Dr. Mahalingam College of Engineering and Technology

(An Autonomous Institution)

Pollachi - 642 003

Curriculum and Syllabus

B.E. COMPUTER SCIENCE AND ENGINEERING

SEMESTER I to VIII

REGULATIONS 2016

DR MAHALINGAM

MCET

COLLEGE OF ENGINEERING AND TECHNOLOGY

Enlightening Technical Minds

DEPARTMENT OF COMPUTER SCIENCE AND ENGINEERING

2016 REGULATION

Curriculum for B.E Computer Science and Engineering from Semester I to VIII

SEMESTER I

Course Code	Course Title	Hours/Week			Credits	Marks
		L	T	P		
THEORY						
16ENT11	Communication Skills – I	2	0	2	3	100
16MAT14	Engineering Mathematics - I	3	2	0	4	100
16PHT14	Engineering Physics	3	0	0	3	100
16GET16	Fundamentals of Computing and Programming	3	0	2	4	100
16GET17	Basics of Electrical & Electronics Engineering	3	0	0	3	100
PRACTICAL						
16PHL11	Engineering Physics Laboratory	0	0	4	2	100
16EPL12	Engineering Practices Laboratory (Electrical, Electronics, Civil and Mechanical)	0	0	4	2	100
16PSL12	Sports for Wellness	0	0	2	1	100
	TOTAL	**14**	**2**	**14**	**22**	**800**

SEMESTER II

Course Code	Course Title	Hours/Week			Credits	Marks
		L	T	P		
THEORY						
16ENT21	Communication Skills - II	2	0	2	3	100
16MAT24	Engineering Mathematics - II	3	2	0	4	100
16PHT24	Material Science	3	0	0	3	100
16GET26	C Programming	3	0	0	3	100
16GET27	Introduction to Engineering	3	0	0	3	100
PRACTICAL						
16CPL21	C Programming Laboratory	0	0	4	2	100
16EGL21	Engineering Graphics	1	0	4	3	100
16PSL22	Promotion of Students Wellness	0	0	2	1	100
	TOTAL	**15**	**2**	**12**	**22**	**800**

BoS Chairman

SEMESTER III

Course Code	Course Title	Hours/Week			Credits	Marks
		L	T	P		
THEORY						
16EET35	Digital System Design	3	0	0	3	100
16MAT34	Discrete Mathematics	3	2	0	4	100
16ECT34	Principles of Communication Engineering	3	0	0	3	100
16CST31	Operating Systems	3	0	0	3	100
16CST32	Data Structures and Algorithm Analysis - I	3	0	0	3	100
16CST33	Java Programming	3	0	2	4	100
PRACTICAL						
16CSL31	Data Structures and Algorithm Analysis - I Laboratory	0	0	4	2	100
16EEL32	Digital System Design Laboratory	0	0	4	2	100
16PSL31	Personal Effectiveness	0	0	2	1	100
XXXX	One Credit Course	0	0	2	1	100
	TOTAL	**18**	**2**	**14**	**26**	**1000**

SEMESTER IV

Course Code	Course Title	Hours/Week			Credits	Marks
		L	T	P		
THEORY						
16CST41	Database Systems	3	0	0	3	100
16MAT44	Probability and Queuing Theory	3	2	0	4	100
16CST42	Computer Architecture	3	0	0	3	100
16CST43	Software Engineering	3	0	0	3	100
16CST44	Data Structures and Algorithm Analysis - II	3	0	0	3	100
16CST45	Mobile Application Development	3	0	2	4	100
PRACTICAL						
16CSL41	Data Structures and Algorithm Analysis - II Laboratory	0	0	4	2	100
16CSL42	Database Systems Laboratory	0	0	4	2	100
16PSL41	Ethical and Moral Responsibility	0	0	2	1	100
XXXX	One Credit Course	0	0	2	1	100
	TOTAL	**18**	**2**	**14**	**26**	**1000**

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SEMESTER V

Course Code	Course Title	Hours/Week			Credits	Marks
		L	T	P		
THEORY						
16EET55	Microcontroller and System Interfacing	3	0	2	4	100
16CST51	Computer Networks	3	0	0	3	100
16CST52	Data Warehousing and Mining	3	0	0	3	100
16CST53	Formal Languages and Automata Theory	3	0	0	3	100
16CST54	Web Technologies	3	0	0	3	100
XXXX	Elective I	3	0	0	3	100
PRACTICAL						
16CSL51	Computer Networks Laboratory	0	0	4	2	100
16CSL52	Web Technologies Laboratory	0	0	4	2	100
16PSL51	Teamness and Inter-Personal Skills	0	0	2	1	100
XXXX	One Credit Course	0	0	2	1	100
	TOTAL	**18**	**0**	**14**	**25**	**1000**

SEMESTER VI

Course Code	Course Title	Hours/Week			Credits	Marks
		L	T	P		
THEORY						
16CST61	Artificial Intelligence	3	0	2	4	100
16CST62	Big Data Technologies	3	0	0	3	100
16CST63	Object Oriented Analysis and Design	3	0	2	4	100
16CST64	Open Source Software Development	3	0	0	3	100
XXXX	Elective II	3	0	0	3	100
PRACTICAL						
16CSL61	Big Data Technologies Laboratory	0	0	4	2	100
16CSL62	Open Source Software Development Laboratory	0	0	4	2	100
16PSL61	Campus to Corporate	0	0	2	1	100
XXXX	One Credit Course	0	0	2	1	100
	TOTAL	**15**	**0**	**16**	**23**	**900**

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SEMESTER VII

Course Code	Course Title	Hours/Week			Credits	Marks
		L	T	P		
THEORY						
16CST71	Cloud Technology	3	0	0	3	100
16CST72	Cryptographic Techniques	3	0	0	3	100
16CET73	Environmental Studies	3	0	0	3	100
XXXX	Elective III	3	0	0	3	100
XXXX	Elective IV (Open Elective)	3	0	0	3	100
PRACTICAL						
16CSL71	Cloud Technology Laboratory	0	0	4	2	100
16CSL72	Cryptographic Techniques Laboratory	0	0	4	2	100
16CSL73	Innovative and Creative Project	0	0	8	4	100
	TOTAL	**15**	**0**	**16**	**23**	**800**

SEMESTER VIII

Course Code	Course Title	Hours/Week			Credits	Marks
		L	T	P		
THEORY						
XXXX	Elective V	3	0	0	3	100
XXXX	Elective VI	3	0	0	3	100
XXXX	Elective VII	3	0	0	3	100
PRACTICAL						
16CSL81	Project	0	0	20	10	200
	TOTAL	**9**	**0**	**20**	**19**	**500**

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ELECTIVES

Course Code	Course Title	Hours/Week			Credits	Marks
		L	T	P		
PROGRAMMING PARADIGMS AND ALGORITHMS						
16CSE01	Python Programming	3	0	0	3	100
16CSE02	Web Technologies II	3	0	0	3	100
16CSE03	User Interface Design	3	0	0	3	100
16CSE04	Advanced Data Structures and Algorithms	3	0	0	3	100
16CSE05	Advanced Java Programming	3	0	0	3	100
16CSE06	Graphics and Visualization	3	0	0	3	100
DATA MANAGEMENT						
16CSE07	Multimedia Systems and Applications	3	0	0	3	100
16CSE08	Soft Computing	3	0	0	3	100
16CSE09	Machine Learning Techniques	3	0	0	3	100
16CSE10	Information Retrieval Techniques	3	0	0	3	100
16CSE11	Social Network Analytics	3	0	0	3	100
SYSTEM DESIGN AND NETWORKING						
16CSE12	Advanced Computer Architecture	3	0	0	3	100
16CSE13	Compiler Design	3	0	0	3	100
16CSE14	Software defined Networks	3	0	0	3	100
16CSE15	Distributed Computing	3	0	0	3	100
16CSE16	Network and Internet Security	3	0	0	3	100
16CSE17	Ad-hoc & Sensor Networks	3	0	0	3	100
16CSE18	High Speed Networks	3	0	0	3	100
SOFTWARE ENGINEERING						
16CSE19	Software Quality Assurance and Testing	3	0	0	3	100
16CSE20	Software Project Management	3	0	0	3	100
16CSE21	Agile Software Development	3	0	0	3	100
16CSE22	Business Intelligence	3	0	0	3	100
16CSE23	Engineering Economics and Financial Accounting	3	0	0	3	100
16CSE24	Principles of Management	3	0	0	3	100

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OPEN ELECTIVES

Course Code	Course Title	Hours/Week			Credits	Marks
		L	T	P		
THEORY						
	Human Computer Interface Design	3	0	0	3	100
	Cyber Security and Computer Forensics	3	0	0	3	100
	Green Computing	3	0	0	3	100

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SEMESTER I

Course Code: 16ENT11	**Course Title:** COMMUNICATION SKILLS I (Common to all B.E/B.Tech Programmes)	
Core	**L : T : P : C**	2: 0 : 2 :3
Type: Theory & Practical	Total Contact Hours:	**60**

Prerequisites

The student should have undergone English as his/her first or second language in school.

Course Objectives

The course is intended to:

1. Listen and understand monologues and dialogues of a native speaker on par with A2 of CEFR level
2. Speak in simple sentences to convey their opinion and ideas on par with A2 of CEFR level
3. Read and infer a given text on par with A2 of CEFR level
4. Draft basic formal written communication on par with A2 of CEFR level
5. Speak and write with minimal grammatical mistakes on par with A2 of CEFR level

Unit I - LISTENING **12**

Short conversations/monologues - numbers and spelling (dates, prices, percentages, figures, etc.) - and locate specific information - longer monologue and guided note taking - gap filling - Understanding the gist and extracting the main idea.

