13. COURSES OF STUDY AND SCHEME OF ASSESSMENT

M.Sc. THEORETICAL COMPUTER SCIENCE (2015 REGULATIONS)

(Minimum No. of credits to be earned: 210*)

Course Code	Course Title	Hours/Week			Credit	Maximum marks			CAT
		Lecture	Tutorial	Practical		CA	FE	Total	
I SEMESTER									
15XT11	MATHEMATICAL METHODS	3	2	0	4	50	50	100	BS
15XT12	MATERIALS SCIENCE	4	0	0	4	50	50	100	BS
15XT13	ANALOG AND DIGITAL ELECTRONICS	4	0	0	4	50	50	100	BS
15XT14	C PROGRAMMING	3	0	0	3	50	50	100	PC
15XT15	ENGLISH FOR PROFESSIONAL SKILLS	3	0	0	3	50	50	100	HS
15XT16	MATERIALS SCIENCE AND DIGITAL ELECTRONICS LAB	0	0	4	2	100	-	100	BS
15XT17	C PROGRAMMING LAB	0	0	4	2	100	-	100	PC
15XT18	ENGINEERING GRAPHICS AND GEOMETRIC MODELLING	0	0	4	2	100	-	100	ES
15XT29	PERSONALITY AND CHARACTER DEVELOPMENT	0	0	** Refer Sem 2 and footnote					MC
	Total 31Hrs	**17**	**2**	**12**	**24**	**550**	**250**	**800**	
II SEMESTER									
15XT21	DISCRETE STRUCTURES	3	0	0	3	50	50	100	BS
15XT22	COMPLEX VARIABLES AND TRANSFORMS	4	0	0	4	50	50	100	BS
15XT23	PROBABILITY AND STATISTICS	3	2	0	4	50	50	100	BS
15XT24	DATA STRUCTURES AND ALGORITHMS	3	0	0	3	50	50	100	PC
15XT25	OBJECT ORIENTED PROGRAMMING	3	0	0	3	50	50	100	PC
15XT26	MATHEMATICAL COMPUTING AND STATISTICAL PACKAGES L AB	0	0	4	2	100	-	100	BS
15XT27	DATA STRUCTURES LAB	0	0	4	2	100	-	100	PC
15XT28	OBJECT ORIENTED PROGRAMMING C++ LAB	0	0	4	2	100	-	100	PC
15XT29	PERSONALITY AND CHARACTER DEVELOPMENT	0	0	** Grade - - -					MC
	Total 30Hrs	**16**	**2**	**12**	**23**	**550**	**250**	**800**	

***** Indicated is the minimum number of credits to be earned by a student.

** - Total 40 hrs in semesters I & II put together. Grade: Completed / Not Completed.

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M.Sc. THEORETICAL COMPUTER SCIENCE **2015 REGULATIONS**

Course Code	Course Title	Hours/Week			Credit	Maximum marks			CAT
		Lecture	Tutorial	Practical		CA	FE	Total	
III SEMESTER									
15XT31	STOCHASTIC PROCESSES	3	2	0	4	50	50	100	BS
15XT32	GRAPH THEORY	4	0	0	4	50	50	100	BS
15XT33	ABSTRACT ALGEBRA	3	0	0	3	50	50	100	BS
15XT34	ADVANCED DATA STRUCTURES	4	0	0	4	50	50	100	PC
15XT35	COMPUTER ORGANIZATION AND ASSEMBLY LANGUAGE PROGRAMMING	3	0	0	3	50	50	100	PC
15XT36	PYTHON PROGRAMMING LAB	0	0	4	2	100	-	100	PC
15XT37	ADVANCED DATA STRUCTURES LAB	0	0	4	2	100	-	100	PC
15XT38	ASSEMBLY LANGUAGE PROGRAMMING LAB	0	0	4	2	100	-	100	PC
	Total 31Hrs	**17**	**2**	**12**	**24**	**550**	**250**	**800**	
IV SEMESTER									
15XT41	LINEAR ALGEBRA AND NUMERICAL ANALYSIS	3	2	0	4	50	50	100	BS
15XT42	SOFTWARE ENGINEERING	3	0	0	3	50	50	100	PC
15XT43	OPTIMIZATION TECHNIQUES	3	0	0	3	50	50	100	BS
15XT44	OPERATING SYSTEMS	3	0	0	3	50	50	100	PC
15XT45	COMPUTER NETWORKS AND TCP/IP	3	0	0	3	50	50	100	PC
15XT46	OPTIMIZATION TECHNIQUES WITH R LAB	0	0	4	2	100	-	100	PC
15XT47	OPERATING SYSTEMS LAB (LINUX)	0	0	4	2	100	-	100	PC
15XT48	COMPUTER NETWORKS AND TCP/IP LAB	0	0	4	2	100	-	100	PC
	Total 29Hrs	**15**	**2**	**12**	**22**	**550**	**250**	**800**	

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M.Sc. THEORETICAL COMPUTER SCIENCE **2015 REGULATIONS**

Course Code	Course Title	Hours/Week			Credit	Maximum marks			CAT
		Lecture	Tutorial	Practical		CA	FE	Total	
V SEMESTER									
15XT51	THEORY OF COMPUTING	4	0	0	4	50	50	100	PC
15XT52	COMPUTATIONAL NUMBER THEORY AND CRYPTOGRAPHY	4	0	0	4	50	50	100	PC
15XT53	DATABASE DESIGN	3	0	0	3	50	50	100	PC
15XT54	DESIGN AND ANALYSIS OF ALGORITHMS	3	0	0	3	50	50	100	PC
15XT55	PROFESSIONAL ELECTIVE-I	3	2	0	4	50	50	100	PE
15XT56	JAVA PROGRAMMING LAB	0	0	4	2	100	-	100	PC
15XT57	RDBMS LAB	0	0	4	2	100	-	100	PC
15XT58	DESIGN AND ANALYSIS OF ALGORITHMS LAB	0	0	4	2	100	-	100	PC
	Total 31 Hrs	**17**	**2**	**12**	**24**	**550**	**250**	**800**	
VI SEMESTER									
15XT61	MACHINE LEARNING	3	2	0	4	50	50	100	PC
15XT62	COMPUTER GRAPHICS AND VISUALIZATION	3	0	0	3	50	50	100	PC
15XT63	PRINCIPLES OF COMPILER DESIGN	3	0	0	3	50	50	100	PC
15XT64	SECURITY IN COMPUTING	3	0	0	3	50	50	100	PC
15XT65	OPEN ELECTIVE – I	3	2	0	4	50	50	100	OE
15XT66	COMPUTER GRAPHICS AND VISUALIZATION LAB	0	0	4	2	100	-	100	PC
15XT67	COMPILER DESIGN LAB	0	0	4	2	100	-	100	PC
15XT68	SECURITY IN COMPUTING LAB	0	0	4	2	100	-	100	PC
	Total 31 Hrs	**15**	**4**	**12**	**23**	**550**	**250**	**800**	
VII SEMESTER									
15XTP1	PROJECT WORK I – INDUSTRY / RESEARCH PROJECT	**0**	**0**	**-**	**12**	50	50	100	EEC

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M.Sc. THEORETICAL COMPUTER SCIENCE **2015 REGULATIONS**

Course Code	Course Title	Hours/Week			Credit	Maximum marks			CATEGORY
		Lecture	Tutorial	Practical		CA	FE	Total	
VIII SEMESTER									
15XT81	GAME THEORY	3	0	0	3	50	50	100	PC
15XT82	PARALLEL AND DISTRIBUTED COMPUTING	3	0	0	3	50	50	100	PC
15XT83	MATHEMATICAL MODELLING	3	0	0	3	50	50	100	PC
15XT84	PROFESSIONAL ELECTIVE – II	3	2	0	4	50	50	100	PE
15XT85	OPEN ELECTIVE – II	3	2	0	4	50	50	100	OE
15XT86	PARALLEL AND DISTRIBUTED COMPUTING WITH HADOOP ARCHITECTURE LAB	0	0	4	2	100	-	100	PC
15XT87	OPEN SOURCE SOFTWARE LAB	0	0	4	2	100	-	100	PC
15XT88	RESEARCH SPECIALIZATION LAB	0	0	4	2	100	-	100	EEC
	Total 31 Hrs	**15**	**4**	**12**	**23**	**550**	**250**	**800**	
IX SEMESTER									
15XT91	INFORMATION RETRIEVAL	3	0	0	3	50	50	100	PC
15XT92	SOFTWARE PATTERNS	3	0	0	3	50	50	100	PC
15XT93	DATA MINING	3	0	0	3	50	50	100	PC
15XT94	PROFESSIONAL ELECTIVE – III	3	2	0	4	50	50	100	PE
15XT95	PROFESSIONAL ELECTIVE –IV	3	2	0	4	50	50	100	PE
15XT96	INFORMATION RETRIEVAL LAB	0	0	4	2	100	-	100	PC
15XT97	SOFTWARE PATTERNS LAB	0	0	4	2	100	-	100	PC
15XT98	DATA MINING LAB	0	0	4	2	100	-	100	PC
	Total 31 Hrs	**15**	**4**	**12**	**23**	**550**	**250**	**800**	
X SEMESTER									
15XTP2	PROJECT WORK II – INDUSTRY / RESEARCH PROJECT	**0**	**0**	**-**	**12**	50	50	100	EEC

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Course Code	Course Title	Hours/Week			Credit	Maximum marks			CAT
		Lecture	Tutorial	Practical		CA	FE	Total	
PROFESSIONAL ELECTIVES (Four to be opted)									
15XTE1	PRINCIPLESOF PROGRAMMING LANGUAGES	3	2	0	4	50	50	100	PE
15XTE2	MULTI PARADIGM PROGRAMMING LANGUAGES	3	2	0	4	50	50	100	PE
15XTE3	PROGRAM SEMANTIC ANALYSIS	3	2	0	4	50	50	100	PE
15XTE4	NATURAL LANGUAGE PROCESSING	3	2	0	4	50	50	100	PE
15XTE5	RANDOMIZED ALGORITHMS	3	2	0	4	50	50	100	PE
15XTE6	APPROXIMATION ALGORITHMS	3	2	0	4	50	50	100	PE
15XTE7	NETWORK ALGORITHMICS	3	2	0	4	50	50	100	PE
15XTE8	WIRELESS NETWORKS	3	2	0	4	50	50	100	PE
15XTE9	SOCIAL NETWORK ANALYSIS	3	2	0	4	50	50	100	PE
15XTEA	ADVANCED COMPUTER GRAPHICS	3	2	0	4	50	50	100	PE
15XTEB	COMPUTER VISION AND IMAGE ANALYSIS	3	2	0	4	50	50	100	PE
15XTEC	DATA COMPRESSION	3	2	0	4	50	50	100	PE
15XTED	SEMANTIC WEB	3	2	0	4	50	50	100	PE
15XTEE	CLOUD COMPUTING	3	2	0	4	50	50	100	PE
15XTEF	PERVASIVE COMPUTING	3	2	0	4	50	50	100	PE
15XTEG	ADAVANCED DATA BASE MANAGEMENT SYSTEMS	3	2	0	4	50	50	100	PE
15XTEH	SOFTWARE PROCESS MANAGEMENT	3	2	0	4	50	50	100	PE
15XTEI	ARTIFICIAL INTELLIGENCE	3	2	0	4	50	50	100	PE

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Course Code	Course Title	Hours/Week			Credit	Maximum marks			CAT
		Lecture	Tutorial	Practical		CA	FE	Total	
OPEN ELECTIVES (Two to be opted)									
15XTO1	COMPUTATIONAL FINANCE	3	2	0	4	50	50	100	OE
15XTO2	COMPUTATIONAL GEOMETRY	3	2	0	4	50	50	100	OE
15XTO3	DATA SCIENCE	3	2	0	4	50	50	100	OE
15XTO4	DATA VISUALIZATION	3	2	0	4	50	50	100	OE
15XTO5	PRINCIPLES OF MANAGEMENT AND BEHAVIOURAL SCIENCES	3	2	0	4	50	50	100	OE
15XTO6	ENTREPRENEURSHIP	3	2	0	4	50	50	100	OE
15XTO7	INFORMATION THEORY AND ERROR CONTROL CODING	3	2	0	4	50	50	100	OE
15XTO8	COMPUTATIONAL COMPLEXITY THEORY	3	2	0	4	50	50	100	OE

Labeling and Grouping of Courses

HUMANITIES AND SOCIAL SCIENCES (HS)				
S.No.	**Course Code**	**Course Title**	**L:T:P:C**	**Preferred Semester**
1	15XT12	ENGLISH FOR PROFESSIONAL SKILLS	3:0:0:3	1

BASIC SCIENCES (BS)				
S.No.	**Course Code**	**Course Title**	**L:T:P:C**	**Preferred Semester**
1	15XT11	MATHEMATICAL METHODS	3:2:0:4	1
2	15XT13	MATERIALS SCIENCE	4:0:0:4	1
3	15XT14	ANALOG AND DIGITAL ELECTRONICS	4:0:0:4	1
4	15XT16	MATERIAL SCIENCE AND DIGITAL ELECTRONICS LAB	0:0:4:2	1
5	15XT21	DISCRETE STRUCTURES	3:0:0:3	2
6	15XT22	COMPLEX VARIABLES AND TRANSFORMS	4:0:0:4	2
7	15XT23	PROBABILITY AND STATISTICS	3:2:0:4	2
8	15XT26	MATHEMATICAL COMPUTING AND STATISTICAL PACKAGES LAB	0:0:4:2	2
9	15XT31	STOCHASTIC PROCESSES	3:2:0:4	3
10	15XT32	GRAPH THEORY	4:0:0:4	3
11	15XT33	ABSTRACT ALGEBRA	3:0:0:3	3
12	15XT41	LINEAR ALGEBRA AND NUMERICAL ANALYSIS	3:2:0:4	4
13	15XT43	OPTIMIZATION TECHNIQUES	3:0:0:3	4

PROFESSIONAL CORE (PC)				
S.No.	**Course Code**	**Course Title**	**L:T:P:C**	**Preferred Semester**
1	15XT15	C PROGRAMMING	3:0:0:3	1
2	15XT17	C PROGRAMMING LAB	0:0:4:2	1
3	15XT24	DATA STRUCTURES AND ALGORITHMS	3:0:0:3	2
4	15XT25	OBJECT ORIENTED PROGRAMMING	3:0:0:3	2
5	15XT27	DATA STRUCTURES LAB	0:0:4:2	2
6	15XT28	OBJECT ORIENTED PROGRAMMING C++ LAB	0:0:4:2	2
7	15XT34	ADVANCED DATA STRUCTURES	4:0:0:4	3
8	15XT35	COMPUTER ORGANIZATION AND ASSEMBLY LANGUAGE PROGRAMMING	3:0:0:3	3
9	15XT36	PYTHON PROGRAMMING LAB	0:0:4:2	3
10	15XT37	ADVANCED DATA STRUCTURES LAB	0:0:4:2	3
11	15XT38	ASSEMBLY LANGUAGE PROGRAMMING LAB	0:0:4:2	3
12	15XT42	SOFTWARE ENGINEERING	3:0:0:3	4
13	15XT44	OPERATING SYSTEMS	3:0:0:3	4
14	15XT45	COMPUTER NETWORKS AND TCP/IP	3:0:0:3	4
15	15XT46	OPTIMIZATION TECHNIQUES WITH R LAB	0:0:4:2	4
16	15XT47	OPERATING SYSTEMS LAB (LINUX)	0:0:4:2	4
17	15XT48	COMPUTER NETWORKS AND TCP/IP	0:0:4:2	4
18	15XT51	THEORY OF COMPUTING	4:0:0:4	5
19	15XT52	COMPUTATIONAL NUMBER THEORY AND CRYPTOGRAPHY	4:0:0:4	5
20	15XT53	DATABASE DESIGN	3:0:0:3	5
21	15XT54	DESIGN AND ANALYSIS OF ALGORITHMS	3:0:0:3	5
22	15XT56	JAVA PROGRAMMING LAB	0:0:4:2	5
23	15XT57	RDBMS LAB	0:0:4:2	5
24	15XT58	DESIGN AND ANALYSIS OF ALGORITHMS LAB	0:0:4:2	5
25	15XT61	MACHINE LEARNING	3:2:0:4	6
26	15XT62	COMPUTER GRAPHICS AND VISUALIZATION	3:0:0:3	6
27	15XT63	PRINCIPLES OF COMPILER DESIGN	3:0:0:3	6
28	15XT64	SECURITY IN COMPUTING	3:0:0:3	6
29	15XT66	COMPUTER GRAPHICS AND VISUALIZATION LAB	0:0:4:2	6
30	15XT67	COMPILER DESIGN LAB	0:0:4:2	6
31	15XT68	SECURITY IN COMPUTING LAB	0:0:4:2	6
32	15XT81	GAME THEORY	3:0:0:3	8
33	15XT82	PARALLEL AND DISTRIBUTED COMPUTING	3:0:0:3	8
34	15XT83	MATHEMATICAL MODELLING	3:0:0:3	8
35	15XT86	PARALLEL AND DISTRIBUTED COMPUTING WITH HADOOP ARCHITECTURE LAB	0:0:4:2	8
36	15XT87	OPEN SOURCE SOFTWARE LAB	0:0:4:2	8
37	15XT91	INFORMATION RETRIEVAL	3:0:0:3	9
38	15XT92	SOFTWARE PATTERNS	3:0:0:3	9
39	15XT93	DATA MINING	3:0:0:3	9
40	15XT96	INFORMATION RETRIEVAL LAB	0:0:4:2	9
41	15XT97	SOFTWARE PATTERNS LAB	0:0:4:2	9
42	15XT98	DATA MINING LAB	0:0:4:2	9

PROFESSIONAL ELECTIVES (PE)				
S.No.	**Course Code**	**Course Title**	**L:T:P:C**	**Preferred Semester**
1	15XTE1	PRINCIPLESOF PROGRAMMING LANGUAGES	3:2:0:4	FROM V
2	15XTE2	MULTI PARADIGM PROGRAMMING LANGUAGES	3:2:0:4	FROM V
3	15XTE3	PROGRAM SEMANTIC ANALYSIS	3:2:0:4	FROM V
4	15XTE4	NATURAL LANGUAGE PROCESSING	3:2:0:4	FROM V
5	15XTE5	RANDOMIZED ALGORITHMS	3:2:0:4	FROM VI
6	15XTE6	APPROXIMATION ALGORITHMS	3:2:0:4	FROM VI
7	15XTE7	NETWORK ALGORITHMICS	3:2:0:4	FROM VI
8	15XTE8	WIRELESS NETWORKS	3:2:0:4	FROM V
9	15XTE9	SOCIAL NETWORK ANALYSIS	3:2:0:4	FROM V
10	15XTEA	ADVANCED COMPUTER GRAPHICS	3:2:0:4	FROM VII
11	15XTEB	COMPUTER VISION AND IMAGE ANALYSIS	3:2:0:4	FROM VIII
12	15XTEC	DATA COMPRESSION	3:2:0:4	FROM V
13	15XTED	SEMANTIC WEB	3:2:0:4	FROM V
14	15XTEE	CLOUD COMPUTING	3:2:0:4	FROM IX
15	15XTEF	PERVASIVE COMPUTING	3:2:0:4	FROM VI
16	15XTEG	ADAVANCED DATA BASE MANAGEMENT SYSTEMS	3:2:0:4	FROM V
17	15XTEH	SOFTWARE PROCESS MANAGEMENT	3:2:0:4	FROM V
18	15XTEI	ARTIFICIAL INTELLIGENCE	3:2:0:4	V

OPEN ELECTIVES (OE)				
S.No.	**Course Code**	**Course Title**	**L:T:P:C**	**Preferred Semester**
1	15XTO1	COMPUTATIONAL FINANCE	3:2:0:4	VI or VIII
2	15XTO2	COMPUTATIONAL GEOMETRY	3:2:0:4	VI or VIII
3	15XTO3	DATA SCIENCE	3:2:0:4	VI or VIII
4	15XTO4	DATA VISUALIZATION	3:2:0:4	VI or VIII
5	15XTO5	PRINCIPLES OF MANAGEMENT AND BEHAVIOURAL SCIENCES	3:2:0:4	VI or VIII
6	15XTO6	ENTREPRENEURSHIP	3:2:0:4	VI or VIII
7	15XTO7	INFORMATION THEORY AND ERROR CONTROL CODING	3:2:0:4	VI or VIII
8	15XTO8	COMPUTATIONAL COMPLEXITY THEORY	3:2:0:4	VI or VIII

EMPLOYABILITY ENHANCEMENT COURSES (EEC)				
S.No.	**Course Code**	**Course Title**	**L:T:P:C**	**Preferred Semester**
1	15XTP1	PROJECT WORK I– INDUSTRY / RESEARCH PROJECT	0:0:0:12	7
2	15XT88	RESEARCH SPECIALIZATION LAB	0:0:4:2	8
3	15XTP2	PROJECT WORK II– INDUSTRY / RESEARCH PROJECT	0:0:0:12	10

ENGINEERING SCIENCES (ES)				
S.No.	**Course Code**	**Course Title**	**L:T:P:C**	**Preferred Semester**
1	15XT18	ENGINEERING GRAPHICS AND GEOMETRIC MODELING	0:0:4:2	1

SEMESTER - I

15XT11 MATHEMATICAL METHODS

3 2 0 4

LIMITS AND CONTINUITY: Graphs of standard functions of single variable, Limit, continuity, piecewise continuity, periodic, differentiable, Riemann sum, integrable functions, fundamental theorem of calculus. (7+4)

SEQUENCES & SERIES: Sequences – increasing, decreasing, bounded, function limit properties - Series – convergence and divergence – alternating series test, absolute convergence – ratio test, power series, Taylor series (single variable). (5+3)

FUNCTIONS OF TWO VARIABLES: Models, partial derivative and its geometrical interpretation. Stationary points – maxima, minima and saddles. Taylor series about a point. Constrained maxima and minima – Lagrange multiplier method. (5+4)

MULTIPLE INTEGRALS: Evaluation of multiple integrals – Cartesian and polar, Change of order of integration - Applications of multiple integrals to find area and volume of solid. (9+5)

FOURIER SERIES: Even and odd functions, Dirichlet's conditions, statement of Fourier theorem, Fourier coefficients, change of scale, Half-range sine and cosine series, RMS value, Parseval's theorem, Applications to signals and systems. (7+6)

ORDINARY DIFFERENTIAL EQUATIONS: Linear Differential Equations of first order - Exact differential equations, Integrating factors, Bernoulli equations -Linear Differential Equations of higher order with constant coefficients -Euler's equation with variable coefficients - Simultaneous equations - Method of variation of parameters. Modeling simple systems. (12+8)

Total L:45+T:30=75

TEXT BOOKS:

1. Thomas G B Jr., Maurice D Wier, Joel Hass, Frank R. Giordano, "Thomas' Calculus", Pearson Education, 2013.
2. Erwin Kreyszig, "Advanced Engineering Mathematics", John Wiley, 2013.

REFERENCES:

1. Margaret L Lial, Thomas W. Hungerford and John P. Holcomb, "Mathematics with Applications", Addison Wesley, 2010.
2. Riley K F, Hobson M P and Bence S J, "Mathematical Methods for Physics and Engineering", Cambridge University Press, 2006.
3. Ray Wyile C and Raymond Wyile C, "Advanced Engineering Mathematics", McGraw Hill, 2003.
4. Roland E Thomas, Albert J Rosa, "The Analysis and Design of Linear Circuits", John Wiley, 2009.
5. Michael D Greenberg, "Advanced Engineering Mathematics", Pearson Education, 2009.
6. Thomas L Harman, James B Dabney and Norman John Richert, "Advanced Engineering Mathematics with MATLAB", Brooks/Cole, 2000.

