement, Loop invariant and the correctness of the algorithm, Sorting Algorithms and analysis: Bubble sort, Selection sort, Insertion sort, Shell sort Heap sort, Sorting in linear time : Bucket sort, Radix sort and Counting sort
	Unit 2: Approximation Algorithms and local search: Centre selection problem, Set Cover, Pricing Method: Vertex Cover, The Metropolis Algorithm and Simulated Annealing, An Application of Local Search to Hopfield Neural Networks.
	Unit 3: Polynomials and FFT: Representation FFT (Recursive and Iterate), KD-Trees, Binomial and Fibonacci Heaps.
	Unit 4: Maximum Flow Problem and the Ford Fulkerson Algorithm, Maximum Flows and Minimum Cuts in a Network,Choosing good Augmenting Paths, A First Application: The Bipartite Matching Problem, Disjoint Paths in Directed and Undirected Graphs, Extension to the Maximum Flow Problem.
Course Assessment	Continuous Evaluation 25% Mid Semester 25% End Semester 50%