Unit II - SPEAKING **12**

Answering questions about oneself, agreeing and disagreeing, expressing preferences - mini-presentation on a business theme (Oral) - Giving information and expressing opinions - discussion on business related topics – initiate a conversation and respond appropriately -business vocabulary - collocation.

Unit III - READING **12**

Read short texts and understand the main message (signs, messages, postcards, notes, emails, labels) - Read and find specific information - Interpreting visual information - Comprehend detailed factual information - gather gist – cloze test.

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Unit IV - WRITING 12

Internal written communication - short messages to colleagues -note, message, memo, email- External communication -letter, email, notice - set phrases for letters and e-mails- Discourse markers, sign post words.

Unit V - GRAMMAR 12

Types of sentences – Declarative, interrogative, imperative and exclamatory – Usage of tenses (Simple and continuous forms) - Voices – Concord (Subject and verb) - Auxiliary - Infinitive and Gerunds –Article - Preposition - Comparative and superlative adjectives.

Course Outcomes

At the end of the course the student will be able to:

1. Listen to conversations, comprehend and answer questions equivalent to BEC preliminary listening exercises.
2. Answer questions about one self and business-related themes on par with BEC preliminary speaking tests.
3. Read passages, infer and respond to the questions from BEC preliminary reading exercises.
4. Write appropriate business e mail, note, memo and letter on par with BEC preliminary writing tests.
5. Write simple and grammatically correct sentences.

Text Books:

1. Whitby Norman, Business Benchmark Pre-intermediate to Intermediate Students' Book CUP Publications, 2nd Edition, 2014
2. Wood Ian, Williams Anne, Cowper Anna, Pass Cambridge BEC Preliminary, Cengage Learning, 2nd edition, 2015.

Reference Books:

1. BEC-Preliminary - Cambridge Handbook for Language Teachers, 2nd Edition, CUP 2000.
2. Hewings Martin - Advanced Grammar in use - Upper-intermediate Proficiency, CUP, Third Edition, 2013.

Web References:

1. www.cambridgeenglish.org/exams/business.../business-preliminary/
2. http://www.pearsonlongman.com/intelligent_business/bec_tests/preliminary.html

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Course Code: 16MAT14	Course Title: ENGINEERING MATHEMATICS - I (FOR B.E CSE only)	
Core	L: T: P: C	3 : 2 : 0 : 4
Type: Theory	Total Contact Hours:	75

Course Objectives

1. Calculate Eigen values and Eigen vectors.
2. Use different testing methods for convergence and divergence.
3. Apply the concepts of differentiation.
4. Identify the extreme values for two variable functions.
5. Apply multiple integrals.

Unit I – EIGEN VALUES AND EIGEN VECTORS **9+6**

Solution of system of equations-Eigen values and Eigen vectors of a real matrix - Characteristic equation - Properties of eigenvalues and eigenvectors - Diagonalization of matrices by orthogonal transformation - Reduction of a quadratic form to canonical form by orthogonal transformation.

Unit II - SEQUENCES AND SERIES **9+6**

Sequences: Definition and examples- Series: Types and Convergence - Series of positive terms-Tests of convergence: Comparison test, Cauchy's root test, Integral test and D'Alembert's ratio test - Alternating series- Leibnitz's test - Series of positive and negative terms - Absolute and conditional convergence.

Unit III - DIFFERENTIAL CALCULUS **9+6**

Curvature - Cartesian and polar coordinates - Radius and Centre of curvature - Circle of curvature - Involutes and Evolutes- Envelopes.

Unit IV - FUNCTIONS OF SEVERAL VARIABLES **9+6**

Partial derivatives - Homogeneous functions and Euler's theorem - Total derivative- Change of variables - Jacobians - Partial differentiation of implicit functions – Taylor's series for functions of two variables - Maxima and minima of functions of two variables – Lagrange's method of undetermined multipliers.

Unit V - MULTIPLE INTEGRALS **9+6**

Double integration - Cartesian and polar coordinates - Change of order of integration- Transformation from Cartesian to polar, spherical and cylindrical coordinates - Triple integration in Cartesian Coordinates - Applications: Evaluating area and volume using multiple integrals.

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Course Outcomes

1. Calculate Eigen values and Eigen vectors for a given real matrix.
2. Use different testing methods to check the convergence and divergence of infinite series.
3. Apply the concepts of differentiation to curvature.
4. Identify the extreme values for two variable functions.
5. Apply multiple integrals to find area and volume.

Text Books:

1. Srimanta Pal &Subodh C. Bhunia, "Engineering Mathematics", First Edition, 2015, Oxford University Press.
2. Erwin Kreyszig, "Advanced Engineering Mathematics", Tenth Edition, 2015, Wiley India.

Reference Books:

1. Peter V. O'Neil, "Advanced Engineering Mathematics", Seventh Edition,2012, Thomson Nelson, Toronto.
2. K.A. Stroud & Dexter J. Booth, "Advanced Engineering Mathematics", Fifth Edition,2011, Palgrave Macmillan.

Web References:

1. http://nptel.ac.in/video.php?subjectId=122107036

BoS Chairman

Course Code: 16PHT14	Course Title: ENGINEERING PHYSICS (Common to CSE and IT)	
Core	L : T : P : C	3 :0 :0:3
Type: Theory	Total Contact Hours:	45

Course Objectives

The course is intended to:

1. Explain the properties of light and colors.
2. Illustrate the laser characteristics, principles and applications.
3. Explain the mode of propagation and attenuation.
4. Identify a suitable fabricating integrated circuits (ICs) technique.
5. Describe the concept of luminescence.

Unit I - LIGHT 9

Nature of Light- Laws of reflection and refraction - Dispersion- Interference - Diffraction - Mono chromatic light- Dispersion and combining white light- Colors - Primary and secondary colors – Color addition and subtraction - The electromagnetic spectrum- properties of electromagnetic radiation. Quantum concepts: Properties of matter waves- de Broglie wave equations.

Unit II - LASERS 9

Laser principles: Stimulated and spontaneous emissions of radiations - Population inversion and pumping methods- Properties of lasers - Nd: YAG laser and CO_2 molecular laser - Semiconductor laser (Homo junction and hetro junction) - Holograms and Holographic data storage (record/read).

Unit III - FIBER OPTICS 9

Optical fibers - Propagation of light through optical fibers -Expressions for numerical aperture and acceptance angle -Types of optical fibers based on material, refractive index, and mode of propagation- Losses in optical fiber - Attenuation- Bending and reflection losses- Photo detectors: PN, PIN & Avalanche photo diodes- Fiber optic communication link.

Unit IV - INTEGARATED CIRCUITS (ICs) 9

Advantages of Integrated circuits (ICs) over discrete components- IC classification- Basic plannar processes – Silicon wafer preparation- Epitaxial growth & Oxidation- Photolithography- Diffusion – Isolation, base and emitter diffusion - Aluminium metallization – IC Assembly processing and packaging.

Unit V - DISPLAY DEVICES 9

Optical Emissions: Luminescence, photoluminescence, cathode luminescence- electroluminescence -Injection electro Luminescence- Working principles of displays: Plasma display, LED display, Liquid crystal display (LCD) and Numeric display.

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Course Outcomes

At the end of the course the student will be able to:

1. Explain the properties of light and colors for electronic display devices.
2. Illustrate the characteristics, principles and applications of laser.
3. Explain the mode of propagation and attenuation in optical fibers.
4. Identify a suitable technique for fabricating integrated circuits (ICs).
5. Describe the concept of luminescence in various electronic display devices.

Text Books:

1. Gilbert Rowell, Sydney Herbert, "Physics", Cambridge University Press, 2008.(Unit I)
2. M. N. Avadhanulu and P. G. Kshirsagar, "Text Book of Engineering Physics", S. Chand & Company Ltd., New Delhi, 2013.(Unit II,III,IV)
3. David Armitage "Introduction to Micro displays", John Wiley & Ltd, 2006.(Unit V)

Reference Books:

1. R.K. Gaur, S.L. Gupta, "Engineering Physics", Dhanpat Rai Publications, 2015.
2. A. Marikani "Engineering Physics" Second Edition, PHI Learning, New Delhi, 2014.
3. Arthur Beiser, "Modern Physics", Tata McGraw-Hill Co, New Delhi, 2003.
4. David Halliday, Robert Resnick, Jearl Walker," Fundamentals of Physics Extended", Ninth Edition, Wiley India, 2014.
5. D. Roy Choudhry, Shail Jain, "Linear Integrated Circuits", Third Edition New Age International Pvt. Ltd, 2010.

Web References:

1. http://nptel.ac.in/syllabus/syllabus.php?subjectId=115103034
2. http://nptel.ac.in/syllabus/syllabus.php?subjectId=115104041
3. http://nptel.ac.in/courses/115102025/
4. http://www.slideshare.net/ManojHarsule/display-devices-crt-and-lcd-screen
5. http://educypedia.karadimov.info/library/Display%20Technology%20Overview.pdf

BoS Chairman

Course Code: 16GET16	Course Title: FUNDAMENTALS OF COMPUTING AND PROGRAMMING (Common to CSE and IT)	
Core	L : T : P : C	3 :0 :2: 4
Type: Theory & Practical	Total Contact Hours:	75

Course Objectives

The course is intended to:

1. Develop a flow chart.
2. Comprehend the process of program development.
3. Construct repetition structures programs.
4. Solve searching and sorting problems.
5. Create a modular program.