15XT12 ENGLISH FOR PROFESSIONAL SKILLS

3 0 0 3

READING COMPREHENSION: Developing Reading Skills like Skimming and Scanning for information, Critical Reading, Inferential, Cognition, and analytical Skills- appropriate reading texts to be used from general, scientific, and literary genres. (10)

PRINCIPLES OF CLEAR WRITING: The fundamental aspects of formal writing like objectivity, conciseness, clarity, simplicity, coherence, parallelism, unity, cohesion and accuracy to be focused. Writing in different ways to create an emphasis – samples from news items, creative articles and reports to be used. (4)

TECHNICAL WRITING: Technical Style, Mechanics, Critical Evaluation of different types of technical texts and different genres of technical writing – Format and different types of formal reports – Technical Papers. (4)

CORRESPONDENCE: Memos, Principles of Official, Social, and E-mail Correspondence to be focused. (4)

FOCUS ON SOFT SKILLS: Intra and Interpersonal Communication, Telephone Etiquette, Body language and Interview Techniques. (5)

PRACTICALS: Listening exercises using Language Laboratory, Making short speeches, Group Discussions and Role-Plays. (18)

Total L:45

TEXTBOOK:

1. Teaching Material prepared by the Faculty, Department of English.

REFERENCES:

1. Meenakshi Raman and Sangeeta Sharma, "Technical Communication", Oxford University Press, 2009.
2. Dorothy E Zemach and Lynn Stafford – Yilmaz,"Writers at Work**:** The Essay", Cambridge University Press, 2008.
3. Jill Singleton, "Writers at Work: The Paragraph", Cambridge University Press, 2005.
4. Garry Adams and Terry Peck, "Useful Exercises for IELTS", Adams and Austen Press,2001.

5. IMS Learning Resources, “Communication Skills Builder”, IMS Publications, 2008.
6. AyshaViswamohan, “English for Technical Communication”, Tata McGraw Hill, 2008.
7. Mark Ibboston, “Cambridge English for Engineering”, Cambridge University Press, 2011.
8. Suresh Kumar E and Sreehari P, “A Handbook for English Language Laboratories”, Osmania University, 2011.

15XT13 MATERIALS SCIENCE

4 0 0 4

LASERS AND FIBER OPTICS: Principle of Laser: spontaneous and stimulated emission, types of laser: He-Ne, CO2 and Nd:YAG laser. Applications: Laser diodes, holography, cutting, drilling, welding. Principle of Fiber optics. Modes of propagation. Classification based on materials, refractive index profile, modes. Splicing. Losses in optical fiber. Fiber optical communication system, Light sources and Detectors. Fiber optic sensors – temperature, displacement and strain. (12)

CONDUCTORS AND APPLICATIONS : Drude Lorentz theory of electrical conduction, Band theory of solids. Factors affecting resistivity of metals – temperature, alloying, magnetic field and strain.Applications of conductors – Strain gauge, conducting material, and resistance thermometer. (12)

SEMICONDUCTORS AND DEVICES: Elemental and compound semiconductors. Intrinsic and extrinsic semiconductors - Properties. Hall effect - Hall coefficient in extrinsic semiconductors, experimental determination of Hall coefficient. Application of Semiconductors –Solar Cells, LED and LCD. Introduction to semiconductor memory devices: Random Access Memory (RAM), Read only Memory (ROM), DRAM CCD. (12)

MAGNETIC MATERIALS AND MEMORY DEVICES: Origin of magnetism, Classification, Ferro magnetic materials – Properties. Domain theory of ferromagnetism.Hysteresis.Hard and soft magnetic materials. Ferrite – structure and properties. Applications – optical, magnetic and magneto optical memory devices. (12)

ADVANCED MATERIALS AND APPLICATIONS: NANO MATERIALS -Synthesis - PVD and ball milling techniques.properties, applications. Shape Memory alloys (SMA) – Characteristics, properties of NiTi alloy, application in MEMS. Superconductivity- types of superconductors - High Tc superconductors, Application of superconductors -SQUID, Levitation and cryotron. (12)

Total L:60

TEXT BOOKS:

1. William D Callister Jr. and David G. Rethwisch, "Material Science and Engineering", John Wiley, 2011.
2. Rajendran and Marikani, ”Materials Science", Tata McGraw Hill,2006.

REFERENCES:

1. Leonid V Azaroff and James J Brophy, "Electronic Processes in Materials”, McGraw Hill, 1991.
2. Raghavan V, "Materials Science and Engineering- A First Course”, Prentice Hall, 2006.
3. Sze SM, “Modern Semiconductor Device Physics”, John Wiley,2012.

15XT14 ANALOG AND DIGITAL ELECTRONICS

4 0 0 4

SEMICONDUCTOR DEVICES AND CIRCUITS: (Qualitative treatment only) Fundamental aspects of semiconductors - PN junction diode - Zener diode - Rectifiers - Zener voltage regulators - Filters - Bipolar Junction Transistors - Transistor Amplifiers - Field Effect Transistor. (7)

NUMBER SYSTEM AND CODES: Binary - Octal - Hexadecimal - BCD - excess three - Gray codes - Error correcting and detecting codes. (7)

DIGITAL CIRCUITS AND GATES: AND, OR, NOT, NAND and NOR gates - exclusive OR gates. Positive and negative logic systems - Digital integrated circuits-Characteristics -TTL and MOS logic circuits - Comparison. (6)

BOOLEAN ALGEBRA AND KARNAUGH MAPS: Boolean relations - Laws and theorems - Simplifications - Karnaugh maps and simplifications - Don’t care conditions - NAND-NAND realizations. (7)

COMBINATIONAL LOGIC: Design and Implementation of Half and Full adders - Subtractors - Parallel adders - Carry look ahead addition - Encoders and decoders - Multiplexers and De-multiplexers. (8)

SEQUENTIAL LOGIC: R-S, J-K, D and T type Flip-Flops - Binary counters: Ripple and synchronous types - UP/DOWN counters - Decade counters - Shift registers - Ring counters. (7)

OPERATIONAL AMPLIFIERS: Definition of terms - Inverting and non-inverting amplifiers, inverting summing amplifier, integrators and differentiators. (9)

A/D AND D/A CONVERTORS: DACs - weighted and binary ladder types – ADCs - counter, dual slope, successive approximation types. (9)

Total L:60

TEXT BOOKS:
1. Leach DP, “Digital Principles & Applications”, Tata McGraw Hill, 2011.
2. Mottershed A, “Electronic devices and circuits”, Prentice Hall, 2009.

REFERENCES:
1. Gothamann H, “Digital Electronics: An Introduction to Theory and Practice”, Prentice Hall, 2001.
2. Paul Horowitz and Winfield Hill, “The Art of Electronics”, Cambridge University Press, 2015.
3. Hamachar V C, Vranesic Z G and Zaky S G, “Computer Organization”, McGraw Hill, 2011.

15XT15 C PROGRAMMING

3 0 0 3

PROBLEM SOLVING: Introduction to Problem Solving- Program development- Analyzing and Defining the Problem- Modular Design – Algorithm-Flow Chart - Programming language-Types of programming language- Program Development Environment. (3)

C LANGUAGE: Introduction to C Language - C character set - Identifiers and Keywords - Data Types - Constants - Variables - Arrays - Declarations - Expressions - Statements - Symbolic constants - Operators and Expressions - Library Functions - Data Input and Output Functions. (6)

CONTROL STATEMENTS: While Statement - Do While Statement –For Loop–NestedLoop - If Else - Switch - Break - Continue - Comma Operator – GotoStatement. (4)

FUNCTIONS: Defining Function - Accessing a Function - Passing Arguments to Functions - Specifying ArgumentsData Types - Function Prototypes - Storage Classes - Auto - Static - Extern and Register Variables. (6)

ARRAYS: Defining Array –Processingarray - Passing array to a function - Multi dimensional array - Array and strings. (5)

POINTERS: Declarations - Pointers to a function - Pointers and one dimensional arrays - Operating a pointer - Pointer and multi-dimensional arrays - arrays of pointers - passing functions to other functions. (7)

STRUCTURES AND UNIONS: Definition of Structure and Union - Processing a structure - User defined data types - Structures and pointers - Passing structure to functions - Self-referential structures. (6)

FILES: File concepts – Operations on Files – Types of Files, Various Read and Write Functions on Files. (4)

ENUMERATED DATA TYPE : Typedef–PreprocessorDirectives - Command Line Arguments. (4)

Total L:45

TEXT BOOKS:
1. Kernighan B W and Ritchie D M, “C Programming Language (ANSI C)”, Pearson Education, 2013.
2. Deitel H M and Deitel P J, “C How to Program”, Prentice Hall, 2013.

REFERENCES:
1. Herbert Schildt, “C The Complete Reference", McGraw Hill, 2010.
2. Gottfried B, “Programming With C”, McGraw Hill, 2011.

15XT16 MATERIALS SCIENCE AND DIGITAL ELECTRONICS LAB

0 0 4 2

MATERIALS SCIENCE LABORATORY:
1. Resistivity of an Alloy – Carey Foster’s Bridge.
2. Band Gap of Thermistor – Post Office Box
3. Thermal Conductivity of Metallic Wire – Wiedmann Franz law.
4. Temperature co-efficient of Resistance – Post Office Box.
5. Efficiency of Solar Cell.
6. Band Gap Determination – Reverse Saturation Current.
7. Photodiode Characteristics.
8. Determination of Wavelength of laser source using grating.

DIGITAL ELECTRONICS LABORATORY:
1. Study of basic logic gates and realization of logic gates using universal gates.
2. Multiplexer and Dmultiplexer.
3. Half and full adder / subtractor.
4. Encoder and decoder.
5. Binary counter.
6. BCD to seven segment decoder.

7. Study of D/A converter.
8. Crystal Oscillator using logic gates.

Total P:60

15XT17 C PROGRAMMING LAB

0 0 4 2

1. Simple programs to understand the concepts of data types.
2. Familiarizing conditional, control and repetition statements.
3. Usage of single and double dimensional arrays including storage operations.
4. Implementation of functions, recursive functions.
5. Defining and handling structures, array of structures and union.
6. Implementation of pointers, operation on pointers dynamic storage allocation.
7. Creating and processing data files.

Note:
Separate Problem Sheets will be provided in due course.

Total P:60

15XT18 ENGINEERING GRAPHICS AND GEOMETRIC MODELLING

0 0 4 2

INTRODUCTION: BIS specifications - lines, lettering, and dimensioning. Projection –types.
FIRST ANGLE PROJECTION: Introduction- Projection of points, lines, planes, and solids –parallel, perpendicular and inclined to planes.
ISOMETRIC PROJECTION: Introduction- prismatic and cylindrical components.
INTERACTIVE GRAPHICS: Parametric modeling –1D, 2D and 3D geometry – transformations - display – points, lines using software.
CURVES: Types- parametric curves generation-displaying - evaluating points on curves.
SURFACES: Types- parametric surface generation-displaying - evaluating points on surfaces.
SOLIDS: Generation of part models using Computer Aided Geometric Modeling software.

LAB
Engineering Graphics using CAD
1. Introduction to CAD Software.
2. Exercise on first angle projection of
   a. Points b. Lines
3. Exerciseon projection of
   a. Planes b. Solids
4. Exercise on conversion of isometric to orthographic projection.
5. Exercise on orthographic to isometric projection.
6. Exercise on Sectioning of regular solids.
7. Exercise on Perspective projection of simple solids.

Geometric Modeling using a graphical programming language
1. Modeling and displaying a point and line using orthographic projection and performing simple geometric transformation.
2. Modeling and displaying of parametrically represented analytical curves
   a. Circle b. Ellipse
3. Modeling and displaying of parametrically represented synthetic curves
   a. Bezier Curve b. B-spline
4. Modeling and displaying of parametrically represented NURBS curve.
5. Modeling and displaying of parametrically represented synthetic surface.
   a. Planar surface b. Ruled surface
6. Modeling and displaying of Bezier surface.
7. Modeling and displaying of B-Spline surface.

Total P:60

TEXT BOOKS:

1. "A Primer on Engineering Drawing using Pro Engineer", Department of Production Engineering and CAD/CAM Centre, PSG College of Technology, Coimbatore, 2012.
2. Michael E Mortensen, "Geometric Modeling (Digitized)", Industrial Press, 2011.

REFERENCES:

1. David F Rogers, Alan Adams J., "Mathematical Elements in Computer Graphics (Digitized)", McGraw Hill, 2007.
2. David Solomon, "Computer Graphics and Geometric Modeling", Springer, 2013.
3. Martti Mantyla, "An Introduction to Solid Modeling (Digitized)", Computer Science Press, 2007.

SEMESTER – 2

15XT21 DISCRETE STRUCTURES

3 0 0 3

MATHEMATICAL LOGIC: Proposition - Logical operators - Truth tables – Laws of Logic – Equivalences – Normal forms - Rules of inference - Validity of arguments – Consistency of specifications – Propositional Calculus – Quantifiers and universe of discourse. (10)

PROOF TECHNIQUES: Introduction – Methods of proving theorems – Direct proofs, Indirect proofs – Mathematical induction – Strong mathematical induction and well ordering. (6)

RELATIONS AND FUNCTIONS: Definition and properties of binary relations – Representing Relations – Closures of Relations – Composition of Relations – Equivalence Relations – Partitions and Covering of Sets – Partial Orderings – n-ary Relations and their Applications. Functions-Injective, Surjective, Bijective functions, Composition, Identity and Inverse. (10)

COMBINATORICS: Basics of counting – The Pigeonhole principle - Permutations and Combinations with and without repetition, Permutations with indistinguishable elements, distribution of objects - Generating permutations and combinations in lexicographic order. (8)

RECURRENCE RELATIONS: Some Recurrence Relation Models- Solutions of linear homogeneous recurrence relations with constant coefficients- solution of linear non-homogeneous recurrence relations by the method of characteristic roots. (5)

LATTICES: Lattices as partially ordered set – Properties of Lattices– Lattices as algebraic system – Sublattices – Direct product and Homomorphism – Some special lattices. (6)

Total L:45

TEXT BOOKS:

1. Kenneth H Rosen, “Discrete Mathematics and its Application”, McGraw Hill, 2011.
2. Judith L. Gersting, “Mathematical Structures for Computer Science”, W.H. Freeman and Company, 2014
3. Tremblay J P and Manohar R, “Discrete Mathematical Structures with application to Computer Science”, Tata McGraw Hill,2011.

REFERENCES:

1. Doerr Alan and Levasseur K, "Applied Discrete Structures for Computer Science", Galgotia Publications, 2010.
2. Benard Kolman, Robert C Busby and Sharan Ross, "Discrete Mathematical Structures", Pearson Education, 2014.
3. Ralph P Grimaldi, “Discrete and Combinatorial Mathematics – An Applied Introduction”, Addison Wesley, 2009.

15XT22 COMPLEX VARIABLES AND TRANSFORMS

4 0 0 4

COMPLEX VARIABLES: Introduction- Complex functions- Limits-Continuity- Derivative- Analytic functions – Necessary and sufficient conditions for analytic function- Properties of Analytic Functions - Finding analytic function whose real/ imaginary part is given- conformal mapping, Bilinear map- Complex integration - Cauchy 's fundamental theorem and formula - Taylor's series-Laurent's series - Singularities - Residue theorem- Evaluation of real integrals using contour integration. (15)

TRANSFORM METHODS: Concept of Transformation - Examples for Transformations. (5)

LAPLACE TRANSFORM: Definition - Transforms of Standard Functions - Transform of unit step function - Dirac delta function. – Transforms of derivatives and integrals -Transforms of Periodic functions - Inverse Laplace transform- Convolution Theorem. Method of solving ordinary linear differential equations with constant coefficient and solving integral equations by Laplace transform technique - Some applications to engineering problems. (14)

FOURIER TRANSFORM: Fourier integrals - Fourier transform- Fourier sine and cosine transform - Transforms of standard functions - Properties, Convolution theorem (Statement only) – Discrete Fourier and Fast Fourier Transforms – Discrete Convolution – Periodic sequence and circular convolution – Discrete Fourier Transform – Decimation–in-time algorithm –Computation of inverse DFT. (15)

Z-TRANSFORM: Z - transform of standard functions, inverse Z-transform – properties of Z – transform – Difference equations – Modeling, Solution of difference equations. (11)

Total L:60

TEXT BOOKS:

1. Anthony Croft, Robert Davison and Martin Hargreaves, “Engineering Mathematics – A Foundation for Electronic, Electrical, Communications & Systems Engineers”, Pearson Education, 2013.
2. Erwin Kreyszig, “Advanced Engineering Mathematics”, John Wiley, 2013.

REFERENCES:

1. Michael D Greenberg, “Advanced Engineering Mathematics”, Pearson Education, 2013.
2. Ray Wylie C and Louis C Barret , “Advanced Engineering Mathematics”, McGraw Hill, 2013.
3. Roland E Thomas and Albert J Rosa, “Analysis and design of Linear Circuits”, John Wiley, 2010.
4. Thomas L Harman, James Dabney and Norman Richert, “Advanced Engineering Mathematics with MATLAB”, Brooks/Cole, 2000.

15XT23 PROBABILITY AND STATISTICS

3 2 0 4

PROBABILITY AND CONCEPT OF RANDOM VARIABLE: Introduction - Sample space and events - Axiomatic approach to probability – Basic theorems. Conditional Probability - Law of multiplication - Law of total probability and Bayes’ Theorem - Independence. (7+4)

RANDOM VARIABLES: Discrete and continuous random variables - probability mass function and density function - distribution function - Expectation and variance. Discrete distributions: Binomial, Poisson and Geometric - Continuous distributions: Uniform, Normal, Exponential and Weibull - Joint probability distributions - marginal and conditional distributions - statistical independence , Conditional expectation Moments and moment generating functions- Sums of independent random variables. (12+8)

LIMIT THEOREMS: Markov and Chebyshev inequalities, Law of Large numbers, Central Limit Theorem. (4+4)

STATISTICAL INFERENCE: Sampling distribution - Estimation: Point estimation, interval estimation - Criteria of a good estimator – Interval estimation of mean, proportion, and variance (single sample and two samples) - Maximum likelihood estimator. Hypothesis Testing: General concepts - Errors in Hypothesis testing - One-and two-tailed tests - Tests concerning mean, proportion, and variance - Tests for Goodness of fit and independence of attributes. (11+7)

CORRELATION AND REGRESSION: introduction - Estimation using the regression line - Correlation analysis -Limitations, errors, and caveats of using regression and correlation analyses - Multiple regression and correlation analysis - Inferences about population parameters – Modeling techniques. (6+5)

ANALYSIS OF VARIANCE: Introduction to design of experiments, Analysis of variance - Completely Randomized Design and Randomized Block Design. (5+2)

Total L:45 +T:30 =75

TEXT BOOKS:

1. Saeed Ghahramani, “Fundamentals of Probability with Stochastic Processes”, Prentice Hall, 2014.
2. Trivedi K S, “Probability and Statistics with Reliability, Queueing and Computer Science Applications”, Prentice Hall, 2011.
3. Jay L Devore, “Probability and Statistics for Engineering and Sciences”, Cengage Learning, 2015.

REFERENCES:

1. Richard I Levin. David S. Rubin, “Statistics for Management”, Pearson Education, 2007.
2. Sheldon M Ross, “Introduction to Probability Models”, Academic Press, 2014.
3. Richard A Johnson, “Probability and Statistics for Engineers and Scientists”, Prentice Hall, 2014.
4. Douglas C Montgomery and George C Runges, “Applied Statistics and Probability for Engineers”, John Wiley, 2006.
5. Ronald E Walpole, Raymond H Meyers and Sharon L Meyers, “Probability and Statistics for Engineers and Scientists”, Pearson Education, 2012.

15XT24 DATA STRUCTURES AND ALGORITHMS

3 0 0 3

INTRODUCTION: Software Development process – Abstraction - Data structures - Abstract Data Types - Primitive data structures - Analysis of algorithms - Best, worst and average case time complexities - notations. (4)

ARRAYS: Operations - Implementation of one, two, three and multi dimensioned arrays – Sparse and dense matrices - Applications. (3)

STACKS: Primitive operations - Sequential implementation - Applications: Subroutine handling - Recursion – Expression Processing. (4)

QUEUES: Primitive operations - sequential implementation - Priority Queues - Dequeues - Applications: Image component labeling; Machine shop simulation. (4)

LISTS: Primitive Operations - Singly linked lists, Doubly linked lists, Circular lists, Multiply linked lists - Applications: Addition of Polynomials; Sparse Matrix representation and Operations. – Linked Stacks - Linked queues - Linked Priority queues - Dynamic Storage Management. (10)

TREES: Terminologies – Binary tree: Properties - Sequential and linked representation - Common binary tree operations - Traversals - Expression trees - Infix, Postfix and Prefix expressions - Threaded trees - Tournament trees - Heaps, Max heap, Min heap. (10)

SORTING AND SEARCHING: Insertion sort, selection sort, bubble sort, heap sort, iterative quick sort and merge sort, count sort and radix sort - searching , Linear Search, Binary search– Algorithms and their time complexities. (10)

Total L:45

TEXT BOOKS:
1. Sahni Sartaj, "Data Structures, Algorithms and Applications in C++", Silicon Press, 2011.
2. Aaron M Tanenbaum, Moshe J Augenstein and Yedidyah Langsam, "Data structures using C and C++", Prentice Hall, 2012.
3. Michael T. Goodrich, Roberto Tamassia and David Mount, " Data Structures and Algorithms in C++", John Wiley, 2011.

REFERENCES:
1. Mark Allen Weiss, "Data Structures and Algorithm Analysis in C++", Addison-Wesley, 2013.
2. Nell Dale, "C++ Plus Data Structures", Jones and Bartlett Learning, 2011.
3. Robert L Kruse and Clovis L Tondo, "Data Structures and Program design in C", Pearson Education, 2013.

15XT25 OBJECT ORIENTED PROGRAMMING

3 0 0 3

PRINCIPLES OF OBJECT ORIENTED PROGRAMMING: Software crisis Software Evolution - Procedure Oriented Programming - Object Oriented Programming Paradigm - Basic Concepts and Benefits of OOP - Object Oriented Programming Language - Application of OOP - Structure of C++ - Tokens, Expressions and Control Structures - Operators in C++ - Manipulators. (6)

FUNCTIONS IN C++: Function Prototyping - Call by Reference - Return by reference - Inline functions - Default, Const Arguments - Function - Overloading - Friend and Virtual Functions - Classes and Objects - Member functions - Nesting of Member functions - Private member functions - Memory allocation for Objects - Static data members - Static MemberFunctions - Arrays of Objects - Objects as Function Arguments - Friend Functions - Returning Objects - Const Member functions - Pointers to Members. (9)

CONSTRUCTORS: Parameterized Constructors - Multiple Constructors in a Class - Constructors with Default Arguments - Dynamic Initialization of Objects - Copy and Dynamic Constructors – Destructors overloading. (4)

OPERATOR OVERLOADING: Overloading Unary and Binary Operators - Overloading Binary Operators using Friend functions – Operator Type conversion. (5)

INHERITANCE: Defining Derived Classes - Single Inheritance - Making a Private Member Inheritable - Multiple Inheritance - Hierarchical Inheritance - Hybrid Inheritance - Virtual Base Classes - Abstract Classes - Constructors in Derived Classes - Member Classes - Nesting of Classes – Composition – Aggregation. (10)

POLYMORPHISM: Basics of polymorphism – Types of polymorphism - Compile and Run Time Polymorphism - Virtual function – Object Slicing – Virtual Destructor – Dynamic binding. (4)

TEMPLATES & EXCEPTION HANDLING: Introduction to Templates, Generic Functions and Generic Classes – Exception Handling – Examples. (4)

STREAMS: String I/O -Character I/O - Object I/O - I/O with multiple Objects - File pointers - Disk I/O with member functions. (3)

Total L:45

TEXT BOOKS:
1. BjarneStroustrup, "The C++ Programming Language", Pearson Education, 2014.
2. Stanley B Lippman, Josee Lajoie and Barbara E. Moo, "The C++ Primer", Addison Wesley, 2013.