Overview of Engineering Education (Not included for assessment) 3

Expectation and Aspirations of engineering students, Graduate Engineering Attributes, Outcome based Engineering Curriculum, Engineering Skills – Technical and Professional Courses, Course map, Concepts and Theories of Learning – Higher order Thinking Skills, Multiple Intelligences.

Unit I - INTRODUCTION TO PROGRAMMING 8

Introduction to Programming: General Problem Solving Strategy, Program Development Cycle - Basic Programming Concepts: A Simple Program, Data Input, Program Variables and Constants - Data Types - Data Processing and Output - Case Study: RAPTOR.

Unit II - PROGRAM DEVELOPMENT AND SELECTION STRUCTURES 8

Process of Developing a Program - Program Design - Coding, Documenting, and Testing a Program - Structured Programming - Types of Selection Structures - Relational and Logical Operators - Applications of Selection Structures.

Unit III - REPETITION STRUCTURES 8

Introduction to Repetition Structures - Types of Loops - For Loop - Combining Loops and Selection Structures - Nested Loops - Applications of Repetition Structures.

Unit IV - ARRAYS, SORTING AND SEARCHING 9

Introduction to Arrays - One Dimensional Array - Arrays Declaration, Strings as Arrays of Characters - Two-Dimensional Arrays - Introduction to Sorting and Searching - Bubble Sort Technique - Binary Search - Applications of Arrays.

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Unit V - FUNCTIONS **9**

Introduction to Arguments and Parameters - Subprograms: Value and Reference Parameters - Difference between Value and Reference Parameters- Scope of a Variable - Functions: Built-in Functions - User Defined Functions - Applications of Functions.

LAB COMPONENT **30**

Students must develop programs for any two problems (not limited to the list) in each category using RAPTOR / SCRATCH tools.

1. Experiments using MS-Office package
    i. Create resume using MS-Word
    ii. Generation of mark sheet of a student using MS-Excel
    iii. Generation of Electricity Bill using MS-Excel
    iv. Create presentation for Product Marketing
2. Programs using Fundamental Algorithms
    i. Exchanging the values of Two Variables
    ii. Counting, Summation of a set of Numbers
    iii. Factorial Computation
    iv. Reversing the Digits of an Integer
3. Programs using Factoring Methods
    i. Finding the square Root of a number
    ii. The Smallest Divisor of an Integer
    iii. The Greatest Common Divisor of Two Integers
    iv. Computing the n^{th} Fibonacci number
4. Programs using Array Techniques
    i. Array Order Reversal
    ii. Finding the Maximum Number in a Set
    iii. Removal of Duplicates from an Ordered Array
    iv. Finding the k^{th} Smallest Element
5. Programs using Sorting and Searching
    i. Bubble Sort
    ii. Selection Sort
    iii. Linear Search
    iv. Binary Search
6. Programs using Function
    i. Area of Circle
    ii. CGPA calculation
    iii. Simple Interest Calculation
    iv. Fibonacci Series

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Course Outcomes

At the end of the course the student will be able to:

1. Develop flow charts for simple problems.
2. Comprehend the process of language independent program development.
3. Construct programs using suitable selection and repetition structures.
4. Solve searching and sorting problems using arrays.
5. Create modular programs using functions.

Text Books:

1. Venit S, and Drake E, "Prelude to Programming Concepts and Design", Sixth Edition, Pearson Education, 2015
2. R.G.Dromey, "How to Solve it by Computer", Second Edition, Pearson Education, India, 2008. (For Lab Component)

Reference Books:

1. Tony Gaddis, "Starting Out with Programming Logic and Design", Fourth Edition, Pearson Education, 2015.
2. MajedMarji, "Learn to Program with Scratch", No Starch Press, 2014.

Web References:

1. http://raptor.martincarlisle.com/
2. https://scratch.mit.edu/

BoS Chairman

Course Code: 16GET17	Course Title: BASICS OF ELECTRICAL AND ELECTRONICS ENGINEERING (Common to CSE and IT)	
Core	L : T : P : C	3 :0 :0:3
Type: Theory	Total Contact Hours:	45

Course Objectives

The course is intended to:

1. Apply basic DC circuit's laws.
2. Comprehend basic AC circuits.
3. Differentiate and specify electrical machines.
4. Identify suitable basic electronics and display devices.
5. Categorize opto-electronic devices and transducers.

Unit I - FUNDAMENTALS OF DC CIRCUITS 9

Definition, Symbol and Unit of Quantities– Active and Passive elements – Ohm's law: statement, illustration and limitation – Kirchoff's Laws: statement and illustration – Resistance in series and voltage division technique – Resistance in parallel and current division technique – Method of solving a circuit by Kirchoff's laws – Star to Delta and Delta to Star Transformation.

Unit II - AC FUNDAMENTALS 9

Magnetic circuits: Definition of magnetic quantities – Law of electromagnetic induction - Generation of single phase alternating EMF – Terminology – Concept of 3-Phase EMF generation – Root Mean Square – Average Value of AC – Phasor representation of alternating quantities –Pure resistive, inductive and capacitive circuits.

Unit III - ELECTRICAL MACHINES 9

DC generator and DC motor: Construction, Working Principle, Characteristics of shunt and series motor – Single phase Transformer: Construction, working principle – Three phase and single phase induction motor: Construction, Working Principle.

Unit IV - SEMICONDUCTOR DEVICES 9

Theory of semiconductor: PN junction diode, Forward Bias Condition, Reverse Bias Condition, V-I Characteristics – Bipolar Junction Transistor: Operation of NPN and PNP Transistor, Types of configuration: Common Emitter – Field Effect Transistor: Construction and operation of n- channel Junction Field Effect Transistor.

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Unit V - DISPLAY DEVICES AND TRANSDUCERS 9

Opto - Electronic Devices: Working principles of photo conductive cell, photo voltaic cell, solar cell – Display Devices: Light Emitting Diode, Liquid Crystal Display - Transducers: Capacitive and Inductive transducer, Thermistors, Piezoelectric and Photoelectric transducer.

Course Outcomes

At the end of the course the student will be able to:

1. Apply basic laws to study simple DC circuits.
2. Comprehend basic AC circuits and their phasor representation.
3. Differentiate and specify electrical machines like motor, generator and transformer.
4. Identify suitable basic electronic and display devices for simple applications.
5. Categorize opto-electronic devices and transducers for real time entities.

Text Book:

1. Muthu Subramanian R &Salivahanan S, "Basic Electrical, Electronics and Computer Engineering", Tata McGraw Hill Limited, New Delhi, 2009.

Reference Books:

1. William D.Stanley, John R. Hackworth, Richard L. Lones, "Fundamentals of Electrical Engineering and Technology", Thomson Delmar Learning, 2007.
2. Theraja.B.L and Theraja.A.K, "A Text book of Electrical Technology", (Volume I and II), S.Chand and Company Ltd., New Delhi (India), 2001.
3. SimonHaykin,"CommunicationSystems",4thEdition,JohnWiley&Sons,NewYork(US),2001.

Web References:

1. www.auupdates.com/
2. www-inst.eecs.berkeley.edu/
3. https://www.cengagebrain.co.nz/
4. www.allaboutcircuits.com
5. www.electrical4u.com

BoS Chairman

Course Code: 16PHL11	Course Title: ENGINEERING PHYSICS LABORATORY (Common to CSE and IT)	
Core	L : T : P : C	0: 0 :4 :2
Type: Practical	Total Contact Hours:	60

Course Objectives

The course is intended to:

1. Measure optical parameters of Light, Laser and optical fiber.
2. Estimate electrical properties of metal and semiconductor.
3. Evaluate magnetic properties of a soft magnetic material.

LIST OF EXPERIMENTS(Any ten)

1. Air wedge- Thickness of thin material
2. Determination of wavelength of Laser light – Laser diode
3. Determination of particle size of given powder using Laser diode
4. Determination of Acceptance angle and Numerical aperture of an optical fiber – Laser diffraction method
5. Determination of band gap of semi conducting materials – Thermistor (Germanium)
6. Determination of specific resistance of a given wire - Carey Foster's Bridge
7. Determination of thermal conductivity of bad conductor- Lees disc method
8. Light Illumination characteristics of Light dependent resistor (LDR)
9. Current- Voltage characteristics of semiconductor solar cell
10. To study the truth tables of various basic logic gates (AND, OR, NOT, NAND, NOR)
11. Magnetic hysteresis- Determination of Hysteresis losses in a ferromagnetic material.
12. Conductivity, Resistivity – Four Probe method

Course Outcomes

At the end of the course the student will be able to:

1. Measure optical parameters of Light, Laser and optical fiber.
2. Estimate electrical properties of metal and semiconductor.
3. Evaluate magnetic properties of a soft magnetic material.

Reference

1. Dr. Jayaraman, V.Umadevi, S.Maruthamuthu& B. Saravanakumar, Engineering Physics Laboratory Manual, Pearson Publishers, New Delhi, 2014.

BoS Chairman

Course Code: 16EPL12	**Course Title:** ENGINEERING PRACTICES LABORATORY (Common to CSE and IT)	
Core	**L : T : P : C**	0 :0 :4 :2
Type: Practical	Total Contact Hours:	**60**

Course Objectives

The course is intended to:

1. Draw the basic symbols of Electrical and Electronic components.
2. Execute the circuit soldering practice.
3. Verify basic laws and demonstrate basic wiring.
4. Demonstrate the basic civil and mechanical operations.
5. Demonstrate the hand forging and sand moulding process.