REFERENCES:
1. Scott Meyers, "Effective C++", Addison Wesley, 2005.
2. Scott Meyers, "More Effective C++", Addison Wesley, 2008.
3. Bjarne Stroustrup, "The Design and Evolution of C++", Addison Wesley, 2005.
4. Stanley B Lippman, "Inside the C++ Object Model", Addison Wesley, 1996.

15XT26 MATHEMATICALCOMPUTINGAND STATISTICAL PACKAGES LAB

0 0 4 2

1. Programs on differentiation and integration.
2. Finding Fourier series
3. Solving ordinary differential equations using Laplace transform techniques.
4. Solving boundary value problems using Fourier series techniques.
5. Conformal mappings of standard functions.
6. Implementation of classification and tabulation of data and Graphical and diagrammatic presentation of data
7. Perform calculations that measure the central tendency and dispersion of data and Implementation of measures of Skewness, moments and kurtosis.
8. Determination of point and interval estimates.

9. Solving linear regression, polynomial regression and non-linear regression based problems and solving multiple regression and correlation analysis based problems.
10. Solving the problems based on Time series analysis and forecasting and implementing statistical quality control charts.
Implementations using mathematical packages like SPSS, MATLAB, MATHEMATICA, MAPLE, or R.

Total P:60

15XT27 DATA STRUCTURES LAB

0 0 4 2

Implementation of the following problems:
1. Sparse and dense Matrix operations using arrays.
2. Linked Lists: Singly linked, Doubly linked and Circular lists.
3. Problems using Stacks.
4. Problems using Queues.
5. Linked Stacks and Queues.
6. Conversion and Manipulation of Expressions.
7. Binary trees and Threaded trees (with graphical representation).
8. Problems related to sorting and searching algorithms.

Total P:60

15XT28 OBJECT ORIENTED PROGRAMMING C++ LAB

0 0 4 2

1. Arithmetic operations using array of objects and dynamic data members.
2. Creation of a class having read-only member function and processing the objects of that class.
3. Creation of a class which keeps track of the member of its instances. Usage of static data member, constructor and destructor to maintain updated information about active objects.
4. Illustration of a data structure using dynamic objects.
5. Usage of static member to count the number of instances of a class.
6. Illustration for the need of default arguments.
7. Usage of a function to perform the same operation on more than one data type.
8. Creation of a class with generic data member.
9. Overloading the operators to do arithmetic operations on objects.
10. Acquisition of the features of an existing class and creation of a new class with added features in it.
11. Implementation of run time polymorphism.
12. Overloading stream operators and creation of user manipulators.
13. Implementation of derived class which has direct access to both its own members and the public members of the base class.
14. Implementation of Streams to store and maintain Library system, with the features of Book Issue and Book Return.

Total P:60

SEMESTER – 3

15XT31 STOCHASTIC PROCESSES

3 2 0 4

STOCHASTIC PROCESSES: Introduction – Classification of Stochastic Processes – Markov Chain: Introduction -Transition Probability Matrices – Chapman Kolmogorov Equations - Classification of States – Limit Theorems – Branching Processes – Time Reversible Markov chains – Markov Decision Processes. (13+8)

CONTINUOUS TIME MARKOV CHAINS: Introduction – Poisson Process - Birth and Death Processes – Kolmogorov Differential Equations – Pure Birth Process - Pure Death Process - Applications. (10+7)

GENERAL QUEUEING MODELS: Single and Multiserver Poisson Queues - Single Server Queue with Poisson input and general service M / G/1 – General input and exponential service – G/M/1 Queueing model. (9+6)

RENEWAL THEORY: Introduction – Distribution - Renewal Theorems - Residual and Excess Life Times -Alternating Renewal Process - Renewal Reward Processes – Regenerative Processes. (9+6)

BROWNIAN MOTION: First Passage time distribution – The maximum of a Brownian Motion – The Zeros of Brownian Motion – Brownian Motion with Drift - Geometric Brownian Motion. (4+3)

Total L:45 + T:30 = 75

TEXT BOOKS:

1. Saeed Ghahramani, "Fundamentals of Probability with Stochastic Processes", Pearson Education, 2014.
2. Sheldon M Ross, "Introduction to Probability Models", Academic Press, 2014.
3. Roy D Yates and David J Goodman, " Probability and Stochastic Processes – A friendly Introduction for Electrical and Computer Engineers", John Wiley, 2014.

REFERENCES:

1. Sheldon M Ross, "Stochastic Processes", John Wiley, 2007.
2. Medhi J, "Stochastic Processes", New Age International Publishers, 2014.
3. Samuel Karlinand Howard E.Taylor, "A First course in StochasticProcesses", Academic Press, 2011.
4. Gross.D and Harris C.M, "Fundamentals of Queueing theory" John Wiley, 2013.

15XT32 GRAPH THEORY

4 0 0 4

BASIC CONCEPTS: Graphs - directed and undirected, subgraphs, graph models, degree of a vertex, degree sequence, Havel-Hakimi theorem, Hand-shaking lemma. Connectivity, walk, path, distance, diameter. Isomorphic graphs. Common classes of graphs – regular, complete, Petersen, cycle, path, tree, k-partite, planar, hypercube. Spanning trees – Matrix tree theorem, graph decomposition. (12)

CONNECTIVITY: Vertex and edge connectivity, Vertex and edge cuts, relationship between vertex and edge connectivity, bounds for connectivity. Harary's construction of k-connected graphs. (12)

EULERIAN AND HAMILTONIAN GRAPHS: Eulerian graphs, Route inspection problem, Hamiltonian graphs, Dirac's and Ore's theorems, Gray codes, Walecki's construction. (12)

MATCHING, VERTEX-COLORING AND DOMINATION: Matching, Perfect matching, Bipartite matching, Hall's theorem- Vertex-coloring – upper chromatic number, bounds using clique number, Δ(G), Welsh – Powell theorem. Dominating set, domination number, bounds. Applications of the above concepts to networks. (12)

RANDOM GRAPHS: Random graph – Definitions of G(n, p) and G(n, M) models. Ramsey number – definition, Erdos theorem. n-existentially closed graphs, asymptotically almost surely graphs and their existence theorem. Expectation and the first moment method, variance and second moment method, threshold function. Web graph models, applications to social networks. (12)

Total L:60

TEXT BOOKS:

1. Anthony Bonato, "A Course on Web Graphs", American Mathematical Society, 2008.
2. Jonathan Gross and Jay Yellen, "Graph Theory and its Applications", CRC Press, 2006.
3. Balakrishnan R and Ranganathan, K, "A Textbook of Graph Theory", Springer-Verlag, 2012.

REFERENCES:

1. Bondy J A, Murty U S R, "Graph Theory", Springer, 2013.
2. Anthony Bonato and Richard Nowakowski, "The Game of Cops and Robbers on Graphs", American Mathematical Society, 2011.
3. Douglas B West, "Introduction to Graph Theory", PHI Learning Pvt. Ltd., 2014.
4. Thulasiraman K and Swamy M N S, "Graphs: Theory and Algorithms", John Wiley, 2014.

15XT33 ABSTRACT ALGEBRA

3 0 0 3

ALGEBRAIC STRUCTURES: Groups - Definition and Example, Properties of Groups, Permutation Groups, Symmetric Groups, Cyclic Groups. (8)

SUBGROUPS AND NORMAL SUBGROUPS: Subgroups – Definition, Cosets and Lagrange's theorem, Homomorphism, Isomorphism, Automorphism – Cayley's theorem – Normal subgroups – Factor group – Fundamental theorem of group homomorphism. (10)

GROUPS AND CODING: Coding of Binary information and Error detection – Group codes – Decoding and Error correction. (6)

RINGS: Definition and Properties – Subrings, Ring of Quaternions, Integral domain - Homomorphism – Ideals and Quotient Rings – Euclidean ring - Unique factorization theorem, Domain of Gaussian Integers. Polynomials Rings – Properties, Division -Algorithm, Factorization of Polynomials – Primitive polynomials. (10)

FIELDS: Definition – subfields - Finite fields – structure of Finite field, GF (2^n). (7)

GEOMETRIC CONSTRUCTIONS: Constructible numbers , circle and squares. (4)

Total L : 45

TEXT BOOKS:

1. Herstein I N., “Topics in Algebra”, John Wiley, 2012.
2. Joseph A. Gallian, “Contemporary Abstract Algebra”, Brooks/Cole, 2013.
3. Tremblay J. P. and Manohar R., “Discrete Mathematical Structures with Applications to Computer Science”, Tata McGrawHill, 2011.

REFERENCES:

1. Ron M. Roth, “Introduction to Coding Theory”, Cambridge University Press, 2007.
2. Ralph P. Grimaldi and Ramana B. V., “Discrete and Combinatorial Mathematics: An Applied Introduction”, Pearson Education, 2014.

15XT34 ADVANCED DATA STRUCTURES

4 0 0 4

INTRODUCTION: Algorithms – Overview of analysis of algorithms – best case, worst case and average case complexities-, Amortized time complexity. (8)

HASH TABLES: Dictionaries – Dictionary ADT, Hash functions – Collision handling schemes - Separate chaining, Linear probing, Quadratic probing, Double Hashing – Load factor and rehashing. (8)

BINARY SEARCH TREES: Searching – Minimum and Maximum - Insertion and deletion of elements – randomly built binary search trees- analysis - Height balancing techniques- AVL trees - Height – searching – insertion and deletion of elements- AVL rotations – analysis - Red Black trees – Height - searching – insertion and deletion of elements – algorithms and their time complexities - Splay trees – Amortized analysis. (14)

MULTIWAY SEARCH TREES: Indexed Sequential Access – m-way search trees – B-Tree – Searching, insertion and deletion - B+ trees – Tries - dictionary applications. (8)

PRIORITY QUEUES (HEAPS): d-Heaps- Leftist Heaps - Leftist Heaps property and operations: Skew Heaps - Binomial trees and binomial heaps – Operations on binomial heap. (8)

DATA STRUCTURES FOR DISJOINT SETS: Disjoint set operations-linked list representation of disjoint sets, disjoint set forests, tree representation, union by rank, find by path compression - analysis. (8)

GRAPHS: Definition – Representations (Adjacency matrix, packed adjacency list and linked adjacency list) – Network representation, shortest path- Dijkstra’s algorithm - applications of shortest paths, Graph search methods (Breadth first and depth first traversals)- Applications of depth first search-biconnectivity- finding strong components. (6)

Total L:60

TEXT BOOKS:

1. Thomas H Cormen, Charles E Leiserson and Ronald L Rivest, “Introduction to Algorithms”, MIT Press, 2009.
2. Mark Allen Weiss, “Data Structures and Algorithm Analysis in C++”, Addison-Wesley, 2013.

REFERENCES:

1. Michael T. Goodrich, Roberto Tamassia and David Mount, “ Data Structures and Algorithms in C++”, John Wiley, 2011.
2. Robert L Kruse and Clovis L Tondo, “Data Structures and Program design in C”, Pearson Education, 2013.
3. SahniSartaj, "Data Structures, Algorithms and Applications in C++", Silicon Press, 2011.

15XT35 COMPUTER ORGANIZATION AND ASSEMBLY LANGUAGE PROGRAMMING

3 0 0 3

DATA REPRESENTATION: Data types - Fixed point and floating point number representation (IEEE format) - Representation of signed numbers – arithmetic operation on signed numbers - Alphanumeric data representation. (4)

REGISTER TRANSFER AND MICRO OPERATIONS: Register transfer language - Inter register transfer - Arithmetic micro operations - Logic micro operations - Shift micro operations - Control functions. (3)

BASIC COMPUTER ORGANIZATION AND DESIGN: Instruction codes- Computer registers - Computer Instructions - Timing and Control - Instruction Cycle - Memory Reference Instructions - Input - Output and Interrupts – Complete Computer Description - Design of Basic Computer. (6)

CENTRAL PROCESSING UNIT: Processor Bus organization - Stack organization - Instruction formats - Data transfer and manipulation -– Multiprocessor Organization - RISC and CISC machine characteristics – Control Unit Design -Hardwired and micro programmed control (5)

MEMORY INTERFACING: Memory hierarchy - Main memory: RAM and ROM address spaces - - Cache memory – Cache Hit rate – Hit and Miss Ratio – Associative memory - Memory Interleaving. (5)

PERIPHERAL DEVICES INTERFACING : I/O interface - I/O bus versus memory bus - Isolated I/O versus Memory - Mapped I/O - Example of I/O interface – DMA - Input-Output processor. (6)

INTRODUCTION TO MICROPROCESSORS: Evolution of Microprocessors - Microprocessor based systems– Examples -Instruction Level Parallelism. (4)

INTEL 8086/88 PROCESSOR: Functional units of 8086 – Pipelining in 8086 - Addressing modes – Instruction format - Instructions - assembler directives – Construction of Machine code –Data Transfer and Data Manipulation Instructions (6)

ASSEMBLY LANGUAGE PROGRAMMING: Programs for multi precision addition, subtraction- Block moves- Array processing - String processing- Procedures and Interrupts - Interrupt Service Routines. (6)

Total L:45

TEXT BOOKS:

1. John L Hennessy and David A Patterson, “Computer Architecture – A quantitative Approach”, Morgan Kaufmann, 2012.
2. Barry B Brey, "The Intel Microprocessors - 8086/88, and 80186,80286, 80386, and 80486", Pearson Prentice Hall, 2009.
3. Morris Mano, "Computer Systems Architecture", Pearson Education, 2008.
4. Randall Hyde, “Art of Assembly Language”, No Starch Press, 2010.

REFERENCES:

1. Hamachar V C, Vranesic Z G and Zaky S G, "Computer Organization", McGraw Hill, 2012.
2. John P Hayes, “Computer Architecture and Organization (Digitized) ”, WCB/McGraw Hill, 2007.
3. Douglus V Hall, "Microprocessors and Interfacing", McGraw Hill, 2010.
4. Nicholas Carter, Raj Kamal, “Computer Architecture & Organization”, Schaum’s Outline Series, 2009.

15XT36 PYTHON PROGRAMMING LAB

0 0 4 2

Exercises pertaining to the following outlines are to be experimented using Python:

1. Write a program that asks the user about textbook prices and reports how overpriced the textbooks are.
2. Create a new function called clubhouseAnimate(objlist) that loops through the window objects in the list and randomly switches them to either yellow (200, 190, 100) or dark (40, 50, 60). You can use a slice like mylist[1:] to loop over all the elements in a list except the first one.
3. Create a main function that creates a GraphWin, calls clubhouseInit and assigns its return value to a variable like cbhouse. Then loop over the variable and call the draw method on each primitive object. Then call the getMouse and close methods of your GraphWin object. Test your clubhouse.
4. Problems to practice various image drawing functions.
5. Problems to practice lists and objects collections.
6. Problems to practice python function and parameters.
7. Problems to practice classes, dictionaries and inheritance.
8. Problems to practice command line arguments.
9. Problems to create your own Python module packages containing functions and data.
10. Problems to Import your own and other Python modules and use contained objects.
11. Problems to understand the use of local, global and built-in names within functions.

Total P:60

15XT37 ADVANCED DATA STRUCTURES LAB

0 0 4 2

Implementation of the following problems:

1. Dictionary Implementation using Hash Tables.
2. Applications of binary search tree and its operations.
3. AVL tree including all rotations.
4. B-tree and its operations.
5. Disjoint set operations and some applications.
6. Problem using heap data structure.
7. Problems related to graphs and graph traversals.
8. Real time problem using shortest path algorithm.

Total P:60

15XT38 ASSEMBLY LANGUAGE PROGRAMMING LAB

0 0 4 2

1. Implementing the functionality of AND, OR and NOT gates.
2. Conversion of data between different number systems.
3. Arithmetic operations of binary numbers using both one's complement and two's complement arithmetic.
4. Implement parity bit generation for a n-bit binary data.
5. Practice on the DEBUGGER and 8086 Emulator Tool.
6. Conversion of BCD numbers into ASCII characters and vice versa.
7. Multiprecision addition and subtraction.
8. Packing and unpacking of BCD digits.
9. Programs on Logical and Arithmetic Instructions.
10. Implementation of Control Structures (FOR, LOOP, IF.. THEN, DO.. WHILE etc.,).
11. Programs using Arrays and Strings.
12. Programs using Special Instructions DAA, XCHG, CMPSW etc.
13. Programs using interrupt functions for input and output.

Total P:60

SEMESTER – 4

15XT41 LINEAR ALGEBRA AND NUMERICAL ANALYSIS

3 2 0 4

SYSTEM OF LINEAR EQUATIONS: System of linear equations – Row reduction and Echelon forms – Vector equation – Matrix equation Ax=b.Gauss – Jordan elimination, Applications**-**Linear models in business, science and engineering. (4+3)

NUMERICAL SOLUTION OF ALGEBRAICSYSTEM OF LINEAR EQUATIONS: Gauss – Jordan elimination, Cholesky method, Crout's method, Gauss – Jacobi method, Gauss – Seidel method. Matrix Inverse by Gauss – Jordan method. (6+5)

SPARSE MATRICES : Introduction – Storage Schemes – Basic sparse matrix operations – Sparse direct solutions – random walk problems. (5+3)

VECTOR SPACES: Vector spaces and subspaces – Linear combination, Span, Linear independence and dependence - Null space, Column space, and Row space – Basis and dimension of a vector space – Rank and nullity.Applications to coding theory. (10+7)

LINEAR TRANSFORMATION: Introduction to linear transformations – General Linear Transformations – Kernel and range – Linear Transformations from R^2 to R^2– Change of basis. (6+4)

INNER PRODUCT SAPCES: Inner product, Length, and orthogonality – Orthogonal sets – Orthogonal projections – Inner product spaces – Orthonormal bases:Gram-Schmidt process – Best Approximation, Least-squares. (6+3)

EIGEN VALUES, EIGEN VECTORS AND SINGULAR VALUE DECOMPOSITION: Eigen values and Eigen vectors– Eigen vectors and linear transformations –Diagonalization – Diagonalization of symmetric matrices – Singular value decomposition.Applications to Markov chains. Power method for finding dominant Eigenvalues, Jacobi method for symmetric matrix. (8+5)

Total L:45+T:30 = 75

TEXT BOOKS:

1. Howard Anton and Chris Rorres, "Elementary Linear Algebra", John Wiley, 2011.
2. Steven C. Chapra and Raymond P. Canale, "Numerical Methods for Engineers with Software and Programming Applications",McGraw Hill, 2011.

REFERENCES:

1. Gilbert Strang, "Linear Algebra and its Applications", Thomson Learning, 2009.
2. Curtis F Gerald,and Patrick O Wheatley, "Applied Numerical Analysis", Pearson Education, 2011.
3. Yousef Saad, "Numerical methods for large eigen value problems", University Press, 2011.

15XT42 SOFTWARE ENGINEERING

3 0 0 3

INTRODUCTION: System - System Development - Types of systems – People involved in the systems development - The project life cycle models - Need for Software Engineering - Objectives and Benefits of Software Engineering - Factors that influence Quality & Productivity – Quality attributes of a software product. (5)

SOFTWARE PLANNING: Software Project Estimation - Different techniques of Project cost estimation Decomposition techniques - COCOMO & PUTNAM models. (4)

SOFTWARE ANALYSIS: Functional and non-functional requirements- Requirements engineering process – Elicitation – validation and management – software prototyping - Principles of Analysis - Analysis tools - Analysis Models. (8)

DESIGN CONCEPTS AND PRINCIPLES: Design process and concepts – Levels of Design - Coupling – Cohesion -Design Tools - Software Design Methods – Design Techniques - Design of Input and control - Design of Output. (8)

OBJECT ORIENTED SYSTEMS DEVELOPMENT: Object Oriented Systems Development life Cycle - Object oriented methodologies - Rational Unified Process – Unified Modeling Language –Process workflows – Importance of Modeling – Types of Modeling. (15)

SOFTWARE TESTING: Introduction – Types of Testing – Testing Life cycle – Test Strategy and Tools. (5)

Total L:45

TEXT BOOKS:

1. Pressman RS, "Software Engineering – A Practitioner's Approach", Tata McGraw Hill, 2015.
2. Ian Sommerville, "Software Engineering", Pearson Addison Wesley, 2014.
3. John Hunt, "The Unified Process for Practitioners", Springer Science & Business Media, 2013.

REFERENCES:

1. Shari Lawrence Pfleeger, "Software Engineering Theory and Practice", Pearson Education, 2014.
2. Philippe Krucheten, "The Rational Unified Process – An Introduction", Pearson Education, 2004.
3. Grady Booch , James Rumbaugh and Ivar Jacobson , "The Unified Modeling Language User Guide", Pearson Education, 2005.
4. Martin Fowler and Kendall Scott, "UML Distilled", Addison Wesley, 2004.
5. Hans-Erik Eriksson, Magnus Penker, Brain Lyons, David Fado, "UML 2 Toolkit", John Wiley, 2008.
6. Robert Laganiere, "Object Oriented Software Engineering", Tata McGrawHill, 2008.
7. James F Peters, "Software Engineering – An engineering approach", John Wiley, 2008.

.

15XT43 OPTIMIZATION TECHNIQUES

3 0 0 3

LINEAR PROGRAMMING: Graphical method for two dimensional problems – Central problems of Linear Programming – Definitions – Simplex Algorithm – Phase I and Phase II of Simplex Method. (10)

CONVEX OPTIMIZATION: Convex sets and cones- Convex functions- Convex optimization problems- linear and quadratic programs; second-order cone and semi-definite programs; quasi-convex optimization problems; vector and multi-criterion optimization. (6)

SIMPLEX MULTIPLIERS: Dual and Primal – Dual Simplex Method – Revised Simplex Method - Sensitivity Analysis – Transportation problem and its solution – Assignment problem and its solution by Hungarian method – Karmakar'smethod – Statement, Conversion of the Linear Programming problem into the required form, Algorithm. (8)

INTEGER PROGRAMMING:Gomory cutting plane methods for all integer and mixed integer programming problems - Branch and Bound method (Land – Dolg and Dakin algorithms) – Zero-One Implicit enumeration Algorithm. (6)

DYNAMIC PROGRAMMING: Principle of Optimality – Backward and forward induction methods- Calculus method of solution- Tabular method of solution – Shortest path network problems – Applications in production. (6)

PERT: Arrow networks - Time estimates - Earliest expected time, latest allowable occurrence time and slack of events - Critical path - Probability of meeting scheduled date of completion of project. (9)

Total L:45

TEXT BOOK:

1. Hamdy A Taha, "Operations Research – An Introduction", Prentice Hall, 2011.

REFERENCES:

1. Hillier F and Liberman G J, "Introduction to Operations Research", McGraw Hill, 2014.
2. Kambo N S, "Mathematical Programming Techniques", East-West Press, 2012.
3. Singiresu S Rao, "Engineering optimization theory and Practice", John Wiley, 2014.