LIST OF EXPERIMENTS

Electrical & Electronics: **30**

1. Symbols of Electrical and Electronic components.
2. Identification of Resistor and Capacitor Values.
3. Soldering practice of simple circuits and checking the continuity.
4. Verification of Ohms law.
5. Verification of Kirchhoff's current & voltage law.
6. Fluorescent tube, Stair case and House wiring

Civil & Mechanical: **30**

1. Make a wooden Tee joint to the required dimension.
2. Assemble the pipeline connections with different joining components for the given layout.
3. Make a tray in sheet metal to the required dimension.
4. Make a "V" fitting to the required dimension using fitting tools.
5. Weld a butt joint using welding process to the required dimension.
6. Demonstration on hand forging and sand moulding process.

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Course Outcomes

At the end of the course the student will be able to:

1. Draw the basic symbols of Electrical and Electronic components and identify the elements.
2. Execute soldering practice for electrical and Electronics circuits.
3. Verify basic laws and demonstrate basic wiring.
4. Demonstrate the basic plumbing, carpentry, fitting, sheet metal and welding operations.
5. Demonstrate the hand forging and sand moulding process.

Reference Books:

1. Jeyachandran.K, Natarajan.S. & Balasubramanian.S, "A Primer on Engineering Practices Laboratory", Anuradha Publications, 2007.
2. Rajendra Prasad. A & Sarma.P.M.M.S, "Workshop Practice", Sree Sai Publication, 2002.
2. Kannaiah.P & Narayana.K.L, "Manual on Workshop Practice", Scitech Publications,1999
4. MCET - Engineering Practices Laboratory Manual.

BoS Chairman

Course Code: 16PSL12	**Course Title:** SPORTS FOR WELLNESS (Common to CSE, ECE and IT)	
Core	**L : T : P : C**	0 :0 :2 :1
Type: Practical	Total Contact Hours:	**30**

Course Objectives

The course is intended to:

1. Explain the significance of physical fitness.
2. Maintain physical fitness.
3. Exhibit mental agility.

Unit I - HEALTH **6**

Meaning of health - Components of health - physical, mental, social, emotional, spiritual -importance of health - Personal hygiene - Heredity and environment –Adopting healthy habits.

Unit II - FITNESS & WELLNESS **6**

Fitness and wellness – what is physical fitness - categories - components of health related physical fitness- components of skill related physical fitness-values of physical fitness – Physical fitness development.

What is wellness - importance of wellness for engineers –factors promoting wellness – Physiology and health: cardio-respiratory, muscular and nervous systems – ageing.

Unit III - FOOD & HEALTH **6**

Energy balance and body composition – nutrients- problems of surplus and deficiency- balanced diet - good food habits for better health – hazards of junk food - food and the gunas.

Unit IV - FITNESS & DEVELOPMENT I **6**

Exercises related ailment and injuries - safety and precautions - first aid.

Muscular strength – exercises (calisthenics): pull-up, sit-up, push-up and weight training.

Explosive power – exercises: vertical jump, long jump,

Cardio respiratory endurance– exercises: walking, jogging, treadmill, stair climbing, bicycling, skipping.

Flexibility –exercises: stretching

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Unit V - FITNESS & DEVELOPMENT II **6**

Speed, agility, balance and coordination – exercises: sprint, cone drill, ladder drill, hurdle drill, ball throw - mental agility tests.

Dexterity - 12 minutes cooper test – long run – adventure games

Team games.

Course Outcomes

At the end of the course the student will be able to:

1. Explain the significance of physical fitness for healthy living.
2. Maintain physical fitness through exercises.
3. Exhibit mental agility.

References

1. Tony Buzan, Harper Collins, The Power of Physical Intelligence (English)
2. Student reading material and workbook prepared by PS team of the college.

OPERATIONAL MODALITIES:

Orientation programme

Special lectures by invited resource persons at semester beginning

3 lectures x 4 hours = 12 hours

Follow-up practice

12 weeks x 2 hours/week = 24 hours

Evaluation

Continuous evaluation:

Physical Exercises	= 40 marks
Assessment of students workbook	= 20 marks
Total	= 60 marks

Semester end examination:

Written test (MCQ and short answers)	= 30 marks
Physical exercises	= 50 marks
Viva-voce	= 20 marks
Total	= 100 marks

End semester mark out of 100 is reduced to 40 marks

The student should get a total of 50 marks put together for a pass.

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MEASUREMENTS: At the Beginning + At Semester End

SCHEDULE OF EXERCISES FOR STUDENTS WITH DIFFERENT PHYSICAL CONDITIONS

Underweight	Normal	obese
Flexibility exercises - stretching	Flexibility exercises - stretching	- Brisk walking
Minor games -forward running relay -backward running relay - over&under relay -circle games, etc.	-Walking - Walking-cum-jogging	- Minor games
Strength Training - Calisthenics	Cardio/Functional Fitness - Skipping - Stair climbing - jogging - bicycling - long distance running	flexibility exercises - stretching - Cycling (static)
Cardio/Functional Fitness - Skipping - Stair climbing - jogging - bicycling	Agility - ladder drills - hurdle drill - cone drill	Cardio/Functional Fitness Skipping Jogging bicycling
Agility exercises - ladder drills - hurdle drill - cone drill	Strength Training -Calisthenics -gym workout for major muscles	Strength Training - Calisthenics - gym workouts
Diet Considerations	Diet considerations	Diet considerations
Measurements		
BMI Hand grip strength test 12 m Cooper run Sit & reach	BMI 12 m Cooper run Sit & reach test Illinois agility test	BMI Body fat percentage Waist-to-hip ratio Slt&reach

END OF SEMESTER I

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SEMESTER II

Course Code: 16ENT21	**Course Title:** COMMUNICATION SKILLS II (Common to all B.E/B.Tech Programmes)	
Core	**L : T : P : C**	2 : 0 : 2 : 3
Type: Theory & Practical	Total Contact Hours:	**60**

Prerequisites: The student should have undergone the course(s):
16ENT11 Communication Skills I

Course Objectives

1. Listen and understand monologues and dialogues of a native speaker on par with B1 of CEFR level
2. Speak in simple sentences to convey their opinion and ideas on par with B1 of CEFR level
3. Read and infer a given text on par with B1 of CEFR level
4. Draft basic formal written communication on par with B1 of CEFR level
5. Speak and write with minimal grammatical mistakes on par with B1 of CEFR level

Unit I - LISTENING **12**

Listening to monologues or dialogues and noting specific information - Listening to identify topic, context, and function -Listening for details and main ideas - Gap filling and matching job descriptions and titles.

Unit II - SPEAKING **12**

Giving personal information -Talking about present circumstances, past experiences and future plans, expressing opinions, speculating -mini-presentation on a business theme -Giving information and expressing and justifying opinions -discussion on a business-related topic -Expressing and justifying opinions, speculating, comparing and contrasting, agreeing and disagreeing, etc. – negotiating and persuading.

Unit III - READING **12**

Reading - skimming for gist and scanning for specific information(Newspaper and magazine articles, reports, advertisements, letters, messages, brochures, guides, manuals) -Reading and understanding text structure – Comprehension –Reading for vocabulary and structure -understanding sentence structure and finding errors.

Unit IV - WRITING **12**

Internal written communication - Writing a message, memo or an email: giving instructions, explaining development, asking for comments, requesting information,

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agreeing to requests -External Communication (e.g. explaining, apologizing, reassuring, complaining), reports (e.g. describing, summarizing) or proposals (e.g. describing, summarizing, recommending, persuading and negotiating).

Unit V - GRAMMAR **12**

Conditional sentences – Modals and their usage- common errors - Linkers and discourse markers – concord (pronoun and antecedent)

Course Outcomes

At the end of the course the student will be able to:

1. Listen to monologues or dialogues, comprehend and answer questions equivalent to BEC vantage listening exam.
2. Answer questions about oneself and business-related themes on par with BEC vantage speaking exam.
3. Read business correspondence, infer and respond to the questions similar to BEC vantage reading exam.
4. Write appropriate business e mail, memo, proposal, report and letter on par with BEC vantage writing exam.
5. Write complex sentences using appropriate discourse markers.

Text Book:

1. Whitby Norman, Business Benchmark Upper Intermediate Students' Book CUP Publications, Second Edition, 2014.

Reference Books:

1. Cambridge BEC Vantage - Practice Tests, Self-study Edition, Cambridge University Press, 2002.
2. Hewings Martin, Advanced Grammar in use - Upper-intermediate Proficiency, CUP, Third Edition, 2013.

Web References:

1. www.cambridgeenglish.org/exams/business.../business-preliminary/
2. http://www.examenglish.com/BEC/BEC_Vantage.html
3. www.splendid-speaking.com/exams/bec_speaking.htmlhtml

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Course Code: 16MAT24	Course Title: ENGINEERING MATHEMATICS-II (FOR B.E CSE only)	
Core	L: T: P: C	3 : 2 : 0 : 4
Type: Theory	Total Contact Hours:	75

Prerequisites: The student should have undergone the course(s):

16MAT14 Engineering Mathematics I

Course Objectives

The course is intended to:

1. Compute the Fourier series expansion.
2. Calculate the Fourier transform.
3. Understand the basic concepts of vector spaces.
4. Apply inner product of vectors.
5. Apply the concept of diagonalization.

Unit I - FOURIER SERIES **9+6**

Fourier series - Dirichlet's condition - Half range sine and cosine series - Parseval's identity - Harmonic Analysis.

Unit II - FOURIER TRANSFORMS **9+6**

Fourier transforms - Fourier Cosine and Sine transforms - Inverse transforms - Convolution theorem and Parseval's identity for Fourier transforms.

Unit III - VECTOR SPACES **9+6**

Vector spaces – Subspace of a vector space – basis and dimension of vector space – linear combination and spanning sets of vectors – linear independence and linear dependence of vectors – Row space, Column space and Null space – Rank and nullity of subspaces – Inner product of vectors: length of a vector, distance between two vectors.

Unit IV - ORTHOGONALITY AND INNER PRODUCT SPACES **9+6**

Orthogonality of vectors – Orthogonal projection of a vector – Gram-Schmidt process to produce orthogonal and orthonormal basis – Inner product spaces – Fourier approximation of continuous functions using inner product spaces.

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Unit V - SYMMETRIC MATRICES AND QUADRATIC FORMS 9+6

Diagonalization of symmetric matrices – Spectral Theorem – Spectral Decomposition – Quadratic forms – Constrained Optimization – Singular Value Decomposition.

Course Outcomes

At the end of the course the student will be able to:

1. Compute the Fourier series expansion for given periodic functions
2. Calculate the Fourier transform of an aperiodic function.
3. Understand the basic concepts of vector spaces.
4. Apply inner product of vectors to produce an orthonormal basis.
5. Apply the concept of diagonalization in singular value decomposition of a matrix

Text Books:

1. Srimanta Pal &Subodh C. Bhunia, "Engineering Mathematics", First edition, 2015, Oxford University Press.
2. David C. Lay, "Linear algebra and its Applications", Fifth Edition, 2016, Pearson Education.

Reference Books:

1. Peter V. O'Neil, "Advanced Engineering Mathematics", Seventh Edition, 2012, Thomson Nelson, Toronto.
2. Howard Anton and Chris Rorres, "Elementary Linear Algebra", Eleventh Edition John Wiley & Sons, 2014.

Web References:

1. http://www.nptel.ac.in/courses/117101055/downloads/Lec-15.pdf
2. http://nptel.ac.in/courses/111106051/
3. http://nptel.ac.in/downloads/111102011/
4. http://nptel.ac.in/downloads/111108066/
5. http://nptel.ac.in/courses/111103021/15

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Course Code: 16PHT24	Course Title: MATERIAL SCIENCE (Common to CSE and IT)	
Core	L : T : P : C	3 :0 :0:3
Type: Theory	Total Contact Hours:	45

Prerequisites: The student should have undergone the course(s):
16PHT14 Engineering Physics

Course Objectives

The course is intended to:

1. Interpret the fundamental behavior of conduction.
2. Explain the semiconductors nature.
3. Explain the semiconductor devices functioning.
4. Choose suitable magnetic and dielectric material.

Unit I - CONDUCTING MATERIALS 9

Basics of Electrical Conduction- Current density- Mobility - Classical free electron theory of metals - Derivation for electrical and thermal conductivity- Wiedemann Franz law- Draw backs of Classical free electron theory- Sources of resistivity – Low and high resistive materials

Unit II - SEMICONDUCTING MATERIALS 9

Classification of solids based on band gap - Properties of semi conducting materials - Covalent bond in semiconductors (Ge, Si)-Intrinsic and extrinsic semiconductors- Expression for carrier concentration (n type) - Variation of carrier concentration and fermi level with temperature - Hall Effect – Determination of Hall coefficient- Applications: Hall multiplier-Hall effect sensor.

Unit III - SEMICONDUCTING DEVICES 9

PN junction diode – Forward bias – Reverse bias – Bi polar junction transistors- Common emitter (CE) configuration and characteristics - JFET and characteristics - Metal oxide semiconductor field effect transistor (MOSFET) and characteristics.

Unit IV - MAGNETIC MATERIALS 9

Introduction to magnetic materials – Origin of magnetic moment – Properties of dia, para, ferro, antiferro and ferri magnetic materials - Domain theory of ferromagnetism - Hysteresis – Properties of hard and soft magnetic materials - Applications of magnetic materials: Magnetic hard disc, Memory sticks, smart card and flash cards.

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Unit V - DIELECTRIC MATERIALS 9

Classification of dielectric materials- Dielectric constant - Polarization – Electronic, ionic, orientation and space charge polarization –Internal field- Claussius mosotti relation- Frequency and temperature dependence of polarization- Dielectric loss- Dielectric breakdown- Applications : Capacitors, transformers, and capacitive touch screens.

Course Outcomes

At the end of the course the student will be able to:

1. Interpret the fundamental behavior of conduction in materials
2. Explain the nature of semiconductors
3. Explain the functioning of semiconductor devices
4. Choose suitable magnetic and dielectric material for specific engineering application

Text Books:

1. Avadhanulu M.N. and Kshirsagar P G, "Text Book of Engineering Physics", S. Chand & Company Ltd., New Delhi, 2013.(Unit-I,II,IV,V)
2. S.O. Kasap, "Principles of Electronics Materials and Devices", McGraw Hill Higher Education, New Delhi, 2006. (Unit-III)

Reference Books:

1. A. Marikani "Engineering Physics" 2nd Edition, PHI Learning, New Delhi, 2014.
2. William D Callister, "Fundamentals of Materials Science and Engineering: An Integrated Approach", John Wiley and Sons Inc., Sixth Edition, New York, 2012.
3. V Rajendran, "Engineering Physics", Tata McGraw-Hill Co, New Delhi, 2009.

Web References:

1. http://nptel.ac.in/courses/115102026/2
2. http://nptel.ac.in/syllabus/syllabus.php?subjectId=115103029
3. http://nptel.ac.in/courses/115102014/
4. http://www.physicscentral.com/
5. http://www.physicsclassroom.com/

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Course Code: 16GET26	**Course Title:** C PROGRAMMING (Common to CSE and IT)	
Core	**L : T : P : C**	3 :0 :0:3
Type: Theory	Total Contact Hours:	**45**

Prerequisites: The student should have undergone the course(s):
16GET16 Fundamentals of Computing and Programming

Course Objectives

The course is intended to:

1. Choose appropriate programming constructs.
2. Construct programs using arrays and pointers.
3. Write programs using strings and functions.
4. Apply the concepts of structures and unions.
5. Develop programs using preprocessor directives and Files.

Unit I - DATA TYPES, OPERATORS AND STATEMENTS **9**

Overview of C – C Character set - Identifier and keywords - Data types –Storage classes- typedef – Type Casting - Variables and Constants –Structure of C program – Executing a C program - Operators and Expressions – Statements: Input and Output statements –Decision Making - Branching and Looping.

Unit II - ARRAYS AND POINTERS **9**

Arrays: Declaration – Initialization –Single dimensional arrays- Multidimensional arrays– Dynamic memory allocation- Pointers : Declaration of Pointer variable - Operations on Pointers - Relationship between Arrays and Pointers – Array of Pointers – Pointer to a Pointer – Pointer to an Array.

Unit III - STRINGS AND FUNCTIONS **9**

Strings: Character arrays –Reading string input - String library functions – List of strings functions-Functions: Types - Declaration - Definition - Function call - Returning functions – Pass by value – Pass by reference – Passing arrays to functions– Recursion - Pointer to function.

Unit IV - STRUCTURES AND UNION **9**

Structure: Definition – Declaration – Operations on Structures –Pointer to Structures - Array of Structures - Structure within a Structure —Functions and Structures – Union: Definition - Declaration – Operations on Union – Enumerations – Bit-Fields.

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Unit V - PREPROCESSOR DIRECTIVES AND FILES 9

Preprocessor Directives: Types – Macros – File inclusion - Conditional compilation directives - Files: Streams – I/O using Streams – File type - File operations - Command line arguments – Graphics functions.

Course Outcomes

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

1. Choose appropriate data types, variables and statements for solving simple problems.
2. Construct programs using arrays and pointers for a given scenario.
3. Write programs using strings and functions.
4. Generate appropriate structure and union representations for handling compound data.
5. Develop programs using preprocessor directives and Files for a given scenario.

Text Book:

1. Ajay Mittal, "Programming in C- A practical Approach", Pearson Education, 2015.

Reference Books:

1. Kernighan, B.W and Ritchie,D.M, "The C Programming language", Second Edition, Pearson Education, 2006.
2. Stephen G. Kochan "Programming in C", Fourth Edition, Addison Wesley Publishing, August 2014.
3. Byron S Gottfried, "Programming with C", Schaum's Outlines, Second Edition, Tata McGraw-Hill, 2006.
4. K.N.King, "C Programming A modern Approach", Second Edition, W.W.Norton and Company, 2008.
5. E.Balagurusamy, "Programming in ANSI C", Sixth Edition, Tata McGraw Hill, 2012.

Web References:

1. http://www.cprogramming.com/
2. http://www.tutorialspoint.com/cprogramming/
3. http://www.c4learn.com/

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Course Code: 16GET27	Course Title: INTRODUCTION TO ENGINEERING (Common to CSE and IT)	
Core	L : T : P : C	3 :0 :0:3
Type: Theory	Total Contact Hours:	45

Prerequisites: The student should have undergone the course(s):
16PHT14 Engineering Physics

Course Objectives

The course is intended to:

1. Select the best material and suitable foundation.
2. Impart basic knowledge about the components.
3. Explain the various alternate energy sources.
4. Explain different manufacturing processes.
5. Discuss the construction and working of IC engines and refrigerators.