15XT44 OPERATING SYSTEMS

3 0 0 3

INTRODUCTION: Abstract view of an operating system - Operating Systems Objectives and Functions – Evolution of Operating Systems - Dual-mode operation - Protecting I/O, memory, CPU, Kernels and micro-kernels – system calls- Structure of Operating System – Components of Computers – various components of operating systems. (5)

PROCESS DESCRIPTION AND CONTROL: Job/process concepts - Process Creation – Process Termination - Process states – Process Description – Process Control. (4)

PROCESS AND THREADS: Relationship between process and threads – Thread State – Thread Synchronization – Types of Thread – Multithreading model. (3)

PROCESS SCHEDULING: Scheduling basics - CPU-I/O interleaving- (non-)preemption - context switching- Types of Scheduling – Scheduling Criteria – Scheduling Algorithms. (5)

PROCESS SYNCHRONIZATION: Concurrent Process – Principles of Concurrency – Race Condition - Mutual Exclusion – Critical section problems – Software support – Hardware Support – Operating System Support – Deadlock: Deadlock Prevention, Avoidance and Detection and recovery. (5)

MEMORY MANAGEMENT: Memory hierarchy – Linking and Loading the process – Memory Management requirement - Fixed partitioning - Dynamic partitioning – Buddy Systems – Simple paging – Multilevel paging – Inverted paging – Simple Segmentation – segmentation and paging. (7)

VIRTUAL MEMORY MANAGEMENT: Need for Virtual Memory management – Demand Paging –Copy on write - Page Fault handling – Demand Segmentation – Combined demand segmentation and paging –Thrashing- working set model. (5)

FILE SYSTEM MANAGEMENT: Files – Access methods - File System Architecture – Functions of File Management –Directory and disk structure – file sharing –File system implementation – directory implementation - File Allocation – free space management. (6)

I/O MANAGEMENT AND DISK SCHEDULING: Organization of I/O function – Evolution of I/O function – Types of I/O devices – Logical Structure of I/O functions – I/O Buffering – Disk I/O – Disk Scheduling algorithms – Disk Cache. (5)

Total L:45

TEXT BOOKS:

1. Silberschatz A, Galvin, PB. and Gagne, G. “Operating System Concepts Essentials”, John Wiley,2014.
2. Elmasri, E., Carrick A.G. and Levine, D. “Operating Systems: A Spiral Approach”, McGraw Hill, 2012.

REFERENCES:

1. William Stallings, “Operating Systems”, Pearson Education, 2014.
2. McHoes, A M and Flynn, I.M. “Understanding Operating Systems”, Cengage Learning, 2013.
3. Dhamdhere D M, “Operating Systems: A Concept-based Approach”, McGraw-Hill, 2012.
4. Andrew S Tanenbaum, "Modern Operating System", Prentice Hall, 2015.

15XT45 COMPUTER NETWORKS AND TCP/IP

3 0 0 3

INTRODUCTION: Network goals - Applications of Networks - Design issues for the layers - OSI Reference Model - Types of Network - Network Topologies- Analog and Digital data transmission- Data encoding- Bandwidth and data rate-.Bit Rate, Baud Rate- Sampling Rate. (6)

TRANSMISSION OF DIGITAL DATA: Transmission Impairments - Single and Multiple bit error correction-Error Detection and Correction - Cyclic Redundancy Check Code -.Hamming Code. (4)

DATA COMMUNICATION: Multiplexing - Synchronous and Asynchronous TDM – FDM –CDM - Switching, Circuit Switching, Packet Switching. (4)

DATA LINK CONTROL AND PROTOCOLS: Line Discipline - Flow Control - Sliding Window Protocol - Error Control - Automatic Repeat Request – Stop and wait - ARQ - Go back by n ARQ - Selective Reject ARQ. (5)

LOCAL AREA NETWORKS: Random Access protocols- Ethernet – Fast Ethernet – Gigabit Ethernet – Wireless LANs- Internetworking-LAN -LAN Connections – Repeaters- Hubs - Bridge – Spanning tree-Switches – Routers. (6)

TCP/IP: TCP/IP Protocol Structure - Internet Protocol – IP addressing-ICMP-ARP-BOOTP-DHCP- Transport layer- TCP concepts-Port number-UDP – TCP-UDP Vs TCP. (8)

ROUTING AND CONGESTION CONTROL: Distance vector routing _ Link state Routing – RIP – OSPF- Congestion control- TCP congestion control- Rate limiting and traffic shaping. (7)

APPLICATIONS: FTP, SMTP - MIME Format, DNS, HTTP- Content distribution networks. (5)

Total L:45

TEXT BOOKS:

1. Behrouz A Forouzan, “Data Communications and Networking”, Tata McGrawHill, 2013.
2. Behrouz A Forouzan, “TCP/ IP Protocol Suite”, Tata McGraw Hill, 2010.

REFERENCES:

1. Kevin Fall R and Richard Stevens W, "TCP/IP Illustrated, Volume 1: The Protocols”, Addison-Wesley, 2011.
2. James F Kurose and Keith Ross, “Computer Networking: A Top-Down Approach”, Pearson Addison-Wesley, 2012.
3. Douglas Comer, “Internetworking with TCP/IP”, Prentice Hall, 2013.
4. William Stallings, "Data and Computer Communications", Pearson, 2013.

15XT46 OPTIMIZATION TECHNIQUES WITH R LAB

0 0 4 2

1. Solving inequalities using Simplex, Two-phase, Dual simplex methods, Revised simplex method.
2. Finding initial basic feasible solution using (i) North-West corner rule(ii) Matrix minimum and (iii) Vogel’s approximation method and also perform optimalitytest using MODI method.
3. Solving Assignment problem using Hungarian method.
4. Gomory;s cutting plane methods for all IPP and mixed IPP.
5. Solving Dynamic Programming problems.
6. Critical path for the given PERT and CPM networks.

Total P:60

15XT47 OPERATING SYSTEMS LAB (LINUX)

0 0 4 2

Linux - History - General structure - Unix file system - file abstraction, directories, mount points, implementation details - Processes: memory image, life cycle, start of day. The shell: basic operation, commands, standard I/O, redirection, pipes, signals. Character and block I/O. Process scheduling.

1. Overview of an Operating System, Boots and Shutdown
2. UNIX File System Commands
3. UNIX Commands
4. SHELL Programming
5. Programs using UNIX System Calls
6. Process Creation and Execution
7. Thread Creation and Execution
8. Process / Thread Synchronization using semaphore
9. Developing Application using Inter Process communication (using sharedmemory, pipes or message queues)
10. Implementation of Memory Management Schemes
11. Creating Linux Modules

Total P:60

TEXT BOOKS:

1. Neil Matthew and Richard Stones, “Beginning Linux programming”, John Wiley, 2011.
2. Dale Doughherty and Arnold Robbins, “SED & AWK programming”, O’Reilly, 2010.
3. Kay A Robbins and Steven Robbins, “UNIX System programming Communication, Concurrency and Threads”, Pearson Education, 2008.

REFERENCES:

1. Das and Sumitabha , “Unix Concepts And Applications”, Tata McGrawHill, 2006.
2. Richard Stevens W, “UNIX Network Programming”, Pearson Education, 2010.

15XT48 COMPUTER NETWORKS AND TCP/IP LAB

0 0 4 2

1. Familiarize with NS2 simulator
2. Implement Hamming code and CRC check using TCL/tk or Python
3. Implement a primitive email server
4. Familiarize with packet capturing tools in Java and Wireshark
5. Implement a simple firewall system

6. Analyse the existing routing protocols and implement any one of them
7. Write a program where a single entity can communicate with other entities by using IP-multicasting.
8. Assignments using the network simulator

Total P:60

SEMESTER– 5

15XT51 THEORY OF COMPUTING

4 0 0 4

FORMAL LANGUAGES: Four classes of grammar – Regular set – Context free language – Generation trees – Ambiguity – Normal forms (Chomsky and Greibach) – Pumping Lemma. (12)

FINITE AUTOMATA: Finite State Automata – NDFA – Conversion of NDFA to DFA – regular expressions - Equivalence of regular grammar and finite automata, State minimization. (10)

PUSH DOWN AUTOMATA: Definition – Acceptance by final state and empty stack – Equivalence of acceptance by final state and empty stack – Equivalence of PDA and CFL – Definition of DPDA - pumping lemma. (12)

TURING MACHINE: Definition – Models – Construction of a simple turing machine- Programming techniques for turing machine – Extension to the basic turing machine – Restricted turing machine – Turing machine and computers – Halting problem. (14)

UNSOLVABLE PROBLEM AND COMPUTATIONAL FUNCTIONS: Unsolvable problems – Primitive recursive function – recursively enumerable language – Universal Turing machine – Tractable and intractable problems - P and NP problems. (12)

Total L:60

TEXT BOOKS:
1. John C Martin, “Introduction to Languages and the Theory of Computation”, McGraw Hill, 2014.
2. John E Hopcroft, Jeffrey D Ullman and Rajeev Motwani, "Introduction to Automata Theory, Languages and Computation", Pearson Education, 2014.

REFERENCES:
1. Peter Linz, “Introduction to Formal Languages and Automata”, Jones & Bartlett, 2011.
2. Michael Sipser, “Introduction to Theory of Computation”, Cengage Learning, 2013.
3. Mishra KLP, Chandrasekaran N, “Theory of Computer Science: Automata Languages and Computation”, Prentice Hall, 2014.

15XT52 COMPUTATIONAL NUMBER THEORY AND CRYPTOGRAPHY

4 0 0 4

BASICS OF NUMBER THEORY: Divisibility and Primality – Greatest common divisors - Euclidean and Extended Euclidean algorithms, Modular arithmetic- Computing modular inverse – modular exponentiation- efficient algorithms, Congruence’s – Basic properties – Solving linear congruence’s – Residue classes - Chinese remainder theorem - Euler’s Phi function – Euler’s theorem – Fermat’s little theorem, generators and primitive roots in groups – Discrete logarithm. (15)

BASIC CRYPTOGRAPHIC TECHNIQUES: Encryption and Decryption, Classical ciphers- Shift cipher - Substitution ciphers-Affine ciphers - Polyalphabetic ciphers – one time pad – Vigenere cipher – Hill cipher – Permutation cipher - transposition cipher – Crypt analysis of classical ciphers. (8)

SYMMETRIC KEY CRYPTOGRAPHY: Stream cipher – LFSR stream cipher, Block ciphers – DES – AES– Modes of operation. (6)

PUBLIC KEY CRYPTOGRAPHY: Concept of public key cryptography – RSA cryptosystem- cryptanalysis against RSA- the RSA problem –Primality testing -Legendre and Jacobi symbols – quadratic residues – Miller Rabin algorithm - Integer factorization problem, Discrete log problem, ElGamal cryptosystem, Elliptic curve cryptosystem, need for stronger security notions for public key cryptography, random oracle model. (10)

DATA INTEGRITY TECHNIQUES : Symmetric techniques- Cryptographic hash functions – MAC, asymmetric techniques – Digital signatures – RSA signature, ElGamal signature, Digital signature standard algorithm, strong security notion for digital signatures- provable security for ElGamal signature. (11)

AUTHENTICATION AND KEY DISTRIBUTION PROTOCOLS: Data origin authentication and entity authentication, challenge and response-certificates,**S**chnorr identification scheme, zero knowledge protocol, Diffie-Hellman key pre-distribution, session key distribution – The Needham Schroeder scheme, Kerberos, Diffie- Hellman key agreement scheme, man in the middle attack, station to station key agreement protocol. (10)

Total L:60

TEXT BOOKS:
1. Victor Shoup, “A Computational introduction to Number Theory and Algebra”, Cambridge University Press, 2009.
2. Douglas R Stinson, “Cryptography Theory and Practice”, CRC Press,2006.
3. Wenbo Mao,” Modern Cryptography- Theory and Practice”, Pearson Education, 2008.

REFERENCES:
1. Neal Koblitz, “A course in Number Theory and Cryptography”, Springer, 2012.
2. Behrouz. A Forouzan, “ Introduction to Cryptography and Network Security”, Tata McGraw Hill, 2008
3. Alfred J, Menezes, Paul C, Van Oorschot and Scott A Vanstone, “Hand Book of Applied Cryptography”, CRC Press, 2010.

15XT53 DATABASE DESIGN

3 0 0 3

BASIC CONCEPTS : Introduction to databases – Conventional file processing – Data Modeling for a database – Three level architecture – Data Independence – Components of a Database Management System (DBMS) – Advantages and disadvantages of DBMS – System Environment – Users of DBMS. (7)

DATA MODELS : Introduction – Data Associations – entities, attributes, relationships – Entity Relationship data models and ERDiagrams(ERD) – Generalization – Aggregation – Conversion of ERD into tables – Applications – Introduction to Network and Hierarchical data models. (8)

FILE ORGANIZATION : Storage device characteristics – Constituents of a file – Operations on file - Serial files – Sequential files – Index Sequential files – Direct files – Binary and Secondary key retrieval – Indexing using Tree structures. (7)

RELATIONAL MODEL : Introduction – Relational databases – Introduction to Relational Algebra – Relational algebra queries. (4)

RELATIONAL DATABASE MANIPULATION: Structured Query Language (SQL) - Basic data retrieval – SQL Joins - Views and update - Query Processing. (6)

DATA BASE DESIGN THEORY: Functional dependencies – axioms – Normal forms based on primary keys – Second Normal form Third Normal form, Boyce – Codd Normal form - Multivalued dependencies – Fourth Normal form – Data base design process – Database Tuning. (6)

DATABASE SECURITY, INTEGRITY AND CONTROL: Security and Integrity threats – Access Controls and measures, Defense mechanisms-Transaction management, and concurrency control mechanisms. (7)

Total L:45

TEXT BOOKS:
1. Elmasri R and Navathe SB, “Fundamentals of Database Systems”, Pearson Education, 2015.
2. Silberschatz A, Korth H and Sudarshan S, “Database System Concepts”, McGraw Hill, 2011.

REFERENCES:
1. Bipin.C.Desai, “An Introduction to Database System ‘’, Galgotia Publisher, 2012.
2. Raghu Ramakrishnan and Johannes Gehrke, “Database Management System”, McGraw Hill, 2010.

15XT54 DESIGN AND ANALYSIS OF ALGORITHMS

3 0 0 3

INTRODUCTION: Fundamentals of algorithmic problem solving, deciding an appropriate data structure and algorithm design technique – Methods of specifying an algorithm – proving the correctness – analyzing an algorithm, Asymptotic notations, Recurrences – Master theorem. (6)

DIVIDE AND CONQUER: Quick sort , Merge sort**,** Integer multiplication, Strassen’s matrix multiplication, closest pair. (5)

GREEDY METHOD: Optimal caching, minimum cost spanning tree. (Kruskal and Prim’s algorithms) , topological sorting , Huffman codes and data compression. (6)

DYNAMIC PROGRAMMING: Principles of dynamic programming – 0/1 knapsack problem, all pairs shortest problem, optimal binary search trees. (6)

STRING MATCHING : The Naïve Method, Rabin – Karp Algorithm , The Knuth – Morris – Pratt Algorithm. (4)

NETWORK FLOW: Flow networks and Flows – Network with multiple sources and working with flows, The Ford - Fulkerson Method, Augmenting paths, Max- Flow min - cut theorem, The Edmonds - Karp algorithm. (4)

NP AND COMPUTATIONAL INTRACTABILITY: Basic concepts – Polynomial time reductions, efficient certification and NP, NP hard and

NP complete problems – CO-NP and the asymmetry of NP, Examples, PSPACE-some hard problems in PSPACE- Proving problems PSPACE – complete. (6)

COPING WITH NP-COMPLETENESS: Backtracking: n- queens problem, Graph coloring problem, Branch and bound Assignment problem , Traveling salesman problem: Approximation algorithm – Introduction – traveling salesman problem-0/1 Knapsack problem. (8)

Total L:45

TEXT BOOKS:
1. Thomas H. Cormen, Charles E Leiserson, and Ronald LRivest, "Introduction to Algorithms", MIT Press, 2009.
2. Jon Kleinberg and Eve Tardos, "Algorithm Design", Pearson Education, 2012.

REFERENCES:
1. AnanyLevitin, " Introduction to design and analysis of algorithm", Pearson Education, 2011.
2. Michael T. Goodrich, Roberto Tamassia, "Algorithms Design, Foundations, analysis and Internet Examples", Wiley, 2013.

15XT56 JAVA PROGRAMMING LAB

0 0 4 2

JAVA PROGRAMMING: Introduction - Data Types - Operators - Declarations - Control Structures - Arrays and Strings - Input/Output- Java Classes - Fundamentals - Methods - Constructors - Scope rules - this keyword - object based vs oriented programming – Inheritance- Reusability - Composing class - Method overloading - Abstract classes - Virtual Functions.

PACKAGES AND INTERFACES: Packages - Access protection - Importing packages - Interface - Defining and Implementing Interface - Applying Interface - Variables in Interfaces.

EXCEPTION HANDLING: Fundamentals - Exception types - Uncaught Exception - Using Try and Catch - Multiple catch clauses - Nested Try statements - Throw - Throws - Java Built-in Exception - Creating your own subclasses.

MULTI THREADED PROGRAMMING: Java thread model - Priorities - Synchronization - Messaging - Thread class and runnable Interface - Main thread - Creating the Thread - Synchronization - Interthread Communication - Deadlock.

I/O, APPLETS: I/O basics - Stream - Stream Classes - Predefined stream - Reading/Writing console input - Applet fundamentals - Native methods.- GUI Components - Applets - Java Scripts –Swing.

NEW FEATURES IN J2SE V5.0: Generics – Enhanced for Loop – Autobox – Auto unboxing – Enums – Varargs – Static import – Annotations – Collections Frame works – List – Set - Map

TEXT BOOK:
1. Herbert Schildt, "Java: the Complete Reference", McGrawHill, 2014.

REFERENCES:
1. Joyce Farrell , "Java Programming", Cengage Learning, 2015.
2. Patrick Naughton and Herbert Schildt, "JAVA - The Complete Reference", McGraw Hill,2011.
3. Deitel and Deitel, "JAVA - How to Program", Prentice Hall, 2010.
4. Douglas Lea, "Concurrent Programming in Java: Design Principles and Patterns", Addison-Wesley, 2000.

PRACTICALS:
1. To create runtime polymorphism using abstract class, interface.
2. To create callback feature using interface.
3. To create a program for interface inheritance.
4. To implement a user defined package.
5. To implement a user defined checked exception and unchecked exception.
6. To create threads, thread groups.
7. To create inter-thread communication using shared memory, piper stream.
8. To implement socket connections (UDP, TCP).

Total P:60

15XT57 RDBMS LAB

0 0 4 2

Implement the following problems using SQL – ORACLE, SQL SERVER:

1. Working with DDL commands in SQL.
2. Working with DML commands to construct / update / fetch records from single / multiple tables
3. Working with PL/SQL – Functions, Stored procedures, Triggers etc.

4. Develop a Package using RDBMS features.

List of experiments (Problem Sheets) will be given and Package (using appropriate Front-End) will be developed.

Total P:60

15XT58 DESIGN AND ANALYSIS OF ALGORITHMS LAB

0 0 4 2

Implement the following:

1. Problem using closest pair algorithm.
2. Prim's minimum cost spanning tree.
3. Kruskal'sminimum cost spanning tree using min heap data structure, union and find operation.
4. Problem related to topological sorting.
5. Application of all pairs shortest path problem.
6. Optimal binary search tree.
7. Optimal caching.
8. Application of graph coloring using back tracking.
9. TSP using branch – and – bound.
10. Rabin-Karp Algorithm.

Total P:60

SEMESTER – 6

15XT61 MACHINE LEARNING

3 2 0 4

INTRODUCTION - Supervised learning - Supervised learning setup - Regression – Linear regression – polynomial regression – multiple regression. (8)

CLASSIFICATION - Perceptron - Logistic regression- Exponential family- Generative learning algorithms- Gaussian discriminant analysis- Naive Bayes –- Support vector machines - K-Nearest Neighbours. (8)

Decision tree – Linear Discriminant Analysis - Model selection and feature selection - Evaluating and debugging learning algorithms- Maximum likelihood estimation – parametric classification. (7)

LEARNING THEORY - Bias/variance tradeoff. Union and Chernoff/Hoeffding bounds - VC dimension – PAC Learning - Worst case (online) learning. (3)

UNSUPERVISED LEARNING– Clustering - K-means – EM - Mixture of Gaussians - Factor analysis - PCA (Principal components analysis) - ICA (Independent components analysis) – Cluster validity measures. (4)

REINFORCEMENT LEARNING AND CONTROL – MarkovianDecison Process - Bellman equations - Value iteration and policy iteration - Linear quadratic regulation (LQR). LQG. - Q-learning. Value function approximation - Policy search. (8)

SEMI SUPERVISED LEARNING– Introduction – Taxonomy - Graph based methods - collective classification – label propagation - TransductiveSVM. (7)

TUTORIAL PRACTICE:

1. Download the datasets from UCI machine learning repository / www.kaggle.com for classification and clustering.
2. Implement the following Classification algorithms for the above datasets.
    a. Naïve Baye's Algorithm
    b. Decision tree
    c. SVM
    d. K nearest neighbor
    e. Neural network
3. Do tenfold cross validation experiments and statistical validation using t-test and ANOVA.
4. Implement different clustering techniques.
5. Collective classification
6. Reinforcement learning
7. Statistical validation of techniques using ANOVA and t-test.

Total L:45+T:30 =75

TEXT BOOKS:

1. AlpaydinEthem, "Introduction to Machine Learning", MIT Press, 2009.
2. Steven Abney, "Semisupervised Learning for Computational Linguistics", Chapman & Hall, 2007.
3. Richard S. Sutton and Andrew G Barto, "Reinforcement Learning – An Introduction" , MIT Press, 2010.

4. Oliver Chappelle, Bernhard Scholkopf and Alexander Zien, “Semisupervised Learning”, MIT Press, 2006.

REFERENCES:

1. Trevor Hastie, Robert Tibshirani and Jerome Friedman, “The Elements of Statistical Learning”, Springer, 2013.
2. David Barber, “ Machine Learning: A Probabilistic Approach”, http://www.idiap.ch/~barber, 2006.
3. Richard O Duda, Peter E Hart and David G Stork, “Pattern Classification”, John Wiley, 2012.
4. Christopher M Bishop, “Pattern Recognition and Machine Learning”, Springer, 2013.

15XT62 COMPUTER GRAPHICS AND VISUALIZATION

3 0 0 3

GRAPHICS INPUT - OUTPUT DEVICES: Raster scan Displays - Random scan displays - Direct view storage tubes - Flat panel displays - Mouse - Track Ball - Joy Stick - Digitizers - Touch panels - LCD. Graphical User Interface and Interactive Input Methods: The user dialog - Input of graphical data - Input function - Interactive picture construction techniques - Virtual reality environments. (4)

OPENGL: Architecture, The OpenGL API, Primitives and Attributes, Color, Viewing, Control Functions, Programming Event-Driven Input, Transformations, OpenGL Extensions. (4)

TWO DIMENSIONAL GRAPHICS: Basic transformations - Matrix representation and homogeneous coordinates - Composite transformations - Line drawing algorithms: DDA and Bresenham's algorithms - Circle generation algorithms: Midpoint circle algorithm - Point clipping - Line clipping: Cohen Sutherland algorithm - Polygon clipping: Sutherland Hodgeman algorithm - Line covering. (8)

RASTER GRAPHICS: Fundamentals: generating a raster image, representing a raster image, scan converting a line drawing, displaying characters, speed of scan conversion, natural images - Solid area scan conversion: Scan conversion of polygons,Y-X algorithm, properties of scan conversion algorithms - Interactive raster graphics: painting model, moving parts of an image, feedback images. (8)

CURVES AND SURFACES: Parametric representation of curves - Bezier curves – B-Spline curves - Parametric representation of surfaces - Bezier surfaces - Curved surfaces - Ruled surfaces - Quadric surfaces – Concatenation of two curve segments – Order of Continuity.(5)

IMAGE PROCESSING FUNDAMENTALS: Sampling and Quantization, Image Enhancement - Histogram Processing, Filtering, Edge Detection, Image Transforms. (8)

THREE DIMENSIONAL GRAPHICS: 3D transformations - Viewing 3D graphical data - Orthographic, oblique, perspective projections - Hidden lines and hidden surface removal. (4)

FRACTAL-GEOMETRY METHODS: Tiling the plane - Recursively defined curves - Koch curves - C curves - Dragons - Space filling curves - Fractals - Grammar based models - Graftals - Turtle graphics - Ray tracing. (4)

Total L:45

TEXT BOOKS:

1. Donald Hearn and Pauline Baker M, "Computer Graphics", Pearson Education, 2011.
2. William M. Newmann, Robert F Sproull, “Principles of Interactive Computer Graphics”, Tata McGraw Hill, 2014.
3. Angel, “Interactive Computer Graphics- A top down approach with OpenGL”, Pearson Education, 2014.

REFERENCES:

1. Foley James D, VandamAndries and Hughes John F, "Computer Graphics: Principles and Practice", Addison-Wesley, 2006.
2. Rafael C Gonzalez., and Richard Eugene Woods, “Digital Image Processing”, Pearson Education, 2013.
3. Solomon, C., andBreckon, T,“Fundamentals of Digital Image Processing: A practical approach with examples in MATLAB”, John Wiley, 2011.
4. Donald Hearn and Pauline Baker M, “Computer graphics with OpenGL”, Pearson Education,2011.
5. F S Hill, “Computer Graphics Using OpenGL”, Prentice Hall, 2007.

15XT63 PRINCIPLES OF COMPILER DESIGN

3 0 0 3

SYSTEMS PROGRAMMING : Language Processors – Data Structures for Language Processing – Introduction to Assemblers, Macro processors, Interpreters - Linkers and Loaders - its need and working. (7)

COMPILERS – Introduction – phases of a compiler – Bootstrapping – Compiler writing tools. (2)

LEXICAL ANALYSIS: Role of a Lexical Analyzer – Finite Automata – Regular Expressions to Finite Automata – Minimizing the number of states of a Deterministic Finite Automata – Implementation of a lexical analyzer. (6)

PARSING TECHNIQUES: Context free grammars – Derivations and parse trees – Ambiguity – Capabilities of context free grammars. Top down and bottom up parsing – Handles – Shift reduce parsing – Operator precedence parsing – Recursive descent parsing -Predictive

parsing. (9)

AUTOMATIC PARSING TECHNIQUES: LR parsers – Canonical collection of LR(0) items – Construction of SLR parsing tables – LR(1) sets of items construction. (6)

SYNTAX DIRECTED TRANSLATION AND INTERMEDIATE CODE: Semantic actions – Implementations of syntax directed translators – Postfix notation, Quadruples, triples , indirect triples –Methods of translation of assignment statements, Boolean expression and control statements - Representing information in a symbol table. (9)

CODE OPTIMIZATION: Introduction to code optimization – basic blocks – DAG representation – error detection andrecovery - code generation. (6)

Total L:45

TEXT BOOKS:

1. John J. Donovan, "Systems Programming", McGraw Hill , 2012.
2. Aho A.V, Monica S Lam, Ravi Sethi and Ullman J.D., "Compilers : Principles, Techniques and Tools", Pearson Addison Wesley, 2008.

REFERENCES:

1. Dhamdhere D.M., "Systems Programming", Tata McGraw Hill, 2011.
2. Keith Cooper, Linda Torczon, "Engineering a Compiler", Morgan Kaufman Publishers, 2011.

15XT64 SECURITY IN COMPUTING

3 0 0 3

INTRODUCTION: Security concepts –Threats- Attacks, Services and Mechanisms - attacks and defenses on Computer systems – Counter measures.- Risk management, corrective action, risk assessment. (2)

INTRUSION DETECTION: Principles –Models- Architecture- Intrusion Detection and response- Vulnerability Analysis - description of threats, vulnerabilities and exploiting vulnerabilities. (3)

PROGRAM SECURITY: Malicious and non-Malicious programs – Trojan horses- viruses- worms and other malicious code – Targeted Malicious code –Bug exploits -Buffer overflows- Fast flux - Covert channels -Defense mechanisms. (8)

(8)

APPLICATION SECURITY : Email security – PGP – Key rings – PGP certificates – S/MIME – Web Security – Cross site scripting – SQL injection attacks – Defense methods. (6)

SECURITY AT TRANSPORT LAYER: Session integrity for web applications- Secure session management - SSL Architecture – Four protocols – SSL message formats – TLS – Session hijacking. (6)

SECURITY AT NETWORK LAYER:, Network Layer Threats and security controls –Security problems in TCP/IP protocol suite – DNS Cache poisoning - IPSec – modes – security protocols – SA – Internet key exchange -- firewalls –VPN . (5)

OS SECURITY: Security Policies – Types -– Access control – Access control matrix - Separation of duties - Models of security - Confidentiality Policies - Bell-LaPadula model -Multi-level security - Operating system integrity -Biba model -Clark-Wilson model - Security policies on information flow models and mechanisms - Interdependence between information security and operations security - Memory and Address protection– file protection mechanisms – User authentication – Trusted OS design. (8)

DATABASE SECURITY: Security Requirements – Reliability and Integrity – Sensitive data – Multilevel Databases - Privacy in Databases – Inference - Privacy aspects of data mining. (4)

SOCIETAL ISSUES IN COMPUTER SECUIRTY: Digital Rights Management (DRM)- Digital forensics – Incident response and Forensic Analysis. (3)

Total L:45

TEXT BOOKS:

1. Joseph MiggaKizza, "A guide to Computer Network Security", Springer, 2009.
2. Roberta Bragg, Mark Rhodes, Keith Strass Berg J, "Network Security - The complete reference", Tata McGraw Hill, 2007.
3. Matt Bishop, "Introduction to Computer security", Pearson Education, 2009.
4. BehrouzA. Forouzan, "Cryptography and Network Security", Tata McGraw Hill, 2008.

REFERENCES:

1. William Stallings, "Cryptography and Network Security: Principles and Practice", Pearson Education, 2014.

2. Charles P. Pfleegerand Lawrence Pfleeger,"Security in Computing", Pearson Education, 2006
3. Jaegar A, "Operating Systems Security – Synthesis Lectures on Information Security, Privacy and Trust", Morgan & Claypool Publishers, 2008.
4. Michael T. Goodrich and Roberto Tamassia, "Introduction to Computer Security" , Addison Wesley, 2011.

15XT66 COMPUTER GRAPHICS AND VISUALIZATION LAB

0 0 4 2

1. Drawing a line, circle using algorithms.
2. Implementation of 2D Transformations (translation, scaling, rotation).
3. Window – viewport simulation with various aspect ratios.
4. Polygon clipping and line clipping using algorithms.
5. Drawing a 2D curve using Bezier generation.
6. Drawing a 2D curve using B-Spline generation.
7. Model a primitive (car / Aircraft) with OpenGL API.
8. Simulate the primitive.
9. Animate the primitive.

Note: Algorithms in Computer Graphics have to be implemented by the studentusing C++/ OpenGL. (Wherever applicable).

Total P:60

15XT67 COMPILER DESIGN LAB

0 0 4 2

1. Implementation of Transition diagram to strip off comment statements from a given source file.
2. Design and Implementation of a Symbol Table Manager.
3. Implementation of following parsing algorithms.
    a. Recursive descent Parser
    b. Shift reduce parser
    c. Operator Precedence Parser
4. Implementation of the Syntax directed translation Engine to
    a. Simulate Desk Calculator.
    b. Generation of Postfix code.
    c. Post and Pre Code Optimizer.
5. Using LEX and YACC under UNIX environment for compiler design related problems.
6. Using JavaCC tool for designing syntax checker.
7. Case study : Working with following open source compliers.
   open jdk, gcc.

Total P:60

15XT68 SECURITY IN COMPUTING LAB

0 0 4 2

1. Design of a Client server application for a basic cryptosystem.
2. Performing a frequency analysis attack on a cipher text enciphered with Affine cipher.
3. Detection of a Buffer overflow attack.
4. Packet Sniffing using Wireshark Tool to perform the traffic analysis attack.
5. Generation of keys using pseudorandom generators.
6. Key distribution using RSA(KDC) – Key hacking.
7. Key exchange using Diffie- Hellman technique – MITM attack.
8. Authentication of File transfer using Hashing / Message digest.
9. Digital signature, generation and verification.
10. Password authentication.
11. Transaction security using SQL Injection attacks.
12. Port scanning tools.
13. Performing attacks and testing with attack tools.
14. Security testing for Web applications.

Total P:60

SEMESTER – 7

15XTP1 PROJECT WORK 1 – INDUSTRY / RESEARCH PROJECT

0 0 –12

SEMESTER – 8

15XT81 GAME THEORY

3 0 0 3

INTRODUCTION: Game theory the theory of rational choice – Interacting decision makers. (2)

NASHEQUILIBRIUM: Strategic games – Best response – Dominance – Examples from economics, business, environment, military - Symmetric games and symmetric equilibria. Illustrations: Cournot's model of oligopoly, Electoral competition. (7)

MIXED STRATEGIES: Dominance – Equilibrium – Illustrations: Expert diagnosis, Reporting a crime – Formation of players' beliefs. (5)

EXTENSIVE GAMES WITH PERFECT INFORMATION: Strategies and outcomes – Nash equilibrium – Subgame perfect equilibrium - Stackelberg's model of duopoly, Buying votes – Illustrations: Entry into a monopolized industry, Electoral competition with strategic voters, Committee decision making. (7)

GAMES WITH IMPERFECT INFORMATION: Bayesian games – Examples – Strategic information – Transmission – Agenda Control with imperfect Information – Signaling games - Education as a signal of ability. (8)

REPEATED GAMES: The prisoner's dilemma – Finitely repeated and infinitely repeated – Strategies – Nash equilibrium – Subgame – Perfect equilibria and the one – deviation – Property – General results – Finitely replaced games – Variation on a theme: Imperfect observability. (8)

INTRODUCTION TO ALGORITHMIC GAME THEORY: Auction and mechanism design basics - the Vickrey auction - Sponsored Search Auction - Social choice theory - VCG mechanism. Algorithmic Aspects of Equilibria: Existence and computational complexity equilibria - Market Equilibrium - Correlated Equilibrium. (8)

Total L:45

TEXT BOOKS:

1. Martin J Osborne, "An Introduction to Game Theory", Oxford University Press, 2004.
2. Vijay Krishna, "Auction Theory", Academic Press, 2009.

REFERENCES:

1. Joel Watson, 'Strategy: An Introduction to Game Theory', W. W. Norton & Company, 2013.
2. Steven Tadelis, 'Game Theory: An Introduction', Princeton University Press, 2013.
3. David Easley, Jon Kleinberg, "Networks, Crowds, and Markets: Reasoning About a Highly ConnectedWorld", Cambridge University Press, 2010.
4. Matthew O. Jackson, "Social and Economic Networks", Princeton University Press, 2008.
5. N. Nisan, T. Roughgarden, E. Tardos, V. Vazirani, "Algorithmic Game Theory", Cambridge University Press, 2007.

15XT82 PARALLEL AND DISTRIBUTED COMPUTING

3 0 0 3

INTRODUCTION: Concepts and Terminology – Generic Processor / ASIC Processor Architecture – Pipeline Architecture – Instruction Set Architecture - Types of Parallelism - Flynn's Classical Taxonomy – Terminology . (5)

PARALLEL COMPUTER MEMORY ARCHITECTURES: Shared Memory - Distributed Memory -Hybrid Distributed-Shared Memory Multiprocessors: Communication and Memory issues - Message Passing Architectures - Vector Processing and SIMD Architectures. (5)

PARALLEL PROGRAMMING MODELS: Overview -Shared Memory Model - Threads Model - Message Passing Model - Data Parallel Model - Other Models. (4)

DESIGNING PARALLEL PROGRAMS: Automatic vs. Manual Parallelization - Understand the Problem and the Program - Partitioning - Communications - Synchronization -Data Dependencies - Load Balancing -Granularity -I/O -Limits and Costs of Parallel Programming - Performance Analysis and Tuning - Parallel Examples -Array Processing - Compiler Transformation techniques for High performance computing: - Transformations for parallel Machines. (8)

PRAM ALGORITHMS& BSP: PRAM model of computation- Work-Time formalism and Brent's Theorem; algorithm design techniques-parallel prefix, pointer jumping, Euler tours, divide and conquer, symmetry breaking; survey of data-parallel algorithms; relative power of PRAM models - Bulk synchronous parallel model. (6)

HIGH PERFORMANCE COMPUTING ARCHITECTURES - Latency Hiding Architectures -Multithreading Architectures -Dataflow

Architectures - **GPGPU Architecture-** Overview of basic Accelerators /GPU / GPGPU and itsprogramming model – CUDA - OpenCL. (8)

DISTRIBUTED COMPUTING: Introduction -- Definitions, motivation - Communication Mechanisms - Communication protocols,-RPC-RMI.**HadoopArchitecture:**History of HadoopHadoop Background-Architecture-Hadoop and RDBMS-Subprojects-Distributions-Documentation.**Hadoop Distributed File System (HDFS)**: HDFS Clusters – NameNodes,
Data Nodes & Clients - **MapReduce :-**Processing & Generating large data sets, Map functions, Programming MapReduce using SQL / Bash / Python, Parallel Processing, Failover. (9)

Total L : 45

TEXT BOOKS:

1. Michael J Quinn, " Parallel Computing : Theory And Practice", Tata Mcgraw-Hill,2004.
2. Joel M.Crichlow," Distributed And Parallel Computing" , Prentice Hall, 2007.
3. Andrew S. Tanenbaum and Maarten van Steen, " Distributed Systems, Principles and Paradigm", Prentice Hall, 2013.
4. Jason Sanders, Edward Kandrot, "CUDA by Example: An Introduction to General-Purpose GPU Programming", Pearson Education, 2011.

REFERENCES:

1. Lynch N.N., "Distributed Algorithms", Morgan Kaufmann, 2010.
2. Vijay K Garg, "Elements of Distributed Computing", Wiley 2014.
3. Shane Cook , "CUDA Programming: A Developer's Guide to Parallel Computing with GPUs (Applications of GPU Computing)", Elsevier, 2013
4. Tom White, "Hadoop Definitive Guide", O'Reily, 2012.
5. SrinathPerera, ThilinaGunarathne, "Mapreduce Cook book", Packy Publishing, 2013.
6. David F. Bacon, Susan L. Graham and Oliver J. Sharp, "Compiler Transformations for High Performance Computing", Technical report, 1994.

15XT83 MATHEMATICAL MODELLING

3 0 0 3

INTRODUCTION TO MODELING: Modeling process, Overview of different kinds of model. (3)

EMPIRICAL MODELING WITH DATA FITTING: Error function, least squares method; fitting data with polynomials and splines. (4)

CAUSAL MODELING AND FORECASTING: Introduction, Modeling the causal time series, forecasting by regression analysis, predictions by regression. Planning, development and maintenance of linear models, trend analysis, modeling seasonality and trend, trend removal and cyclical analysis, decomposition analysis. Modeling financial time series. Econometrics and time series models. Non seasonal models: ARIMA process for univariate and multivariate. (8)

PORTFOLIO MODELING AND ANALYSIS: Portfolios, returns and risk, risk-reward analysis, asset pricing models, mean variance portfolio optimization, Markowitz model and efficient frontier calculation algorithm, Capital Asset Pricing Models (CAPM). (8)

STOCHASTIC CALCULUS: Brownian motion, martingales, Itô's formula, Itô integral, risk-neutral measure, SDE; Risk-neutral measure, Girsanov's theorem for change of measure. (7)

MODELING WITH BIOINFORMATICS: Introduction, Biological data- types, mode of collection, documentation and submission. Sequence alignment- Definition, significance, dot matrix method, dynamic programming- Global and local alignment tools, scoring matrices and gap penalties. Multiple sequence alignment: Iterative methods. Hidden Markovian models, statistical methods, position specific scoring matrices. (15)

Total L: 45

TEXT BOOKS:

1. Giordano F R, Weir M D and Fox W P,"A First Course in Mathematical Modeling", Brooks/Cole, 2008.
2. Christoffersen P, " Elements of Financial Risk Management", Academic Press, 2012.
3. Capinski M. and ZastawniakT,"Mathematics for Finance: An Introduction to Financial Engineering", Springer, 2010.
4. Mount, DW, "Bioinformatics Sequence and genome analysis ", Cold Spring Harbor Laboratory, 2004.

REFERENCES:

1. Hamdy ATaha, "Operation Research- An Introduction", Pearson Education, 2012.
2. Borovkov K, "Elements of Stochastic Modeling", World Scientific, 2003.
3. Shreve S., "Stochastic Calculus for Finance", Springer, 2004.

15XT86 PARALLEL AND DISTRIBUTED COMPUTING WITH HADOOP ARCHITECTURE LAB

0 0 4 2

1. Basic Master – Worker program and send messages.
2. Write a program to find the summation of largest number in a very larger array of integers. (The contents of the array should be equally distributed to all processes).
3. Write a parallel program in SPMD to calculate the PI value using integral approximation method.
4. Simple Matrix multiplication, Transpose, using parallel algorithm.
5. Select your own choice of very dense computational problem having divide and conquer method and implement it in parallel algorithm. And produce the performance chart with 2, 4, 6 and 8 nodes.
6. Hadoop setup – Map reduce – Programming models – Text mining.

Total P:60

15XT87 OPEN SOURCE SOFTWARE LAB

0 0 4 2

INTRODUCTION: Proprietary Software, Free Software, Open Software, Licenses, Version Control, Explore GitHub – GitHub Workflows, Git Basics, Git Branching, Git on the Server, Distributed Git, GitHub, Git Tools, Customizing Git.

PYTHON PROGRAMMING LANGUAGE: Basic Syntax, Functions, Conditionals and Recursion, Iteration, Strings, Lists, Dictionaries, Tuples, Files, Classes and Objects, Inheritance, CGI, Multithreading, Networking, Python GUI - Tkinter, Distributing Python Modules, Python Standard Library, Django Framework.
RUBY PROGRAMMING LANGUAGE: Foundations and Scaffolding – Ruby Building Blocks, Ruby Ecosystem, The Core of Ruby - Classes, Objects, and Modules, Projects and Libraries, Error Handling, Files and Databases, Files and Databases, Deploying Ruby Applications, Ruby Online – Web Applications Framework, Sinatra, Ramaze, Networking, Sockets, Daemons, Ruby Libraries and Gems.

RUBY ON RAILS: Scaling Rails, rails server, Deploying – Heroku Setup, User Resource, Microposts Resource, Static and Slightly Dynamic Pages, Rails Flavoured Ruby, Filling in the Layout, Modeling Users, Sign Up, Sign In, Sign Out, Updating, Showing, Deleting Users, User Microposts, Following Users.

TEXT BOOKS:

1. Karl Fogel, “Producing Open Source Software: How to Run a Successful Free Software Project”, O'Reilly, 2005.
2. Scott Chacon, “ProGit”, Apress, 2009.
3. Allen B Downey, “Think Python”, O'Reilly, 2012.
4. Peter Cooper, “Beginning Ruby-From Novice to Professional”, Apress, 2009.
5. Michael Hartl, “Ruby on Rails Tutorial”, Addison Wesley, 2012.

REFERENCES:

1. Paul Berry, “Head First Python”, O'Reilly, 2010.
2. David Flanagan, Yukihiro Matsumoto, “The Ruby Programming Language”, O'Reilly, 2008.
3. Barry Burd, “Ruby on Rails for Dummies”, John Wiley Publishers, 2007.

PRACTICALS:

1. Discovering the GitHUb collaboration platform.
2. Lab assignments using NumPy/SciPy, SQLAlchemy, PyTables, PyQt, TreeDict, Sage.
3. Lab exercises in Ruby.
4. Application Development and Deployment using Rails Framework.

TotalP:60

15XT88 RESEARCH SPECIALIZATIONLAB

0 0 4 2

SEMESTER - 9

15XT91 INFORMATION RETRIEVAL

3 0 0 3

INTRODUCTION: Overview of IR Systems - Historical Perspectives - Goals of IR - The impact of the web on IR - The role of artificial intelligence (AI) in IR. (3)

TEXT REPRESENTATION: Statistical Characteristics of Text: Zipf's law; Porter stemmer; morphology; index term selection; using thesauri.**Basic Tokenizing, Indexing:** Simple tokenizing, stop-word removal, and stemming; inverted indices; Data Structure and File

Organization for IR - efficient processing with sparse vectors. (6)

RETRIEVAL MODELS: Similarity Measures and Ranking - Boolean Matching – Extended Boolean models - Ranked retrieval - Vector Space Models -, text-similarity metrics - TF-IDF (term frequency/inverse document frequency) weighting - cosine similarity, Probabilistic Models, Evaluations on benchmark text collections. (8)

QUERY PROCESSING: **Query Operations and Languages**- Query expansion; Experimental Evaluation of IR: Performance metrics: recall, precision, and F-measure. (5)

TEXT CATEGORIZATION AND CLUSTERING: Categorization : Rocchio; Naive Bayes, kNN; Clustering: Agglomerative clustering; k-means; Expectation Maximization (EM); Dimension Reduction: LSI, PCA. (6)

INFORMATION FILTERING TECHNIQUES: introduction to Information Filtering, Relevance Feedback - Applications of Information Filtering: **RECOMMENDER SYSTEMS**: Collaborative filtering and Content-Based recommendation of documents and products. (6)

WEB SEARCH: IR Systems and the WWW - Search Engines: Spidering, Meta Crawlers; Link analysis: Hubs and Authorities, Google PageRank , Duplicate Detection. (5)

INFORMATION EXTRACTION AND INTEGRATION: Extracting data from text; Basic Techniques: NE Recognition, Co-reference Resolution, Relation Extraction, Event Extraction; Extracting and Integrating specialized information on the web, Web Mining and Its Applications. (6)

Total L: 45

TEXT BOOKS:

1. Christopher D. Manning, PrabhakarRaghavan and HinrichSchütze, “Introduction to Information Retrieval”,Cambridge University Press, 2012.
2. Ricardo Baeza-Yates and Berthier Ribeiro-Neto, “Modern Information Retrieval”, Pearson Education, 2010.
3. B. Croft, D.Metzler, T.Strohman, Information Retrieval in Practice, Pearson Education,2010. (Digitized)

REFERENCES:

1. Stephan Buttcher, Charles L.A. Clarke, and Gordon V. Gormack, “ Information Retrieval Implementing and Evaluating Search Engines”, MIT Press, 2010.
2. Francesco Ricci, LiorRokach, BrachaShapira, Paul B. Kantor, Recommender Systems – Handbook, Springer, 2011.
3. AnandRajaraman and Jeffrey Ullman, “Mining Massive Data sets”, Cambridge University Press, 2014

15XT92 SOFTWARE PATTERNS

3 0 0 3

INTRODUCTION TO PATTERNS: Reusable object oriented software, Motivation, Best design practices of object oriented software, Coupling and Cohesion, Types of Cohesion and Coupling, Benefits of patterns, Definition of a Pattern, Types, Pattern description, Pattern Language, IDIOMS, Framework, Architecture. (6)

DESIGN PATTERNS: Creational patterns – Abstract factory, Builder, Factory method, Prototype, Singleton, Structural patterns – Adapter, Bridge, Composite, Decorator, Façade, Flyweight, Proxy, Behavioral patterns – Command, Interpreter, Iterator, Mediator, Memento, Observer, State, Strategy, Template method, Visitor, Chain of Responsibility, Case Studies. (15)

ARCHITECTURAL PATTERNS: From Mud to Structure – Layers, Pipes and Filters, Blackboard, Distributed systems – Broker, Interactive Systems – Model View Controller (MVC), Presentation Abstraction Control, Adaptable Systems – Reflection, Microkernel. Anti-Patterns. (13)

REFACTORING: What is refactoring, Principles in refactoring, Bad smells in code, Refactoring Techniques - Composing methods, Moving features between objects, Organizing data, Simplifying conditional expressions, Making method calls simpler, Dealing with generalization. Design Refactoring – Technical Debt, Design Smells, Abstraction Smells, Encapsulation Smells, Modularization Smells, Hierarchy Smells, Architectural Refactoring. Refactoring Tools. (11)

Total L:45

TEXT BOOKS:

1. Erich Gamma, Richard Helm, Ralph Johnsons and John Vlissides, “Design Patterns: Elements of Reusable Object-Oriented Software”, Pearson Education, 2004.
2. Frank Buschman, RegineMeunier, Hans Rohnert, Peter Sommerland and Michael Stal, “Pattern-Oriented SoftwareArchitecture: A System of Patterns”, John Wiley, 2011.
3. Martin Fowler, Kent Beck, William Opdyke and Don Roberts, “Refactoring: Improving the Design of Existing Code”, Addison-Wesley Longman, 2012.