Unit I - CIVIL ENGINEERING MATERIALS and BUILDING COMPONENTS 9

Scope of Civil Engineering - Functions of civil Engineer and Basic areas in Civil Engineering. Civil Engineering Materials and their properties: - Stones, bricks, sand, aggregate, cement, steel, concrete and Reinforcement cement concrete.

Sub structure: - Bearing capacity of soil – Problems with soil – Type of foundation - Selection of foundation based on soil conditions – Requirement of good foundation – Various types of foundations.

Unit II - BUILDING COMPONENTS, HIGHWAY AND RAILWAY ENGINEERING 9

Super structure: - Vertical Components such as brick masonry walls, stone masonry walls and columns – Horizontal components such as Beam, Lintels, sun shades – various types of roofs and floors.

Highway and Railway Engineering: - Importance of transportation networks-classification of highways-Railway Engineering and its components- Classification of Bridges.

Unit III - ALTERNATE SOURCES OF ENERGY, POWER PLANTS AND BOILERS 9

Types of Boilers –Simple Vertical, Babcock and Wilcox and La-Mont Boiler, Differences between fire tube and water tube boiler. Types of steam turbines- working of a single stage impulse and reaction turbines. Power Plant: Classification of Power Plants- Steam - Nuclear, Diesel, and Hydro Power Plants. Solar, Wind, Tidal, Geothermal and Ocean Thermal Energy Conversion (OTEC).

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Unit IV - MANUFACTURINGPROCESSES 9

Metal Casting-Foundry–Moulding and Casting Processes. Metal Forming-Forging, Rolling, Extrusion processes. Metal Joining processes - Welding, Metal machining–Turning, Milling, Drilling, Shaping - 3D Printing.

Unit V - THERMAL ENGINEERING 9

Refrigeration -Principle of vapour compression system – Layout of typical domestic refrigerator, Refrigerants–types and properties. Air conditioning–Definition, working principle of Window and Split type room air conditioners. Internal combustion engines–Working principle of Petrol and Diesel Engines–Two stroke and Four stroke cycles–Comparison of two stroke and four stroke engines.

Course Outcomes

At the end of the course student will be able to:

1. Select the best material and suitable foundation for the required construction.
2. Impart basic knowledge about the components of structures.
3. Explain the various alternate sources of energy and components of a power plant.
4. Explain different manufacturing processes like casting, forming, welding and machining operations.
5. Discuss the construction and working of IC engines and refrigerators.

Text Books:

1. Jayagopal.L.S & Rudramoorthy.R, "Elements of Civil and Mechanical Engineering", Vikas Publishing House, NewDelhi, 2010.
2. Shanmugam. Gand Palanichamy.M.S, "Basic Civil and Mechanical Engineering", Tata McGraw Hill Publishing Co., New Delhi, 1996.

Reference Books:

1. Bindra.S.P and Arora.S.P,"The text book of Building construction", Dhanpat Rai Publications(P)Ltd., NewDelhi,2011.
2. Anantha narayanan.P," Basic Refrigeration and Air Conditioning", Tata McGraw Hill Publishing Co., NewDelhi,2003.
3. Srinivasan.S, "Automotive engineering" Tata McGraw Hill Publishing Co., NewDelhi, 2003.

Web References:

1. www.electrical4u.com/steam-boiler-working-principle-and-types-of-boiler/
2. www.thelibraryofmanufacturing.com/
3. www.swtc.edu/ag_power/air_conditioning/.../basic_cycle.htm

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Course Code: 16CPL21	Course Title: C PROGRAMMING LABORATORY (Common to CSE and IT)	
Core	L : T : P : C	0 :0 :4 :2
Type: Practical	Total Contact Hours:	60

Course Objectives

The course is intended to:

1. Apply different operators, formatting input and output in problem solving.
2. Design programs involving decision making, loops and functions.
3. Develop programs to demonstrate the usage of arrays and pointers.
4. Construct programs using preprocessor directives, macros, files and graphics.

LIST OF EXPERIMENTS

1. Program to process data types, operators and expression evaluation
2. Program using formatting inputs and outputs
3. Program using decision making and looping Statements
4. Program using arrays and pointers
5. Program for string manipulation
6. Program using functions
7. Program using structures and union
8. Program using preprocessor directives and macros
9. Program on basic file operations
10. Program using graphics functions

Course Outcomes

At the end of the course the student will be able to:

1. Apply different operators, formatting inputs and outputs in designing a program.
2. Design programs involving decision making, loops and functions for a given problem.
3. Develop programs to demonstrate the usage of arrays and pointers in the given application.
4. Construct programs using advanced features like preprocessor directives, macros, files and graphics for a given scenario.

References

1. Kernighan,B.W and Ritchie,D.M, "The C Programming language", Second Edition, Pearson Education, 2006.
2. Stephen G. Kochan "Programming in C", Fourth edition, Addison Wesley Publishing, August 2014.
3. E.Balagurusamy, "Programming in ANSI C", Sixth Edition, Tata McGraw Hill, 2012.

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Course Code: 16EGL21	**Course Title:** ENGINEERING GRAPHICS (Common to CSE and IT)	
Core	**L : T : P : C**	1 :0 :4 :3
Type: Theory & Practical	Total Contact Hours:	**75**

Course Objectives

The course is intended to:

1. Sketch the different curves.
2. Prepare the orthographic projections.
3. Draw the solid projections.
4. Draw the sectioned solids projections.
5. Draw the development of surfaces of simple solids.

Unit I - CURVES USED IN ENGINEERING PRACTICES **13**

Application of curves in Engineering- Conics – Construction of ellipse, Parabola and hyperbola by eccentricity method – Construction of cycloids and involutes of square and circle.

Unit II - ORTHOGRAPHIC PROJECTION **18**

First angle projection – layout of views – Developing visualization skills through free hand sketching of multiple views from pictorial views of objects-Orthographic projection of solids.

Unit III - PROJECTION OF SOLIDS **18**

Projection of solids – Types of solids- Polyhedra and solids of revolution-Orthographic views of solids- Axis inclined to one reference plane.

Unit IV - SECTION OF SOLIDS **13**

Sectional view -Types of section planes-True shape of section-Orthographic views of sectioned solids -Section plane inclined to one reference plane and perpendicular to the other.

Unit V - DEVELOPMENT OF SURFACES **13**

Development of lateral surfaces of simple and truncated solids –Parallel line method - Radial Line method.

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Course Outcomes

At the end of the course the student will be able to:

1. Sketch different curves and explain its application.
2. Prepare orthographic projection from pictorial views and models
3. Draw the projection of solids
4. Draw the projection of sectioned solids.
5. Draw the development of surfaces of simple solids with cuts and slots.

Text Books:

1. K. V. Natrajan, "A text book of Engineering Graphics", Dhanalakshmi Publishers, Chennai (2013).

Reference Books:

1. Dhananjay A. Jolhe, "Engineering Drawing with an introduction to AutoCAD" Tata McGrawHill Publishing Company Limited (2008).
2. Cencil Jensen, Jay D. Helsel and Dennis R. Short Engineering Drawing and Design. Tata McGraw Hill Publishing Company Limited (2012).

Web References:

1. http://www.engineeringdrawing.org/
2. http://nptel.ac.in/
3. http://iitd.ac.in/

BoS Chairman

Course Code: 16PSL22	**Course Title:** PROMOTION OF STUDENTS' WELLNESS (Common to CSE and IT)	
Core	**L : T : P : C**	0: 0: 2: 1
Type: PS	Total Contact Hours:	**30**

Course Objectives

The course is intended to:

1. Maintain physical wellbeing.
2. Maintain mental wellbeing.
3. Maintain social wellbeing.

Unit I - PHYSICAL HEALTH

Physical structure and functions of human body – simplified physical exercises (hand exercises, Leg exercises, breathing exercises, eye exercises – kapalapathi – Maharasanas 1-2 – Massages – Acupuncture – relaxation – importance and benefits. Suryanamaskar.

Unit II - MENTAL HEALTH

Maintenance of youthfulness and life force – kayakalpa yoga – anti ageing process – benefits. Mind and its functions – mind wave frequency – meditation process – Agna, shanthi, thuriam – benefits

Unit III - PERSONALITY DEVELOPMENT – I

Purpose of life and analysis of thought – philosophy of life – introspection – practice. Moralization of desires and neutralization of anger - practices

Unit IV - PERSONALITY DEVELOPMENT – II

Eradication of worries and benefits of blessings – wave theory –practices. Genetic centre – purification – cause and effect theory

Unit V - SOCIAL HEALTH

Greatness of guru – cultural education – love and compassion – fivefold culture. Greatness of friendship and social welfare – individual, family and world peace.

Course Outcomes

At the end of the course the student will be able to:

1. Maintain physical wellbeing - grooming, BMI, flexibility, muscle strength, body compositions (vatha, pitha, kapa)
2. Maintain mental wellbeing - perceptions, attention/concentration, memory, gunas
3. Maintain social wellbeing - etiquettes, emotional and psychological aspects, stress management, morality and values

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Text Book:

1. Vethathiri Maharishi Institute for Spiritual and Intuitional Education, Aliyar ,"Value education for harmonious life (Manavalakalai Yoga)", Vethathiri Publications, Erode, I Ed. (2010)

Reference Books:

1. Dr.R.Nagarathna, Dr.H.R.Nagendra, "Integrated approach of yoga therapy for positive health", Swami Vivekananda Yoga Prakashana, Bangalore, 2008 Ed.
2. Dr.R.Nagarathna, Dr.H.R.Nagendra , "New perspectives in stress management", Swami Vivekananda Yoga Prakashana, Bangalore, I Ed June 1986.