REFERENCES:

1. GirishSuryanarayana, Ganesh Samarthyam, and Tushar Sharma, “Refactoring for Software Design Smells: Managing Technical Debt”, Morgan Kaufmann Publishers, 2014.
2. Len Bass, Paul Clements, and Rick Kazman, “Software Architecture in Practice”, Addison Wesley, 2013.

15XT93 DATA MINING

3 0 0 3

INTRODUCTION: Motivation for Data Mining – Importance – Definition – Kinds of data for Data Mining – Data Mining functionalities – Patterns – Classification of Data Mining Systems – Major issues in Data Mining-Overview of Data Mining Techniques. (5)

DATA PREPROCESSING: Types of data, Data cleaning-Smoothing, Handling missing values- Data Reduction –PCA, LDA- Feature subset selection –Chi square (X^2) and Information Gain- Sampling methods (7)

MINING FREQUENT PATTERNS, ASSOCIATIONS AND CORRELATIONS: Basic concepts – Efficient and Scalable Frequent Itemset Mining methods – Apriori, FP Tree. (6)

CLASSIFICATION AND PREDICTION: Overview of Classification techniques –Ensemble Learning-bagging, boosting, cascading stacking-Dealing with Class imbalance- Semi supervised learning. (6)

C**LUSTER ANALYSIS:** Cluster Analysis – Types of data in Cluster Analysis –Distance measure for numerical and non-numerical data- A categorization of major clustering methods – density based methods –DBSCAN, OPTICS, DENCLUE- Outlier analysis. (6)

MINING DATASTREAMS: Challenges-Mining time- Series databases and sequence data –Stationary data stream learning- Hoeffding trees- Evolving data stream mining. (5)

MINING MASSIVE DATA SETS-Challenges- Distributed file system – Introduction to Map Reduce- Mining high dimensional association rules-CARPENTER- classifying high-dimensional data- PLANET- clustering high-dimensional Data-BIRCH-Distributed Data Mining. (6)

APPLICATIONS AND TRENDS IN DATA MINING: Spatial Data Mining –Graph Mining- Web Mining –Text Mining. (4)

Total L:45

TEXT BOOKS:

1. Jiwai Han and MichelineKamber , “Data Mining – Concepts and Techniques”, Morgan Kaufmann Publishers, 2012.
2. Tan, Steinbach and Kumar, “Introduction to Data Mining”, Pearson Education, 2014.

REFERENCES:

1. AnandRajaraman, Jeffrey Ullman, “Mining Massive Data sets”, Cambridge University Press, 2014.
2. Trevor Hastie, Robert Tibshirani and Jerome Freidman,”The Elements of Statistical Learning: Data Mining, Inference, and Prediction”, Springer Series in Statistics, 2011.
3. Ian Witten, Frank Eibe and Mark A Hall, “Data Mining: Practical Machine Learning Tools and Techniques”, Elsevier, 2011.

15XT96 INFORMATION RETRIEVAL LAB

0 0 4 2

PRACTICALS:

1. Different retrieval models namely Boolean, Vector space and Probability based retrieval.
2. Query refinement techniques.
3. Evaluation of the retrieval algorithms.
4. Dimension Reduction techniques.
5. Classification and Clustering techniques.
6. Recommender systems- Collaborative and Content Based Filtering.
7. Information Extraction techniques.
8. IR on structured data bases.
9. Web based retrieval - Link based retrieval, combining content and link information .
10. Web mining - usage mining, structure mining, content mining.

Total P:60

15XT97 SOFTWARE PATTERNS LAB

0 0 4 2

PRACTICALS:

1. ATM Simulation – Singleton pattern.
2. Image Viewer Application – Bridge pattern.
3. Address Book Maintenance – Prototype pattern.
4. US, Canada Tax and Freight charges – Factory Method pattern.
5. The Fast Food Franchise – Builder pattern.
6. Computer Models with different architectures – Abstract Factory pattern.
7. An Evaluation Application – Decorator pattern.
8. Refactoring Tool Usage.

Total P:60

15XT98 DATA MINING LAB

0 0 4 2

PRACTICALS:

1. Familiarize with tools like WEKA and statistical package like R.
2. Getting to know your Data –Feature Selection.
3. Decision Trees.
4. Other Classification Methods.
5. Ensemble Learning.
6. Clustering.
7. Association Rules.
8. Analyzing data with log linear models and graphical models using R.
9. Handling massive data using map reduce.
10. A Package using data mining techniques preferably research papers.

Total P:60

SEMESTER – 10

15XTP2 PROJECT WORK II – INDUSTRY / RESEARCH PROJECT

0 0 – 12

ELECTIVES

15XTE1 PRINCIPLES OF PROGRAMMING LANGUAGES

3 2 0 4

INTRODUCTION: The Role of Programming Languages: Toward Higher-level Languages, Problems of Scale, Programming Paradigms, Language Implementation Bridging the Gap - Language Description:- Syntactic Structure: Expression Notations, Abstract Syntax Trees, Lexical Syntax, Context -Free Grammars, Grammars for Expressions, Variants of Grammars.
(7)

IMPERATIVE PROGRAMMING: Statements: Structured Programming:- The Need for Structured Programming, Syntax-Directed Control Flow, Design Considerations: Syntax, Handling Special Cases in Loops, Programming with invariants, Proof Rules for Partial Correctness, Control flow in C - Types: Data Representation:- The Role of Types, Basic Types, Arrays Sequences of Elements, Records: Named Fields, Unions and variant Records, Sets, Pointers: Efficiency and Dynamic Allocation, Two String Tables, Types and Error Checking - Procedure Activations:- Introduction to Procedures, Parameter-passing Methods, Scope Rules for Names, Nested Scopes in the Source Text, Activation Records, Lexical Scope: Procedures as in C, Lexical Scope: Nested Procedures and Pascal.
(10)

OBJECT ORIENTED PROGRAMMING : Groupings of Data and Operations:- Constructs fro Program Structuring, Information Hiding, Program Design with Modules, Modules and Defined Types, Class Declarations in C++, Dynamic Allocation I C++, Templates: Parameterized Types, Implementation of Objects in C++. - Object-Oriented Programming- Object-Oriented Thinking - Objects in Smalltalk.
(9)

FUNCTIONAL PROGRAMMING: Elements of Functional Programming:- A little Language of expressions, Types : Values and Operations, Function declarations, Approaches to Expression Evaluation, Lexical Scope, Type Checking - Functional Programming in a Typed Languages:- Exploring a List, Function Declaration by Cases, Functions as First-Class Values, ML: Implicit Types, Data Types, Exception Handling in M, Little quit in Standard ML - Functional Programming with Lists:- Scheme, a Dialect of Lisp, The Structure of Lists, List Manipulation, A Motivating Example: Differentiation, Simplification of Expressions, Storage Allocation for Lists.
(10)

OTHER PARADIGMS: Logic Programming:- Computing with Relations, Introduction to Prolog, Data Structures inProlog, Programming techniques, Control in Prolog, Cuts - An Introduction to Concurrent Programming:- Parallelism in Hardware, Streams: Implicit Synchronization, Concurrency as interleaving, Liveness Properties, Safe Access toShared Data, Concurrency in Ada, Synchronized Access to Shared variables. (9)

TUTORIAL PRACTICE:

1. Language tools like Lex and YACC.
2. Inter – Intra sequence control mechanism.
3. Parameter passing mechanism in C, C++.
4. Comparing Object oriented concepts in C++, Java.

5. List Operations in Prolog.
6. Fact finding & Theorem proving in Prolog.
7. Recursive functions in Functional programming language.
8. Expression evaluation in functional programming language.

Total L:45+T:30 = 75

TEXT BOOKS:
1. Terrence W.Pratt, Marvin V.Selkowitz and T.V.Gopal, "Programming Languages Design and Implementation", Pearson Education,2006.
2. Ravi Sethi, "Programming Languages Concepts and Constructs", Pearson Education, 2007.

REFERENCES:
1. Robert W. Sebesta, "Concepts of Programming Languages", Pearson Addison Wesley, 2008.
2. Robert Harper, "Programming in standard ML", Carnegie Mellon University, 2011.
3. Larry C. Paulson, "ML for working Programmer", Cambridge University Press, 2012.
4. Al Kelley and Ira Pohl, "A Book on C", Pearson Education, 2005.

15XTE2 MULTI PARADIGM PROGRAMMING LANGUAGES

3 2 0 4

INTRODUCTION: The need for multiple paradigms – Terms and concepts Design, Analysis, Domains and Families – Commonality and variability analysis - Multi-paradigm design and programming languages. (4)

COMMONALITIES ANALYSIS: The essences of Abstraction - Priming Analysis – Dimensions of Commonality and Commonality Categories - Commonality and Evolution –Examples. (8)

VARIABILITY ANALYSIS: The Spice of life – The commonality base – Positive and negative variability – The domain and range of variability – Binding time – Variability tables , traps, review and dependency. (9)

APPLICATION AND SOLUTION DOMAIN ANALYSIS: The big picture analysis, Domain analysis and beyond – Sub domains in domain analysis. C++ Solution domain overview. (8)

MIXING AND WEAVING PARADIGMS: An overview of multi-paradigm design and activities. Method and design paradigm weavings - Dimensions of Variability and commonality analysis – Codependent design – Design and Structures. Management issues -Augmenting solution design with patterns. (10)

Multi-paradigm programming languages and Programming in C++ and Oz and Case Studies Text editor and language translator. (6)

TUTORIAL PRACTICE:

Implementation of Multi paradigm programming concepts using Standard C++:

1. Implementation of Abstraction using classes and templates.
2. Implementation of Generic programming : Containers.
   - Reading and sorting integers and floating point numbers
   - Function objects
3. Implementation of class hierarchies and interfaces.
4. Implementation of Multiprogramming paradigm.
   - handling polymorphic objects.

Total L:45+T:30 = 75

TEXT BOOKS:
1. James O Coplien, "Multi-Paradigm Design for C++", Addison Wesley, 2007.
2. Peter Van Roy and SeifHaridi, "Concepts Techniques and Models of Computer Programming", MIT Press, 2009.

REFERENCE:
1. Czarnecki and Eisenecker, "Generative Programming", Addison Wesley, 2003.

15XTE3 PROGRAM SEMANTIC ANALYSIS

3 2 0 4

INTRODUCTION: A Simple Imperative Programming Language - Notion of state of a program in execution (process) using Finite State

Transition diagrams - using first-order logic formulae – Operational semantics and denotational semantics. (4)

ANALYZING ASSIGNMENT STATEMENTS: Deriving strongest postcondition from a given pre-condition - and deriving weakest pre-condition from a given post-condition. Dealing with loops: loop invariants - Appropriateness of loop-invariants for proving desired - Post-conditions of programs – Abstract syntax and semantics of loop in ML – Parsing loop. (8)
FORMAL INTRODUCTION TO HOARE LOGIC: syntax and semantics - Notions of partial and total correctness - Axioms and basic inference rules for partial correctness proofs in Hoare logic. (6)

FIXPOINT THEORY: Undefined operations and infinite loops – Recursively defined mappings – Continuous functions and strict extensions of functions. (4)

STRENGTHENING AND WEAKENING OF CONSTRAINTS: Weakest pre-conditions and strongest post-conditions - using Hoare logic proofs - Incompatibility of the strongest loop invariant in sequential programs- reduction from halting problem of Turing machines - Translating programs (with recursive function calls) manipulating variables of finite-domain types to push-down automata. (6)

ANALYSIS OF PROGRAMS WITH VARIABLES OF FINITE-DOMAIN TYPES: Reducing proof obligations in Hoare logic to state Reachability in an appropriate push-down automaton (PDA) - Deciding state Reachability in PDA by checking non-emptiness of an appropriate context-free language - PDA and CFG based techniques for proving properties of programs. (5)

OPERATIONAL SEMANTICS: Proof-theoretical semantics – Declarations of data structures – Procedures and functions – Objects and classes – Continuations and jumps. (7)

TRANSLATING PROGRAMS: The Formal language to corresponding Boolean programs - Semantics preserving syntactic transformations. Translating assignment statements in original program to parallel assignments to predicate-tracking Boolean variables in a Boolean program- Translating procedure call-free programs in a C-like language to Boolean programs. Discovering traces of a Boolean program from corresponding push-down automaton or context-free grammar. (5)

TUTORIAL PRACTICE:

1. Study on using a static checkup for the verification of code written in a high level Programming Languages.
2. Implementation of Algebraic semantics.
3. Implementation of fixed point identity in recursion in the Lambda calculus.
4. Implementation of action semantics of a calculator.
5. Formal verification using Hoare Logic with updates for a simple while – language.
6. Proving Program correctness with Hoare's Logic for programs with procedures

Total L:45+T:30 = 75

REFERENCES:

1. Michael Huth and Mark Ryan*,"* Logic in Computer Science: Modeling and Reasoning about Systems" , Cambridge University Press, 2004.
2. Bjorn Kirkerud, "Programming language semantics: Imperative and object oriented languages", Thomson computer press, 1997.
3. Glynn Winskel, "Formal Semantics of Programming Languages", MIT Press, 1993.

15XTE4 NATURAL LANGUAGE PROCESSING

3 2 0 4

INTRODUCTION : Applications of NLP techniques and key issues - MT - grammar checkers – dictation - document generation - NL interfaces - Natural Language Processing key issues - The different analysis levels used for NLP: morpho-lexical - syntactic – semantic - pragmatic - markup (TEI, UNICODE) - finite state automata - Recursive and augmented transition networks – open problems. (8)

LEXICAL LEVEL: Error-tolerant lexical processing (spelling error correction) - Transducers for the design of morphologic analyzers – Features - Towards syntax: Part-of-speech tagging (Brill, HMM) - Efficient representations for linguistic resources (lexica, grammars...) tries and finite-state automata. (7)

SYNTACTIC LEVEL: Grammars (e.g. Formal/Chomsky hierarchy, DCGs, systemic, case, unification, stochastic) - Parsing (top-down, bottom-up, chart (Earley algorithm), CYK algorithm) - Automated estimation of probabilistic model parameters (inside-outside algorithm) - Data Oriented Parsing - Grammar formalisms and treebanks - Efficient parsing for context-free grammars (CFGs) - Statistical parsing and probabilistic CFGs (PCFGs) - Lexicalized PCFGs. (8)

SEMANTIC LEVEL: Logical forms - Ambiguity resolution - Semantic networks and parsers - Procedural semantics - Montague semantics - Vector Space approaches - Distributional Semantics - Lexical semantics and Word Sense Disambiguation - Compositional semantics. Semantic Role Labeling and Semantic parsing. (7)

PRAGMATIC LEVEL: Knowledge representation – Reasoning - Plan/goal recognition - speech acts/intentions - belief models-discourse – reference. (5)

NATURAL LANGUAGE GENERATION: content determination - sentence planning - surface realization. (3)

SUBJECTIVITY AND SENTIMENT ANALYSIS - Information extraction - Automatic summarization - Information retrieval and Question answering - Named entity recognition and relation extraction - IE using sequence labeling - Machine translation: Basic issues in MT - Statistical translation - word alignment - phrase-based translation and synchronous grammars. (7)

TUTORIAL PRACTICE:

1. Implementing word similarity.
2. Implementing simple problems related to word disambiguation.
3. Simple demonstration of part of speech tagging.
4. Lexical analyzer.
5. Semantic analyzer.

Total L:45+T:30 = 75

TEXT BOOKS:

1. Daniel Jurafsky and James H. Martin, "Speech and Language Processing: An Introduction to Natural Language Processing, Computational Linguistics and Speech Recognition", Prentice Hall, 2009.
2. Ian H. Witten, Eibe Frank and Mark A Hall, "Data Mining: Practical Machine Learning Tools and Techniques", Morgan Kaufmann, 2011.

REFERENCES:

1. Christopher Manning and HinrichSchütze, "Foundations of Statistical Natural Language Processing", MIT Press, 2003.
2. James Allen, "Natural Language Understanding", Addison Wesley, 2008.
3. Steven Bird, Ewan Klein, and Edward Loper, "Natural Language Processing with Python - Analyzing Text with the Natural Language Toolkit", O'Reilly Media, 2009.

15XTE5 RANDOMIZED ALGORITHMS

3 2 0 4

INTRODUCTION: Randomized algorithms, randomized quick sort, Karger's min-cut algorithm Las Vegas and Monte Carlo algorithms, computational models and complexity classes. (5)

MOMENT, DEVIATION AND TAIL INEQUALITIES: Occupancy problem**,** Markov and Chebyshev inequalities- randomized selection-coupon collector's problem, the Chernoff bound- routing in a parallel computer- a wiring problem. (7)
PROBABILISTIC METHODS: Overview of the method-maximum satisfiability - finding a large cut ,Expander graphs. (5)

MARKOV CHAINS AND RANDOMWALKS: Markov chains, Random walk on graphs - connectivity in undirected graphs – Expanders and rapidly mixing random walks. (6)

DATA STRUCTURES AND GRAPH ALGORITHMS: Random Treaps, hashing – hash tables – perfect hashing, skip lists **-** Fast min-cut. (6)

ONLINE ALGORITHMS: Paging problem-adversary models- paging against an oblivious adversary-relating the adversaries-the adaptive online adversary, k-server problem. (5)
PARALLEL AND DISTRIBUTED ALGORITHMS: Sorting on a PRAM – Maximal Independent sets. (4)

NUMBER THEORETIC ALGORITHMS:, Polynomial roots and factoring, primality testing. (3)

DERANDOMIZATION: The method of Conditional Probabilities – Derandomizing max-cut algorithm – Constructing pairwise independent values modulo a prime - Pairwise independent – large cut. (4)

TUTORIAL PRACTICE:

1. Implementation of randomized quick sort and solve real time problems using it.
2. Find solution for s-t min-cut problem adapting min cut algorithm.
3. Implementation of randomized selection and problems related to it.
4. Implementation of treap data structure.
5. Problems using randomized hash table.
6. Implement the shortest path and fast min-cut algorithms.
7. Implementation of randomized primality testing.
8. Implement the K-server on-line algorithms.

Total L:45+TP:30 = 75

TEXT BOOKS:

1. Motwani R and RaghavanP,"Randomized Algorithms", Cambridge University Press, 2010.
2. Michael Mitzenmacher and Eli Upfal, "Probability & Computing: Randomized Algorithms and Probabilistic Analysis", Cambridge University Press, 2009.

REFERENCES:

1. Thomas H Cormen, Charles E Leiserson and Ronald L Rivest, "Introduction toAlgorithms", MIT Press, 2009.
2. AnanyLevitin, "Introduction to Design and analysis of algorithms", Pearson Education, 2011.

15XTE6 APPROXIMATION ALGORITHMS

3 2 0 4

Introduction: Definition-performance ratios, vertex-cover problem. (4)

COMBINATIONAL ALGORITHMS: lower bounding techniques and Metric TSP, multiway cut problem, the minimum k-cut problem, FPTAS for knapsack, greedy algorithms for Makespan-PTAS for minimum Makespan, Euclidean TSP. (10)

LINEAR PROGRAMMING RELAXATIONS: LP-duality, min-max relations and LP-duality, rounding applied to vertex cover-simple rounding algorithm-randomized rounding, primal dual method and vertex cover. (9)

CUTS, METRICAL RELAXATIONS AND EMBEDDINGS: multiway cut, sum multicommodity flow, some applications of multicut, rounding for Sparsest Cut via L1 Embeddings. (8)

SEMIDEFINITE PROGRAMMING: Strict quadratic programs and vector programs, properties of positive semidefinite matrices, the semidefinite programming problem, randomized rounding algorithm, improving the guarantee for MAX-2SAT. (7)

HARDNESS OF APPROXIMATION: reduction, graphs, and hardness factors, the PCP theorem, hardness of MAX-3SAT. (7)

TUTORIAL PRACTICE:

1. Implementation of vertex-cover algorithm.
2. Implementation of Greedy algorithm for makespan.
3. Problems related to Euclidean TSP.
4. Implementation of different algorithms with rounding.
5. Implementation of applications of multicut.

Total L:45+T:30 = 75

TEXT BOOKS:

1. David P. Williamson, David B. Shmoys, "the design of approximation algorithms", Cambridge university press, 2011
2. Thomas H Cormen, Charles E Leiserson and Ronald L Rivest, "Introduction toAlgorithms", MIT Press, 2009.
3. Vijay V.Vazirani, "Approximation Algorithms", SpringerVerlag, 2003.

15XTE7 NETWORK ALGORITHMICS

3 2 0 4

INTRODUCTION: Algorithms VsAlgorithmics – Network algorithmics – Network bottlenecks – Endnode bottlenecks – Router bottlenecks – characteristics of network algorithmics . (4)

NETWORK IMPLEMENTATION MODELS: Protocols - Hardware - Network device architectures – Operating System Implementation Principles – System Principles – Principles for modularity and efficiency – Principles for speeding up routines – Principles in action. (8)

ENDNODE ALGORITHMICS: Copying data – Transferring Control – Maintaining timers – Protocol Processing. (8)

ROUTER ALGORITHMICS: Exact match lookup – Prefix match look ups – Packet Classification – Switching – Scheduling packets – Computing traffic matrices. (15)

NETWORK SECURITY: Searching for multiple strings in packet payloads – IP trace back via probabilistic marking and logging – Detecting worms. (10)

TUTORIAL PRACTICE:

1. Implementation of CRC using a fast implementation technique.
2. Implementation of IP prefix lookup using lulea tries.
3. Implementation of binary search on prefixes.
4. Implementation of packet classification using linear search.
5. Implementation of packet classification using set pruning trees.
6. Implementation of decision trees approach for packet classification.
7. Implementation of packet scheduling algorithms.
8. Implementation of AhoCorasick algorithm.

Total L:45+T:30 = 75

TEXT BOOKS:

1. George Varghese, "Network Algorithmics, An Interdisciplinary Approach to Designing Fast Networked Devices", Morgan Kaufmann, 2006.
2. Michal Pioro and DeepankarMedhi, "Routing Flow and Capacity Design in Communication and Computer Networks", Morgan Kaufmann, 2007.

REFERENCES:

1. James D McCabe, "Network Analysis, Architecture and Design", Morgan Kaufmann, 2007.
2. Panos C Lekkas, "Network Processors, Architectures, Protocols and Platforms (Telecom Engineering)", McGraw Hill, 2008.

15XTE8 WIRELESS NETWORKS

3 2 0 4

WIRELESS FUNDAMENTALS: Introduction to cellular networks,-wireless local area networks- Spectrum allocations – Radio propagation models-Narrowband digital modulation and wireless fading environments. – Modern Communications Systems – MAC – SDMA – TDMA – FDMA - CDMA - Cellular and Ad-hoc-Concepts. (7)

WLAN TECHNOLOGIES: wireless network architectures – 802.11 PHYs – 802.11 MAC – WPA and 802.11i: Security – 802.11e: MAC Enhancements for Quality of Service – Related Wireless Standards (Hyperlan, HomeRF, Bluetooth, Zigbee, Wireless USB)- WiFi and Wi MAX Standards. (8)

AD HOC AND SENSOR NETWORKS: Ad hoc Network- Characteristics- Table-driven and Source-initiated On Demand routing protocols, Hybrid protocols - Routing in intermittently connected mobile networks. Wireless Sensor networks- Classification, MAC and Routing Protocols. (8)

MOBILE NETWORK AND TRANSPORT LAYERS: Mobile IP – Dynamic Host Configuration Protocol-Mobile Ad Hoc Routing Protocols–Multicast routing-TCP over Wireless Networks – Indirect TCP – Snooping TCP – MobileTCP – Fast Retransmit / Fast Recovery – Transmission/Timeout Freezing-Selective Retransmission – Transaction Oriented TCP- TCP over 2.5 / 3G wireless Networks . (8)

WIRELESS PANs MANs - Physical and MAC layer details, Wireless PANs – Architecture of Bluetooth Systems, Physical and MAC layer details, Standards-WLAN deployment issues- Interference – Resource Allocation (6)

FUTURE TRENDS: Emerging WLAN Related Technologies – 802.11 Trends – Cellular – 802.16 – 802.20 – 802.22 – UWB, Cognitive Radios, RFID – 4G and Data Communications Convergence. (8)

TUTORIAL PRACTICE:

1. Study of NS-2 simulator.
2. Simulation of a IEEE 802.11 LAN under various conditions using NS-2 simulator.
3. Simulation of a priority MAC protocol using NS-2 simulator.
4. Simulation of different routing protocols using simulators.
5. Simulation of TCP over error-prone wireless network using NS-2 simulator.
6. Development of Mobile application using blue tooth.

Total L:45+T:30 = 75

TEXT BOOKS:

1. Gary. S. Rogers and John Edwards, "An Introduction to Wireless Technology", Pearson Education, 2012.
2. SivaRam Murthy C and B.S Manoj, "Ad hoc Wireless Networks Architecture and Protocols", Pearson Education, 2005.
3. KavehPahlavan, Prashant K. Krishnamurthy, "Principles of Wireless Networks : A Unified Approach", John Wiley, 2011.

REFERENCES:

1. William Stallings, “Wireless Communication and Networks”, Pearson Education, 2009.
2. Dharma PrakashAgrawal and Qing-An Zeng, “Introduction to Wireless and Mobile Systems”, Thomson Press, 2007.
3. Feng Zhao and Leonidas Guibas, “Wireless Sensor Networks-An Information Processing Approach”, Elsevier, 2004.
4. Clint Smith, P.E. and Daniel Collins, “3G Wireless Networks”, Tata McGraw Hill, 2007.
5. Ivan Stojmenovic, “Handbook of Wireless Networks and Mobile Computing”, John wiley, 2006.
6. SavoGlisic, “ Advanced Wireless Communications 4G Technologies”, Wiley Publications, 2006.

15XTE9 SOCIAL NETWORK ANALYSIS

3 2 0 4

INTRODUCTION: Motivation - different sources of network data - types of networks - tools for visualizing network data - review of graph theory basics. (9)

GRAPH THEORETIC PROPERTIES OF SOCIAL NETWORKS: Notions of centrality - Strong and weak ties – Homophily - Structural Balance. (5)

DYNAMIC PROPERTIES OF NETWORKS: Information diffusion - networks effects on information diffusion - maximizing influence spread - power law and heavy tail - preferential attachment models - small world phenomenon - cascading behavior on networks - Epidemics. (11)

BEHAVIORAL PROPERTIES ON NETWORKS: Network economics - Bargaining and power in networks - Sponsored search markets. (10)

MINING GRAPHS: Community and cluster detection: random walks - spectral methods - link analysis for web mining. (10)

TUTORIAL PRACTICE:

1. Getting acquainted with UCINET and Netdraw.
2. Implementing graph-theoretic/social network metrics using UCINET.
3. Working with Visualization, Ego networks, Centrality, Community Detection etc.

Total L:45+T:30 = 75

TEXTBOOK:

1. David Easley and Jon Kleinberg, “Networks, Crowds, and Markets: Reasoning About a Highly Connected World”, Cambridge University Press, 2010.

REFERENCES:

1. Stanley Wasserman and Katherine Faust,“Social Network Analysis: Methods and Applications”, Cambridge University Press, 1994.
2. Peter R. Monge and Noshir S. Contractor, “Theories of Communication Networks”, Oxford University Press, 2003.
3. Duncan J Watts. “Six degrees: The Science of a Connected Age”, Norton, 2004.
4. Narahari Y, Garg D, Ramasuri N, and Prakash H, “Game Theoretic Problems in Network Economics and Mechanism Design Solutions”, SpringerVerlag, 2008.

15XTEA ADVANCED COMPUTER GRAPHICS

3 2 0 4

GEOMETRICAL TRANSFORMATIONS: Transformation as a change in coordinate system. Viewing in 3D: Projections – specifying arbitrary 3D viewing – The Mathematics of planar geometric projections – implementing planar geometric projections,Coordinate systems. (3)

OBJECT HIERARCHY: Geometric modeling- Characteristics of retained – mode graphics packages – Defining and displaying structure – Modeling transformations, Hierarchical structure networks.Input devices – interaction techniques And interaction task - USER INTERFACE SOFTWARE: Basic interaction – handling models - window management systems – User-interface management systems. (9)

REPRESENTING CURVES AND SURFACES: Polygon meshing – parametric cubic curves, Parametric bicubic surfaces, Quadricsurfaces. SOLID MODELLING**:** Representing solids – Regularized Boolean set operations – Primitive instancing – Sweep representations – Boundary representations – Spatial – Partitioning representations – Constructive solid geometry – Comparison of representation – User interfaces for solid modeling. VISIBLE SURFACE DETERMINATION : Function of two variables – Techniques for efficient visible surface algorithms – Algorithms for visible line determination– Visible ray tracing. (12)

REALISM: Fundamentaldifficulties – Rendering techniques for line drawing, shaded images – Improved object models – Dynamics – steropsis – Improved displays – Interacting with our other senses – *Aliasing and antialiasing.*ACHROMATIC AND COLORED LIGHT**:** Achromatic light – Chromatic color – Color Models for Raster Graphics – Reproducing Color –

Using Color in Computer Graphics. illuminations and shading: Illumination models – Shading modelsForpolygons – Surface detail – Shadows – Transparency – Inter object reflections – Physically based illumination models – Extended light sources – Spectral sampling – Improved camera model – Global Illumination algorithms – Recursive ray tracing – Radiosity methods – The rendering pipeline. (11)

IMAGE MANIPULATION AND SHADING: Filtering – Image Processing – Geometric transformations of Images – Multipass transformation – Image Composition – Mechanism for Image Storage – *Special Effects with images*. ANIMATION : Conventional and Computer assisted Animation – Animation languages – Methods of controlling animation - Basic rules of animation – Problems peculiar to animation. (10)

TUTORIAL PRACTICE:

Implement the following using OpenGL:

1. Using glRecti function, draw
   a) A flurry b) A checkerboard
2. Write the window to view port mapping functions, and use it to draw the since curve in real world coordinates.
3. Using user defined lineToand moveTo functions, plot the Fibonacci series.
4. Write the Canvas class and it's supporting classes. Use the Canvas class to draw a simple meander.
5. Write functions to change the background and foreground colors.
6. Write a function to draw an n-sided polygon (using the basic Canvas class and line To and move To functions)
7. Write a program to draw the Sierpinski gasket.
8. Write a program to draw the graph of a given mathematical function f(x).
9. Write a program to read a data file that contains a collection of Polylines in the appropriate format and draw each polyline.
10. Write a parameterized function to display a house and call it a number of times by passing different values to form a village.
11. Write a program that displays a colored triangle and rectangle and rotates them at different angles along two axis.

Total L:45+T:30 = 75

TEXT BOOKS:

1. Foley James D, VandamAndries and Hughes John F, "Computer Graphics: Principles and Practice", Addison-Wesley, 2013.
2. Donald Hearn, M. Pauline Baker and Warren Carithers, "Computer Graphics with OpenGL", Pearson Education, 2013.

REFERENCES:

1. Edward Angel and Dave Shreine, "Interactive Computer Graphics- A top down approach with OpenGL", Pearson Education, 2012.
2. Anil K Jain., "Fundamentals of Digital Image Processing", Pearson Education, 2007.
3. F S Hill, "Computer Graphics Using OpenGL", Prentice Hall, 2007.

15XTEB COMPUTER VISION AND IMAGE ANALYSIS

3 2 0 4

OVERVIEW: Computer Imaging Systems: Image formation and Sensing, Color representation, Image Acquisition, Image digitization, Noise, Image Representation. (4)

DIGITAL IMAGE ANALYSIS: Preprocessing, Binary Image Analysis, Edge detection - First order derivative, Second order detection, Color edge detection, Pyramid edge detection, Edge linking and boundary detection, Segmentation - Region based segmentation, clustering techniques, boundary detection, thresholding. (8)

IMAGE ENHANCEMENT: Gray-Scale Modification, Image Sharpening, Image Smoothing - Image Restoration - Noise Models, Noise removal using spatial filters, frequency domain filters, Geometric transforms, Image Reconstruction. (6)

IMAGE TRANSFORMS: Overview of discrete transforms, Fourier Transform, Discrete Cosine transform, Discrete Haar transform, Principal components transform, Discrete Wavelet Transform, Filtering. (6)

IMAGE FEATURE ANALYSIS: Overview, Feature Extraction - Shape, histogram, color, spectral, textural features, feature Analysis. Image Compression - Overview, Lossless compression methods, lossy compression. (5)

MORPHOLOGICAL OPERATIONS - Binary Dilation, Erosion, Opening and Closing, Hit-or-Miss Transform, Basic Morphological Algorithms, Extension to Gray-Scale Images. (4)

IMAGE COMPRESSION - Basic requirements, Types of compression, Coding Algorithms. (4)

APPLICATIONS – CBIR, CBVR, Activity Recognition, computational photography, Biometrics, stitching and document processing; Modern trends - super-resolution; GPU, Augmented Reality; cognitive models, fusion and SR&CS. (8)

TUTORIAL PRACTICE:

1. Implementation of Image segmentation and edge detection.
2. Implementation of feature extraction.
3. Implementation of image classification and clustering.
4. Developing simple image analysis applications

Total L:45+T:30=75

TEXT BOOKS:

1. Umbaugh, S E.,"Digital Image Processing and Analysis: Human and Computer Vision Applications with CVIP Tools", CRC press, 2010.
2. Nagabhushana, S,"Computer vision and image processing", New Age International, 2005.

REFERENCES:

1. Richard Szeliski, "Computer Vision: Algorithms and Applications", Springer-Verlag London Limited 2011.
2. Richard Hartley and Andrew Zisserman, "Multiple View Geometry in Computer Vision", Cambridge University Press, 2004.
3. Gonzalez R C and Woods R E, "Digital Image Processing", Addison Wesley, 2008.

15XTEC DATA COMPRESSION

3 2 0 4

DATA COMPRESSION LEXICON: Introduction to Data Compression - Dawn Age - Coding - Modeling - Zivand Lampel- Lossy Compression. (4)

MINIMUM REDUNDANCY CODING (THE DAWN AGE): The Shannon - Fano Algorithm, The Huffman Algorithm - Into the Huffman Code : Counting the Symbols, Building the tree - Compression Code. (4)

ADAPTIVE HUFFMAN CODING: Adaptive Coding - Updating the Huffman Tree - The Code. (4)

ARITHMETIC HUFFMAN CODING: Arithmetic Coding - The Code. (6)

STATISTICAL MODELING: Higher-order Modeling - Finite Context Modeling - Adaptive Modeling – Highest- Order Modeling. (4)

SLIDING WINDOW COMPRESSION:LZ77 Algorithm - LZSS Compression - Compression Code. (5)

DICTIONARY-BASED COMPRESSION:LZ78 Compression and Decompression algorithms – LZW Compression and Decompression algorithms – LZMW Compression and Decompression – LZAP Compression and Decompression. (8)
SPEECH COMPRESSION: Digital Audio Concepts - Lossless Compression of Sound. (5)

VIDEO COMPRESSION: JPEG Compression – Discrete Cosine Transforms – Coefficient quantization. (5)

TUTORIAL PRACTICE:

1. Implement Shannon Fano algorithm and Huffman algorithm.
2. Design compression and decompression program using adaptive Huffman coding.
3. Implement arithmetic coding algorithm.
4. Design compression program using statistical modeling upto 3 order.
5. Design compression and decompression program using L277 algorithm.

Total L:45+T:30 = 75

TEXT BOOK

1. Mark Nelson and Jean Loup Gailly "The Data Compression Book", M&T Books, 2008

REFERENCES:

1. Yun Q Shi and Huifang Sun, "Image and Video Compression for Multimedia Engineering", CRC Press, Boca Raton, 2008.
2. Khalid Sayood, "Introduction to Data Compression", Morgan Kaufmann, 2006.

15XTED SEMANTIC WEB

3 2 0 4

INTRODUCTION TO SEMANTIC WEB: Today's Web - From Today's Web to the Semantic Web - Examples- Semantic Web Technologies - A Layered Approach. (4)

DESCRIBING STRUCTURED WEB DOCUMENTS USING XML: Introduction to Markup languages - The XML Language - Structuring - Namespaces - Addressing and Querying XML Documents - Processing. (8)

DESCRIBING WEB RESOURCES IN RDF: Introduction to RDF - Basic Ideas - RDF: XML-Based Syntax - RDF Schema: Basic Ideas -

RDF Schema - An Axiomatic Semantics for RDF and RDF Schema - A Direct Inference System for RDF and RDFS - Querying in RQL. (9)

WEB ONTOLOGY LANGUAGE: OWL Introduction - The OWL Language - Examples - OWL in OWL - Future Extensions. (8)

LOGIC AND INFERENCE: Introduction - Example of Monotonic Rules: Family Relationships - Monotonic Rules: Syntax - Monotonic Rules: Semantics - Nonmonotonic Rules: Motivation and Syntax - Example of Nonmonotonic Rules - Rule Markup in XML for Monotonic Rules - Rule Markup in XML for Nonmonotonic Rules. (8)

APPLICATIONS: Horizontal Information Products - Data Integration - e-Learning - Web Services - Other Scenarios. (4)

ONTOLOGY ENGINEERING: Constructing Ontologies Manually - Reusing Existing Ontologies - Using Semiautomatic Methods - On-To-Knowledge Semantic Web Architecture. (4)

TUTORIAL PRACTICE:

1. Generationof well-formed XML document.
2. Creating XML DTD and XSD for the given XML document.
3. Design a XSLT to display the XML document (given as input) based on the constraints given.
4. Generate an RDF graph.
5. Create an RDFS ontology (in triple or graph notation).
6. Write an RDF/XML encoding for the given situation.
7. Generation of OWL document
8. A Package to implement the techniques.

Total L:45+T:30 = 75

TEXT BOOK:

1. Grigoris Antoniou and Frank van Harmelen, "A Semantic Web Primer", MIT Press, 2012.

REFERENCES:

1. Dean Allemans, James Handler, "Semantic web for the working ontologist: Effective modeling in RDFS and OWL", Elsevier, 2011.
2. Pascal Hitzler, Markus Krotzsch, Sebastian Rudolph, "Foundations of Semantic Web Technologies", CRC Press, 2009.

15XTEE CLOUD COMPUTING

3 2 0 4

INTRODUCTION TO PARALLEL AND DISTRIBUTED COMPUTING: Introduction, Architecture and Distributed computing models and technologies SOA, Web Services. (5)

GRID, CLUSTER AND UTILITY COMPUTING: Introduction, Architecture, Pros & Cons, Real time applications. (4)

INTRODUCTION TO CLOUD COMPUTING : Definition, History, Comparison of Cloud Computing with Grid, Cluster and Utility Computing, Deployment models – Private, Public, Hybrid and Community - Pros and Cons of Cloud Computing . SaaS, PaaS, IaaS etc.(8)

VIRUTUALIZATION : Types of Virtualization, Tools for Virtualization, Architecture of VMM, Virtualization for Cloud. (4)

ADVANCED WEB TECHNOLOGIES:AJAX and Mashup – Programing examples using applications. (4)

MAP REDUCE PARADIGMS: Introduction, GFS Architecture, HDFS Architecture, Hbase, Google big Table, Amazon's (key value) pair storage and Microsoft's Azure infrastructure, Map reduce programming examples. (6)

CLOUD COMPUTING FRAMEWORK: Amazon EC3, S3 storage revises, Aneka frame work, IBM blue Cloud. (7)

APPLICATIONS: Distributed search engine and distributed data mining in the cloud. (7)

TUTORIAL PRACTICE:

1. Parallel programming using pvm on Linux platform.
2. Develop web services using Eclipse or similar tools.
3. Virtualization (VM Ware, VCloud, Hyper V)
4. Develop a Mashup website based on 2 or more existing websites.
5. Build Private cloud compatible with AWS API using Eucalyptus
6. Build Cloud platform using Openstack
7. Package development using tools supported by cloud providers as a free service.

Total L:45+T:30 = 75

TEXT BOOK

1. Anthony T. Velte, Toby J. Velte and Robert Elsenpeter “Cloud Computing : A Practical Approach” McGraw Hill, 2010.

REFERENCES:

1. Liu M L, “Distributed Computing Principles and Applications”, Pearson Education, 2005.
2. Joel M.Crichlow,” Distributed And Parallel Computing” , Prentice Hall, 2007.

15XTEF PERVASIVE COMPUTING

3 2 0 4

INTRODUCTION: Past, present, future; the pervasive computing market, m-Business, challenges and future of pervasive computing - modelling key for pervasive computing - pervasive system environment interaction - architectural design for pervasive system, application examples of pervasive computing: Healthcare, Tracking, emergency information systems, home networking appliances and entertainment. (5)

DEVICE TECHNOLOGY FOR PERVASIVE COMPUTING: Hardware,computing devices and their characteristics - pervasive information access devices-smart identification, smart card, labels, tokens - embedded controls, smart sensors, actuators -Human-machine interfaces, Biometrics - Various operating systems for pervasive devices. (4)

COMMUNICATION TECHNOLOGIES FOR PERVASIVE COMPUTING: Connecting the world – WWAN, SRWC, DECT, Bluetooth, IrDA – mobile internet – internet protocols. Audio networks, data networks - wireless data networks - pervasive networks - service oriented networks - network design issues - Managing smart devices in virtual environments, human user-centered and physical environments - pervasive computing issues and outlook. (7)

APPROACHES FOR DEVELOPING PERVASIVE APPLICATIONS: Categorization - smart services for pervasive application development - developing mobile applications – presentation transcoding – device independent view component – heterogeneity of device platforms - Context Awareness and Mobility to build pervasive applications. (8)

CONTEXT AWARE SYSTEMS: Modelling - mobility awareness - spatial awareness - temporal awareness - ICT system awareness - Intelligent Systems - basic concepts- autonomous systems - reflective and self-aware systems - self management and autonomic computing - complex systems. (8)

LOCATION AWARE SYSTEMS: Basic concepts - location modelling - Introduction to location management – DNS Server, server process, client process – location update – location inquiry-location management cost – network topology – mobility pattern, memory less movement model, Markovian Model, Shortest distance model, Gauss-Markov model, Activity Based Model, Mobility Trace, Fluid-flow Model, Gravity Model. (7)

Location dependent information system - location dependent data – location aware queries – location dependent queries – moving object database queries - query transition steps in LDQ processing. (6)

TUTORIAL PRACTICE:

1. Create application with onClick, onKeyDown, onFocusChanged Event Handlers.
2. Create application with Toast Notifications.
3. Create application with Android's Advanced User Interface Functions.
4. Create Android Audio/Video Application.
5. Create application to Create, Modify and Query an SQLite Database.
6. Create application that Works with an Android Content Provider.
7. Create application that performs Data Storage and Retrieval from Android External Storage.
8. Create Location-Aware application that uses Proximity Alerts and Google Maps API.
9. Implementation of small packages to demonstrate all APIs.

Note: All implementations using android.

Total L:45+T:30=75

TEXT BOOKS:

1. Stefan Poslad, “Ubiquitous Computing - Smart Devices, Environment and Interactions”, John Wiley, 2011.
2. Adelstein F and Gupta S K S, “Fundamentals of Mobile and Pervasive Computing”, Tata McGraw Hill, 2008.

REFERENCES:

1. GuruduthBanavar, Norman Cohen, Chandra Narayanaswami, “Pervasive Computing: An Application-Based Approach”, Wiley Inter Science, 2012.
2. Mohammed Ilyas and ImadMahgoub, “Mobile Computing Handbook”, Auerbach Publications, 2005.
3. Burkhardt, Henn, Hepper and Rintdorff, Schaeck. “Pervasive Computing”, Pearson Education, 2009.
4. AshokeTalukdar and RoopaYavagal, “Mobile Computing”, Tata McGraw Hill, 2010.

15XTEG ADVANCED DATABASE MANAGEMENT SYSTEMS

3 2 0 4

QUERY PROCESSING: Database Catalog - Query Processing Methodology - Query Interpretation - Equivalence of Expressions – Selection, Projection and Natural Join Operations - Estimation of Query Processing Cost - Estimation of access costs using Indices - Query Optimization – Heuristic Query optimization – Cost based query optimization. (8)

OBJECT AND SPATIAL DATABASES: Object Model Vs Relational model - Object Oriented Databases - Introduction to ORDBMS - Complex data types - Structured types and Inheritance - Nesting and un-nesting of Relations – Query Processing in ORDBMS – Spatial Databases : Fundamentals of GIS - Spatial Data Types- Spatial relations – Spatial Queries -Spatial indexing techniques - R-trees, KD trees - Quad trees - Applications of spatial databases. (9)

PARALLEL AND DISTRIBUTED DATA BASES: Architecture of parallel databases – Parallel query evaluation, Paralyzing individual operations, Parallel query optimization - Homogeneous and Heterogeneous databases - Architecture of distributed data bases - Storing data in distributed data bases - Distributed query processing - Distributed Transactions. (10)

DATABASE INTEGRATION: Data integration: schema directed data integration - Data exchange: Schema mapping and information preservation - Information Preserving XML Schema Embedding. (8)

NoSQL DATABASES: Big Data and Challenges, NoSQL data models – Key value pair - DynamoDB, Column store - BigTableHbase, Document oriented store- MongoDB –Graph data bases – Neo4g – Apache Hadoop. (10)

TUTORIAL PRACTICE:

Programming exercises are given in the following topics:

1. Query optimization.
2. Object relational databases.
3. Parallel/Distributed databases.
4. Spatial databases.
5. MongoDB,, AmazonDB.
6. BigTable, Hbase.
7. Hadoop.