OPERATIONAL MODALITIES

Theory and practice demonstration:

3 days of Theory and practice demonstration- 7 hours /day for syllabus coverage

Follow-Up Practice

12 weeks x 2 hours/week: 24 hours

EVALUATION

Unit I : Practical

Unit II & Unit III : Written (Objective type test)

Unit IV & Unit V : Written (Objective type test)

Mid semester & Model : Written and Practical

End semester : Written and Practical

Assessment: Using measurement gadgets and questionnaires (as suggested by SVYASA and scoring sheets (from Aliyar)

DIMENSIONS AND TOOLS IN MEASUREMENT

Dimension	Sub dimension	Measurement tools
Physical	BMI	Electronic Weighing Machine, Height Measurement
	Flexibility	Sit & Reach
	Muscle Strength	Handgrip Dynamometer
Mental	Perception	Critical Flicker Fusion
Social	Interpersonal Effectiveness & Self Concept	FIRO B
	Psychological Well Being	Short wellbeing scale
		Short Happiness scale
		Barrat Impulsive Scale

END OF SEMESTER II

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BoS Chairman

SEMESTER III

Course Code: 16EET35	**Course Title:** DIGITAL SYSTEM DESIGN	
Core	**L: T: P: C**	3: 0: 0: 3
Type: Theory	Total Contact Hours:	**45**

Prerequisites: The student should have undergone the course(s):

16PHT14 Engineering Physics
16GET17 Basics of Electrical & Electronics Engineering

Course Objectives

The course is intended to:

1. Illustrate the number systems and Boolean postulates.
2. Explain combinational logic circuits.
3. Design synchronous sequential logic circuits.
4. Describe memory organization and transistor logic.
5. Develop VHDL programs.

Unit I - NUMBER SYSTEMS AND BOOLEAN ALGEBRA **9**

Review of binary, octal and hexadecimal number systems - Conversion methods- One's complement -Two's complement -addition, subtraction- Computer codes - BCD, Gray code - parity codes- Hamming codes- Boolean algebra – basic postulates, theorems , Boolean functions, canonical forms-logic gates.

Unit II - COMBINATIONAL LOGIC DESIGN **9**

Standard representation of logic functions- Simplification of logic functions through K-maps and tabulation method- Implementation using logic gates – Adder, subtractor, decoder, encoder, multiplexer and de-multiplexer.

Unit III - SYNCHRONOUS SEQUENTIAL LOGIC **9**

Introduction to sequential circuits- Flip-flops- latches - Level triggering, edge triggering- Master slave configuration - Design and analysis of synchronous sequential circuits- Shift registers - Up/down, binary and modulus counters.

Unit IV - MEMORY ORGANIZATION AND TRANSISTOR LOGIC **9**

Memory Organization: Main Memory - ROM, RAM and its types - Programmable memory (PLA and PAL).Sequential Programmable Devices-TTL and ECL.

BoS Chairman

Unit V - HARDWARE DESCRIPTION LANGUAGE 9

Introduction to VHDL-Behavioral Modeling - Structural Modeling - HDL description of Combinational Circuit- HDL description of Sequential Logic Circuits:-Flip Flops, Counters.

Course Outcomes

At the end of the course the student will be able to:

1. Illustrate the number systems and Boolean postulates used in digital design.
2. Explain combinational logic circuits using logic gates.
3. Design synchronous sequential logic circuits.
4. Describe the memory organization and transistor logic for programmable devices.
5. Develop VHDL programs for combinational and Sequential circuits.

Text Book:

1. M. Morris Mano and Michael D.Ciletti, "Digital Design", Fourth Edition, Pearson Education, 2008.

Reference Books:

1. John F. Wakerly, "Digital Design Principles and Practices", Fourth Edition, Pearson Education, 2007.
2. Charles H. Roth Jr, "Fundamentals of Logic Design", Fifth Edition, Jaico Publishing House, Mumbai, 2003.
3. Donald D. Givone, "Digital Principles and Design", Tata MCGraw Hill, 2003.
4. G. K. Kharate, "Digital Electronics", Oxford University Press, 2010.

Web References:

1. Digital System Design URL:http://nptel.ac.in/courses/117105080/
2. Introduction to Digital Circuits and Systems URL:http://nptel.ac.in/video.php/subjectId=117106086/
3. Digital Logic URL:http://freevideolectures.com/Course/2319/Digital-Systems-Design/3/.

BoS Chairman

Course Code: 16MAT34	Course Title: DISCRETE MATHEMATICS	
Core	L: T: P: C	3 : 2 : 0 : 4
Type: Theory	Total Contact Hours:	75

Prerequisites: The student should have undergone the course(s):
16MAT14 Engineering Mathematics - I

Course Objectives

The course is intended to:

1. Use combinatorics in the counting problems.
2. Acquaint the knowledge of relations and functions.
3. Use divisibility test to solve problems in division algorithm.
4. Use the concepts of functions in discrete structures.
5. Use the concepts of group codes using algebraic structures.

Unit I - COMBINATORICS **9+6**

Permutation and Combination - Pascal's identity – Permutation with repetition - Circular Permutation – Mathematical induction.

Unit II - RELATIONS AND LATTICES **9+6**

Sets – Ordered pairs and Cartesian product – Relations on sets – Types of relations and their properties – Relational matrix and the graph of relation – Partitions – Equivalence relations – Partial ordering Poset – Hasse diagram – Lattice Properties - Sub-lattices.

Unit III - DIVISIBILITY AND CONGRUENCE **9+6**

Division Algorithm – Prime and composite numbers – Fermat numbers – Congruence - Linear congruence - Chinese Remainder Theorem.

Unit IV - FUNCTIONS **9+6**

Definition of functions – Types of functions - Composition of functions – Inverse functions –Binary and n-ary operations – Characteristic function of a set – Recursive functions – Permutation functions

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Unit V - GROUPS **9+6**

Algebraic systems – Properties – Semi-groups and Monoids – Homomorphism – Sub-semigroups and Sub-monoids - Cyclic groups - Co-sets and Lagrange's theorem.

Course Outcomes

At the end of the course the student will be able to:

1. Solve the counting problems using combinatorics
2. Illustrate different types of relations in matrix form.
3. Use divisibility test and congruence in division algorithm.
4. Apply the concepts of functions in discrete structures.
5. Construct group codes using algebraic structures.

Text Books:

1. T. Veerarajan, "Discrete Mathematics", Tata McGraw–Hill, New Delhi, 2007.
2. Thomas Koshy, "Elementary Number Theory with Applications", Second Edition, Elsevier Publications, 2002.

Reference Books:

1. Tremblay J.P and Manohar R, "Discrete Mathematical Structures with Applications to Computer Science", Tata McGraw–Hill, New Delhi, 2007.
2. Kenneth H Rosen, "Discrete Mathematics and its Applications", Eighth Edition, Tata McGraw Hill, 2006.
3. Ralph P Grimaldi, Ramana.B.V, "Discrete and Combinatorial Mathematics", Fifth Edition, Pearson Education India, 2006.
4. Bernard Kolman, Robert C. Busby, Sharan Cutler Ross, "Discrete Mathematical Structures", Fourth Indian reprint, Pearson Education Pvt Ltd., New Delhi, 2003.

Web References:

1. Video Tutorial URL: http://learnerstv.com/Free-Maths-video-lecture-courses.htm
2. NPTEL Course Content URL: http://nptel.ac.in/video.php?subjectId=122107036

BoS Chairman

Course Code: 16ECT34	Course Title: PRINCIPLES OF COMMUNICATION ENGINEERING	
Core	L: T: P: C	3: 0: 0: 3
Type: Theory	Total Contact Hours:	45

Prerequisites: The student should have undergone the course(s):
16GET17 Basics of Electrical and Electronics Engineering

Course Objectives

The course is intended to:

1. Compare various analog modulation techniques.
2. Compare analog and digital modulation techniques.
3. Describe pulse modulation techniques.
4. Explain the Concepts on satellite and optical communication.
5. Explain wireless communication concepts.

Unit I - ANALOG COMMUNICATION 9

Basic schemes of modern communication system-Need for modulation-Types. Basics of amplitude modulation (Definition, AM waveforms, Equation, Frequency spectrum and bandwidth, Modulation index and power distribution).Frequency Modulation, Equation of FM wave, Effect of Noise in FM Noise, Comparison of AM and FM signals. Phase Modulation-Definition and equation of a PM wave.

Unit II - DIGITAL COMMUNICATION 9

Introduction, Shannon limit for information capacity, bits, bit rate, baud. ASK-FSK Transmitter and Receiver, phase shift keying – binary phase shift keying, QPSK, Quadrature Amplitude modulation - Principle, transmitter and Receiver (block diagram only).

Unit III - DIGITAL TRANSMISSION 9

Introduction, Pulse modulation, PCM – PCM sampling, sampling rate, signal to, quantization noise - ratio – Companding (analog and digital) -delta modulation, adaptive delta modulation, differential pulse code modulation, Inter symbol Interference, eye patterns.