Total L:45+T:30 = 75

TEXT BOOKS:

1. Abraham Silberschatz, Henry F.Korth and S.Sudarshan, “Database System Concepts”, Tata McGraw Hill, 2010.
2. Tamer O Zsu M and Patrick Valduriez, “Principles of Distributed Database Systems”, Pearson Education, 2011.
3. RamezElmasri and ShamkranNavathe, “Fundamentals of Database Systems”, Addison Wesley,2013

REFERENCES:

1. Thomas Connolly and Carolyn Begg, “Database Systems”, Pearson Education, 2010.
2. Raghu Ramakrishnan and Johannes Gehrke, “Database Management Systems”, Tata McGraw Hill, 2004.
3. Corbett J C, “Spanner: Google's Globally-Distributed Database”, OSDI, 2012.
4. Stonebraker, M SQL Databases v. NoSQL Databases, Communications of the ACM, 2010.

15XTEH SOFTWARE PROCESS MANAGEMENT

3 2 0 4

SOFTWARE ENGINEERING: An Introduction - The Personal Software Process - Time Management - The Logic of Time Management - Tracking Time Period and Product Planning - Product Planning - Product Size. (7)

MANAGING YOUR TIME: Elements of Time Management - Managing Commitments - Managing Scheduler - Project Plan - The Project Plan Summary. (7)

SOFTWARE DEVELOPEMNT PROCESS: Defects - Software quality the updated Personal Software Process - Finding Defects - Code Review Checklist - Building a Personal Checklist - Coding Standards - Projecting Defects –Updated Project Plan. (10)
ECONOMICS OF DEFECT REMOVAL DESIGN: Defects - Product Quality - Process Quality. (6)

TEAM SOFTWARE PROCESS (5)

CAPABILITY MATURITY MODEL: Structure - Interpretation - Usage - Key process areas for various levels. (10)

TUTORIAL PRACTICE:

1. Time Measurement Assignment.
2. PSP Programming Assignment.
3. Assessing the Quality of the Student's PSP Data and recording observations in the specified format.
4. Estimating the size of the program using PSP Techniques.
5. Design Review.
6. Code Review.
7. Process and Product quality Measurement.
8. Development of Project Plan.
9. Evaluation of the quality of Team's process and Product.
10. TSP Inspection.

Total L:45+T:30 = 75

TEXT BOOKS:

1. Watts. S. Humphrey, "Introduction to Personal Software Process", Addison-Wesley Professional,2005.
2. Watts.S.Humphrey, "Introduction to the Team Software Process", Addison Wesley Longman,2005.
3. Bill Curtis, "People CMM", Pearson Education, 2010.

REFERENCES:

1. Watts. S. Humphrey, "Managing Technical People: Innovation, Teamwork and the Software People", Addison-Wesley, 2005.
2. Watts. S. Humphrey, "A Discipline for Software Engineering", Addison-Wesley,2005.
3. Patrick Corsi, ErwanNeau, " Innovation Capability Maturity Model", Wiley, 2015.

15XTEI ARTIFICIAL INTELLIGENCE

3 2 0 4

INTRODUCTION: The foundations of AI - The History of AI- Intelligent agents- Agent based system. (2)

PROBLEM SOLVING: State Space models- Searching for solution- Uninformed/Blind search - Informed/ Heuristic search - A* search - Hill-climbing search- Genetic Algorithm– Markovian Decision Process (MDP) – Maximum value policies, Adversarial games– value/policy iteration – Minimax - Expectimax – Alpha-beta pruning – Temporal difference (TD) - Constraint satisfaction problem - factor graphs - Backtracking search. (9)

KNOWLEDGE REPRESENTATION AND REASONING: Knowledge representation - Logics – First order logic- Inference in first order logic – Higher order logic - Markov logic. (5)

UNCERTAIN KNOWLEDGE AND PROBABILISTIC REASONING: Uncertainty-Probabilistic reasoning - Semantics of Bayesian network - , Exact inference in Bayesian network- Approximate inference in Bayesian network- Direct sampling methods, Inference by Markov chain simulation - Probabilistic reasoning over time – Hidden Markov Models – Gibbs sampling – particle filtering Dynamic Bayesian Network. (12)

DECISION-MAKING: basics of utility theory, sequential decision problems - decision network– policy -Decision process in infinite horizon: Optimal policy, Value iteration - policy iteration- Partially observable decision process – Decisions in Multi agent system: elementary game theory, Multi agent decision theory - perfect information - partially observable multi agent reasoning - Mechanism design - Group decision making.(12)

LEARNING: Learning from observation - Knowledge in learning – Supervised Learning - Unsupervised and Reinforcement learning. (3)

ROBOTICS: Introduction. (2)

TUTORIAL PRACTICE:

Lab assignments will be provided for all the topics given below.

1. A* algorithm for 8 –puzzle and Missionaries and Cannibals problem.
2. Hill climbing and genetic algorithm
3. Constraint satisfaction techniques,
4. Simple games – minimax and expectimax
5. Logic based exercises.
6. Implementing HMM models
7. Applications of sequential decision making and multi agent decision making
8. Implementing decision network and dynamic networks.

Total L: 45+T:30 = 75

TEXT BOOKS:

1. Stuart Russell and Peter Norvig, "Artificial Intelligence: A Modern Approach", Pearson Education, 2014.

2. David Pool and Alan Mackworth, “Artificial Intelligence: Foundations of Computational agents”, Cambridge University, 2011.
3. Daphne Koller and N Friedman, “Probabilistic Graphical Models - Principles and Techniques”, MIT, 2009.
4. Tsang and Edward, “Foundations of Constraint Satisfaction: The Classic Text”, BoD–Books on Demand, 2014.

REFERENCES:

1. Christopher M.Bishop, “Pattern Recognition and Machine Learning”, Springer, 2013.
2. Nils J. Nilsson, “The Quest for Artificial Intelligence: A History of Ideas and achievements”, Cambridge University Press, 2010.

OPEN ELECTIVES

15XTO1 COMPUTATIONAL FINANCE

3 2 0 4

INTRODUCTION : Law of one price – Risk neutral pricing – Arbitrage and Hedging – Financial Products and capital markets – Futures, Forwards and options – Options pricing problem and three types of solutions. (3)

MATHEMATICAL PRELIMINARIES : Conditional expectation – Sigma Algebra – Filtrations, Time series analysis - Covariance stationary – autocorrelations - MA(1) and AR(1) models, Stochastic Calculus - Random walk – Brownian motion – Martingales – Ito’s Lemma. (12)

PORTFOLIO THEORY - Introduction - Portfolio theory with matrix algebra - Review of constrained optimization methods, Markowitz algorithm, Markowitz Algorithm using the solver and matrix algebra – Portfolio choice and linear pricing – Statistical analysis of efficient portfolios. (10)

BASIC OPTIONS THEORY – Definitions – Pay off diagrams – Single period binomial options theory – Multi period binomial options theory – Real options – American options, Simulation methods for options pricing – Random variable generation – simulation of stochastic processes. (10)

THE CAPITAL ASSET PRICING (CAP) AND RISK BUDGETING - Mean variance portfolio theory – Asset returns – Variance as a risk measure - The one and two fund theorems, The capital market line – CAP as a pricing formula – Systematic and unsystematic risk – Euler’s theorem – Asset contributions to volatility – beta as a measure of portfolio risk , Limitations of mathematical models in finance. (10)

TUTORIAL PRACTICE:

1. Problems using Capital Asset Pricing model.
2. Problems using Auto correlation.
3. Plot time series data and find outliers
4. Problems using Autoregressive models
5. Problems using Moving average models
6. Monte Carlo Simulation of options pricing

Total L: 45+T:30 = 75

REFERENCES:

1. David Ruppert, “Statistics and Data Analysis for Financial Engineering”, Springer-Verlag, 2011.
2. Edwin J. Elton, Martin J. Gruber, Stephen J. Brown and William N. Goetzmann “Modern Portfolio Theory and Investment Analysis”, Wiley, 2014.
3. Simon Benninga, “Financial Modeling”, MIT Press, 2008.
4. Steven E Shreve, “Stochastic Calculus for Finance – I” , Springer, 2004
5. Glasserman Paul, “Monte Carlo Methods in financial Engineering”, Springer Science and Business media, 2004.

15XTO2 COMPUTATIONAL GEOMETRY

3 2 0 4

MATHEMATICAL & GEOMETRICAL REVIEW: Algorithm analysis – sorting, binary search, balanced binary search, divide and conquer, plane sweep, Kd-trees, Dijkstra’s algorithm, points, lines and planes, basic geometric objects – polygons, polytopes, convexity, graphs - vertex coloring, planar, Euler’s formula. (2)

CONVEX HULLS: Definition, lower bounds, algorithms - Graham's scan, divide and conquer, Jarvis march, 3D hulls. (5)

LINE SEGMENT INTERSECTION: Plane sweep algorithm, Doubly-connected edge list, computing overlay of two subdivisions, Map overlay algorithm, half-plane intersection, arrangements of lines. (8)

POLYGON TRIANGULATION: Art gallery problem – introduction, triangulation, bounds, partition into monotone pieces, triangulating monotone polygon, placement of guards. (8)

ORTHOGONAL RANGE SEARCHING: 1-D and 2-D range searching, rangetrees. (4)

VORONOI DIAGRAMS: Properties, beach line, computing Voronoi diagram, Delaunay triangulations, computing Delaunay triangulations. (8)

ROBOT MOTION PLANNING: Work space and configuration space, point robot, free space, Minkowski sums for convex and nonconvex polygons, translational motion planning, motion planning with rotations, Point location and trapezoidal maps. Visibility graphs - Shortest paths for a point robot, computing visibility graph, shortest paths for a translating polygonal robot. (10)

TUTORIAL PRACTICE:

Implementation of algorithms for the following problems.

1. Convex hull problems.
2. Line and half plane intersections.
3. Map overlay problems using Doubly-connected edge list.
4. Triangulation and Art gallery problem.
5. Orthogonal range searching (1D and 2D) using Kd-trees.
6. Construct Voronoi diagrams.
7. Translational algorithms for robot motion planning.

Total L:45+T:30 = 75

TEXT BOOKS:

1. M. De Berg, M. van Kreveld, M. OvermarsandO.Schwarzkopf, “Computational Geometry - Algorithms and Applications”, Springer Verlag, 2008.
2. Joseph O’Rourke, “Computational Geometry in C”, Cambridge University Press, 2001.

REFERENCES:

1. Franco P. Preparata and Michael Ian Shamos, “Computational Geometry - An Introduction”, Springer-Verlag, (Digitized) 2011 .
2. Goodman J E and O'Rourke, “Handbook of Discrete and Computational Geometry”, CRC Press, 2004.
3. Subir Kumar Ghosh, “Visibility Algorithms in the Plane”, Cambridge University Press, 2007.

15XTO3 DATA SCIENCE

3 2 0 4

INTRODUCTION TO DATA SCIENCE : Data wrangling, cleaning, and sampling to get a suitable data set - Mathematics for understanding the data – Descriptive statistics : Visualizing Data - Central Tendency –Variability –Standardizing -Normal Distribution -Sampling Distributions. (8)

DATA MANIPULATION AT SCALE : Parallel databases, parallel query processing, in-database analytics, MapReduce, Hadoop, Key-value stores and NoSQL; tradeoffs of SQL and NoSQL. (8)

DATA ANALYTICS USING STATISTICAL TECHNIQUES : Review of univariate regression, multiple regression - Linear regression and related methods - splines and regularization - Kernel methods - Generalized additive models - Kernel smoothing - Gaussian mixtures and EM algorithm - Geometry, subspaces, orthogonality, projections, normal equations, rank deficiency, estimable functions and Gauss-Markov theorem - Computation via QR decomposition, Gramm-Schmidt orthogonalization and the SVD - Multivariate normal distribution. (15)

COMMUNICATING RESULTS : Visualization - descriptive statistics and visualisations, privacy, ethics – multivariate visualization. (5)

SPECIAL TOPICS : Graph Analytics: structure, traversals, analytics, PageRank, community detection, recursive queries, Semantic web. (5)

CASE STUDY : Community Detection – Collaborative Network – Opinion mining – Co-citation network . (4)

TUTORIAL PRACTICE:

1. Introduction to R and problems using R.
2. Collect datasets from Kaggle and Data Analysis.
3. Implementation of various predictive models.
4. Generate the results using Confidence levels.
5. Implementation of SVD.

Total L: 45+T:30 = 75

TEXT BOOK:

1. AnandRajaraman and Jeffrey David Ullman, "Mining of Massive Datasets", Cambridge University Press, 2011.
2. Ravi Kannan and John Hopcroft, "Foundations of Data Science", 2013.

REFERENCES:

1. Johannes Ledolter, 'Data Mining and Business Analytics with R', John Wiley & Sons, 2013
2. Gareth James and Daniel Witten, Trevor Hastie, Robert Tibshirani, "An Introduction to Statistical Learning with Applications in R", Springer, 2013.
3. Michael T. Longnecker, R. Lyman Ott," An Introduction to Statistical Methods and Data Analysis", Cengage Learning 2008.
4. T. Hastie, R. Tibshirani, and J. Friedman, "The elements of statistical learning: data mining, inference, and prediction", Springer, 2009.
5. Matthew A. Russell,"Mining the Social Web: Analyzing Data from Facebook, Twitter, LinkedIn, and Other Social Media Sites", O'Reilly Media, 2013.
6. Philipp K. Janert, "Data Analysis with Open Source Tools", O'Reilly Media, 2010.

15XTO4 DATA VISUALIZATION

3 2 0 4

INTRODUCTION: Information visualization – Theoretical foundations – Information visualization types – Design principles - A framework for producing data visualization (8)

Static data visualization – tools – working with various data formats (4)

Dynamic data displays : Introduction to web based visual displays – deep visualization – collecting sensor data – visualization – D3 framework - Introduction to Many eyes and bubble charts (10)

Maps – Introduction to building choropleth maps (3)

Trees – Network visualizations – Displaying behavior through network graphs (10)

Big data visualization – Visualizations to present and explore big data – visualization of text data and Protein sequences (10)

TUTORIAL PRACTICE:

Note : Explore softwares like R, Python, Google Vision, Google Refine, and ManyEyes ; Data sets are available on Gap minder, Flowing data

1. Visualization of static data.
2. Visualization of web data.
3. Visualization of sensor data.
4. Visualization of protein data.

Total L: 45 + T: 30 = 75

TEXT BOOK:

1. Ware C and Kaufman M "Visual thinking for design", Morgan Kaufmann Publishers, 2008.

REFERENCES:

1. Chakrabarti, S "Mining the web: Discovering knowledge from hypertext data ",Morgan Kaufman Publishers, 2003.
2. Fry ,"Visualizing data", Sebastopo",O'Reily, 2007.

15XTO5 PRINCIPLES OF MANAGEMENT AND BEHAVIOURAL SCIENCES

3 2 0 4

PRINCIPLES OF MANAGEMENT: Meaning, Definition and Significance of Management, Basic Functions of Management – Planning, Organizing, Staffing, Directing and Controlling. Organizational Environment – Social, Economic, Technological and Political. Corporate Social Responsibility - Case discussion. (5)

INDUSTRIAL AND BUSINESS ORGANIZATION: Growth of Industries (Small Scale, Medium Scale and Large Scale Industries). Forms of Business Organizations. Resource Management – Internal and External Sources (8)

ORGANIZATIONAL BEHAVIOUR: Significance of OB, Impact of culture on organization. Role of leadership and leadership styles. Personality and Motivational Theories. Attitudes, Values and Perceptions at work - Case discussion(8)

GROUP BEHAVIOUR: Group dynamics, Group formation and development, group structure and group cohesiveness. Informal organization – Sociometry – Interaction analysis – Exercises (8)

GLOBALISATION: Issues for global competitiveness, proactive and reactive forces of globalization. Cross cultural management – Management of work force diversity. (8)

HUMAN RESOURCE MANAGEMENT: Objectives and Functions, Selection and Placement, Training and Development – Conflict management – Stress management - Human resource management in global environment - Human resource information system(HRIS) - Case discussion. (8)

TUTORIAL PRACTICE:
1. Case study on human resource information system.
2. Case study on organizational behavior.
3. Case study on human resource information system.
4. Case study on organizational behavior.

Total L: 45 + T: 30 = 75

TEXT BOOKS:

1. Harold Koontz, Heinz Weihrich and RamachandraAryasri, “Principles of Management”, Tata McGraw Hill, 2004.
2. Mamoria C B, “Personnel Management”, Sultan Chand & Sons, 2005.

REFERENCES:

1. John W Newstrom and Keith Davis, “Organizational Behavior”, Tata McGraw Hill, 2002.
2. Stephen P Robbins, ”Organisational behavior”, Prentice Hall, 2010.
3. Khanna O P, “Industrial Engineering & Management”, DhanpatRai Publications, 2010.

15XTO6 ENTREPRENEURSHIP

3 2 0 4

INTRODUCTION TO ENTREPRENEURSHIP: Definition – Characteristics and Functions of an Entrepreneur – Common myths about entrepreneurs – Importance or Entrepreneurship. Seminar in R5 & R6. (5)

CREATIVITY AND INNOVATION: The role of creativity – The innovation Process – Sources of New Ideas – Methods of Generating Ideas – Creative Problem Solving – Entrepreneurial Process. (6)

DEVELOPING AN EFFECTIVE BUSINESS MODEL: The Importance of a Business Model – Starting a small scale industry - Components of an Effective Business Model. (5)

APPRAISAL OF PROJECTS: Importance of Evaluating Various options and future investments- Entrepreneurship incentives and subsidies – Appraisal Techniques. (8)

FORMS OF BUSINESS ORGANIZATION: Sole Proprietorship – Partnership – Limited liability partnership - Joint Stock Companies and Cooperatives. (4)

FINANCING THE NEW VENTURE: Determining Financial Needs – Sources of Financing – Equity and Debt Funding – Case studies in Evaluating Financial Performance. **(**8)

THE MARKETING FUNCTION: Industry Analysis – Competitor Analysis – Marketing Research for the New Venture – Defining the Purpose or Objectives – Gathering Data from Secondary Sources – Gathering Information from Primary Sources – Analyzing and Interpreting the Results – The Marketing Process**.** (5)

INTELLECTUAL PROPERTY PROTECTION AND ETH ICS: Patents – Copyright - Trademark- Geographical indications – Ethical and social responsibility and challenges. (4)

TUTORIAL PRACTICE:
Case studies

Total L:45+T:30=75

TEXT BOOKS:

1. Donald F.Kuratko and Richard M.Hodgetts, “Entrepreneurship”, South-Western.
2. The Dynamics of Entrepreneurial Development and Management, Vasant Desai, Himalaya Publishing House, 2010.

REFERENCES:

1. S.L.Gupta, Arun Mittal, Entrepreneurship Development, International Book House, 2012.
2. G. S. Sudha, Management and Entrepreneurship Development, Indus Valley Publication, 2009.
3. V. Badi, N. V. Badi , Business Ethics, R, Vrinda Publication (P) Ltd.,, 2012.
4. Prasanna Chandra Projects- Planning, Analysis, Financing, Implementation and review, TATA McGraw Hill, 2012.

15XTO7 INFORMATION THEORY AND ERROR CONTROL CODING

3 2 0 4

MEMORYLESS FINITE SCHEMES : Self information measure – Entropy function – Conditional entropies – Characterisitics of entropy function – Derivation of the noise characteristics of a channel – Mutual information – Redundancy – Efficiency and channel capacity – Capacities of channels with symmetric noise structure. (9)

CONTINUOUS CHANNELS: Definitions of different entropies – Mutual information – Maximization of the entropy of a continuous random variable – Entropy maximization problems – channel capacity under the influence of additive white Gaussian noise – parallel Gaussian channel. (9)

ELEMENTS OF ENCODING : Source coding techniques – Necessary and sufficient conditions for noise less coding – Fundamental theorem of discrete noise-less coding – Fundamental theorem of discrete coding in presence of noise. (9)

ERROR CONTROL CODING–Need for error control coding – Linear block codes – Optimum soft decision decoding of linear block codes – Hard decision decoding – Polynomial representation of codes – Cyclic codes – Convolutional codes – viterbi decoding algorithm – Other decoding methods of convolutional codes – Galois fields – BCH Codes – Reed Solomon codes – Berlecamp Algorithm – Interleaving and concatenated codes – Turbo codes – Low density parity check codes. (9)

ITERATIVE DECODING – Serial concatenation using inner block codes – serial concatenation using inner convolutional codes – product codes – generalized array codes – applications of multi stage coding – The BCJR algorithm – use of extrinsic information – recursive systematic convolutional codes – MAP decoding of RSC codes – Interleaving and Trellis termination – The soft output Viterbi algorithm – Galleger codes – Serial concatenation with iterative decoding – Performance and complexity issues – application to mobile communication. (9)

TUTORIAL PRACTICE:

1. Finding mutual information, entropy and conditional entropy of a channel.
2. Implementation of various encoding and decoding algorithms.

Total L: 45 + T: 30 = 75

REFERENCES:

1. Reza F M, “ An introduction to Information theory”, McGraw Hill, 2012.
2. Joy A Thomas and Cover M, “ Elements of Information theory”, John Wiley, 2006.
3. Peter Sweeney, “Error Control coding from theory to practice”, John Wiley, 2002.
4. Salvatore Gravano, “ Introduction to Error Control codes”, Oxford University Press, 2001.
5. Viterbi A and Omura J K, “ Principles of Digital Communication and Coding”, McGraw Hill, 2009.

15XTO8 COMPUTATIONAL COMPLEXITY THEORY

3 2 0 4

INTRODUCTION: The computational model - Modeling computation and efficiency - Review of Turing machines – Universal Turing machines – Uncomputable functions – Deterministic time and the class P (5)

COMPLEXITY CLASSES - P, NP, NP Complete , NP-Hard - P vs NP – NP completeness – Relation between NP and NP completeness – The cook Levin theorem – The web of reductions – Decision vs Search – coNP, EXP and NEXP (8)

DIAGONALIZATION– Time hierarchy theorem – Space hierarchy theore – non deterministic time hierarchy theorem – Oracle machines - Space complexity – Configuration graphs – Some space complexity classes – PSPACE completeness – NL Completeness. (8)

POLYNOMIAL HIERARCHY AND ALTERNATIONS– The classes $\sum_2^p$ and π_2^p – The polynomial hierarchy – Alternating turing Machines – Time versus alternations – Defining the hierarchy via oracle machines (8)

CIRCUITS – Boolean circuits – Karp Lipton theorem – Circuit lower bounds (2)

RANDOMIZED COMPUTATION : Probabilistic Turing Machines (PTM) –Examples - RP(Randomized Polynomial) , BPP (Bounded Error probabilistic polynomial) ,Complement Randomized Polynomial (Co-RP) – Probabilistic Polynomial (PP) – Randomized logarithmic space polynomial time (RL) – Related problems. (5)

COUNTING PROBLEMS – Counting classes – Complexity of counting problems – An approximate comparison procedure - Constructing A-Comp - Non-Uniform Classes– Oracles – Relativization (6)

APPLICATIONS - Randomized decision tree – Pseudo random number generators (3)

TUTORIAL PRACTICE:
1. Implementation of finding a solution to different classes of problems
2. Implementation of randomized decision tree

Total L: 45 + T: 30 = 75

TEXT BOOKS:
1. SanjeevArora, Boaz Barak, “Computational Complexity : A modern approach”, Cambridge University Press, 2009.
2. Goldreich, “Computational Complexity: A Conceptual Perspective”, CUP 2008.

REFERENCES:
1. Michael Sipser, “Introduction to the Theory of Computation”,Cengage learning, 2005.
2. Luca Trevisan, “Lecture Notes on Computational Complexity”, 2004.