Unit IV - SATELLITE AND OPTICAL COMMUNICATION 9

Satellite communication systems - Kepler's law – LEO, MEO and GEO orbits - GPS System - Footprint - Link model- Optical communication systems-Elements of optical fiber transmission link - Types – Losses.

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Unit V - MOBILE COMMUNICATION 9

Multiple access techniques: TDMA, FDMA, CDMA- Advanced Mobile Phone System (AMPS) - Cellular Concept and Frequency Reuse - Channel Assignment and Hand off – GPRS - Global System for Mobile Communications (GSM) – 2G -3G - 4G-5G systems

Course Outcomes

At the end of the course the student will be able to:

1. Compare various analog modulation techniques for communication systems.
2. Compare analog and digital modulation techniques.
3. Describe pulse modulation techniques for transmission.
4. Explain the concepts related to satellite and optical communication.
5. Explain wireless communication concepts.

Text Books:

1. Wayne Tomasi, "Advanced Electronic Communication Systems", Sixth Edition, Pearson Education, 2007.
2. Rappaport T.S, "Wireless Communications: Principles and Practice", Second Edition, Pearson Education, 2009.

Reference Books:

1. Simon Haykin, "Communication Systems", Fourth Edition, John Wiley & Sons. 2001.
2. Lathi. B.P., "Modern Analog and Digital Communication systems", Third Edition, Oxford University Press, 2007.
3. Blake, "Electronic Communication Systems", Thomson Delmar Publications, 2012.
4. Dennis Roddy and John Coolen," Electronic Communications", Fourth Edition, Pearson Education India, 2012.
5. B.Sklar, "Digital Communication Fundamentals and Applications", Second Edition Pearson Education 2007.

Web References:

1. Basics schemes of modern communication URL: http://www.nptel.ac.in /course.php? disciplineId =106.
2. Multiple Access URL: http://ocw.mit.edu/courses/electrical-engineering-and-computerscience/6-450-principles-of-digital-communications-i-fall-2006.

BoS Chairman

Course Code: 16CST31	Course Title: OPERATING SYSTEMS	
Core	L: T: P: C	3: 0: 0: 3
Type: Theory	Total Contact Hours:	45

Prerequisites: The student should have undergone the course(s):
16GET16 Fundamentals of Computing and Programming
16GET26 C Programming

Course Objectives

The course is intended to:

1. Describe the essential components of operating systems.
2. Choose appropriate process and disk scheduling algorithms.
3. Provide solutions for various synchronization problems.
4. Compare different memory management techniques.
5. Explain the various file system structures and their implementation.

Unit I - OPERATING SYSTEM – COMPONENTS AND SERVICES 9

Operating systems - Definition - Views of OS - Main frame Systems, Desktop Systems – Multiprocessor Systems -Distributed Systems – Clustered Systems – Real Time systems – Hand held Systems. Functionalities of operating system - Program execution, I/O operation, File system manipulation, error detection - OS Services – System Calls – System Utilities.

Unit II - PROCESS SCHEDULING AND DISK SCHEDULING 9

Process concepts - Process scheduling - Short term, long term and medium term scheduling -Preemptive and non-preemptive algorithms - CPU scheduling algorithms - FCFS, SJF, Priority and round robin - Basic disk structure and operation - Disk scheduling algorithms - FCFS, SSTF, LOOK, SCAN, C-SCAN, C-LOOK - selection of the best disk scheduling algorithm.

Unit III - PROCESS SYNCHRONIZATION 10

Inter-process communication techniques - message passing, shared memory, Synchronization- critical section problem-Peterson's solution, synchronization hardware, Synchronization tool- Semaphores, Classic Problems of Synchronization-Reader Writer Problem, Bounded buffer, Dining Philosopher's problem. Deadlock-characteristics, Deadlock handling methods –Deadlock prevention, Deadlock detection, Deadlock Avoidance, Deadlock Recovery.

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Unit IV - MEMORY MANAGEMENT **10**

Memory concept- Swapping, Contiguous memory allocation, Fragmentation, Paging – Hierarchical Paging, Hashed Page Tables, Inverted Page Tables, Segmentation-Paging with Segmentation, Virtual memory - Demand paging, Page-replacement algorithms-FIFO, Optimal Page Replacement, LRU, LFU, MFU.

Unit V - FILE MANAGEMENT **7**

File structures: File concept, File Type, Access methods, Directory structure -Single level directory, two level and Tree structure. File system implementation-FCB, Virtual File system, Directory System Implementation- linear list, hash table implementation.

Course Outcomes

At the end of the course the student will be able to:

1 Describe the essential components of operating systems by tracing the evolution of OS.
2. Choose appropriate process and disk scheduling algorithm for various scenarios.
3. Provide solutions for various synchronization and deadlock problems in cooperating process.
4. Compare different memory management techniques in operating systems.
5. Explain the various file system structures and their implementation for storage systems.

Text Book:

1. Avi Silberschatz, Galvin. P.B., Gagne, G. "Operating System Concepts", Eighth Edition, John Wiley & Sons, 2008.

Reference Books:

1. Pradeep K.Sinha, "Distributed Operating System: Concepts and Design", IEEE Computer Society Press, PHI, 2004.
2. Andrew S. Tanenbaum, "Modern Operating Systems", PHI, Second Edition, 2001.
3. Charles Crowley, "Operating systems A Design oriented Approach", Second Edition, Irwin Professional Publication, 1996.

Web References:

1. NPTEL Course Content on OS URL: http://nptel.ac.in/courses/106108101/
2. Operating Systems Book PPT URL: https://edurev.in/studytube/Notes-Introduction--System-Structures-Operating-Sy/7c9a5bae-816e-4804-9afa9941b7b24ae1_p
3. Critical Section Problem Video Tutorial URL: https://www.youtube.com/watch?v=A9CCDS3Jizc& list= PLLDC 70 psjvq5hIT0kfr1sirNuees0NIbG&index=7.

BoS Chairman

Course Code: 16CST32	Course Title: DATA STRUCTURES AND ALGORITHM ANALYSIS -I	
Core	L: T: P: C	3: 0: 0: 3
Type: Theory	Total Contact Hours:	45

Prerequisites: The student should have undergone the course(s):

16GET16 Fundamentals of Computing and Programming

Course Objectives

The course is intended to:

1. Describe the importance of data structures and asymptotic notations.
2. Perform operations on linear data structures.
3. Determine the complexity of algorithms.
4. Compare the efficiency of brute force & divide and conquer techniques.
5. Apply hashing and string matching techniques.

Unit I - BASIC CONCEPTS OF ALGORITHMS 9

Introduction - Classification of Data Structures - Abstract data type - Algorithm properties - Fundamentals of algorithmic Problem solving - Fundamentals of analysis framework- Efficiency classes - Asymptotic notations.

Unit II - LINEAR STRUCTURES 10

List - Array implementation - Linked List implementation - Singly, Doubly and Circular Linked list - Applications of List – Stack – Implementation – Applications – Queue – Implementation - Applications.

Unit III - MATHEMATICAL ASPECTS AND ANALYSIS OF ALGORITHMS 8

Mathematical analysis of non-recursive algorithms - Mathematical analysis of recursive algorithms - Empirical analysis of algorithms - Algorithm visualization.

Unit IV - SIMPLE ALGORITHMIC DESIGN TECHNIQUES 10

Brute force approach - Exhaustive Search - Divide and Conquer technique - matrix multiplication -Strassen's algorithm –Searching - Linear search - Binary search – Sorting - Selection sort - Bubble sort - Merge sort - Quick sort - Insertion sort.

BoS Chairman

Unit V - HASHING AND STRING MATCHING 8

Hashing - Separate chaining - Open addressing - Double hashing – Rehashing - Extendible hashing - String matching - Naive approach - KMP algorithm.

Course Outcomes

At the end of the course the student will be able to:

1. Describe the need for data structures and the notations used in algorithm analysis.
2. Perform operations on linear data structures for various applications.
3. Determine the complexity of recursive and non-recursive algorithms using mathematical analysis.
4. Compare the efficiency of brute force & divide and conquer techniques for problem solving.
5. Apply suitable methods for efficient data access through hashing and string matching.

Text Books:

1. Mark A. Weiss., "Data Structures and Algorithm Analysis in Java", Third Edition, Pearson Education, 2011.
2. Anany Levitin, "Introduction to the Design & Analysis of Algorithms", Pearson Education, Third Edition, 2011.

Reference Books:

1. Sartaj Sahni, "Data Structures, Algorithms and Applications in C++", Second Edition, Universities Press, 2005.
2. Michael T. Goodrich, Roberto Tamassia, David M. Mount, "Data Structures and Algorithms in C++", Second Edition, John Wiley & Sons, 2010.
3. Cormen.T.H.,Leiserson.C.E., Rivest. R.L. and Stein.C., "Introduction to Algorithms", PHI Pvt. Ltd., 2001.

Web References:

1. Animation of Various Data Structures URL:http://visualgo.net/
2. NPTEL Course Content URL: http://nptel.ac.in/courses/106102064/
3. The Animation of Recursion URL: http://www.animatedrecursion.com/

BoS Chairman

Course Code: 16CST33	Course Title: JAVA PROGRAMMING	
Core	L: T: P: C	3: 0: 2: 4
Type: Lecture & Practical	Total Contact Hours:	75

Prerequisites: The student should have undergone the course(s):
16GET16 Fundamentals of Computing and Programming
16GET26 C Programming

Course Objectives

The course is intended to:

1. Identify the distinct properties and features of Object Orientation.
2. Illustrate name spaces, concurrency and handle exceptional conditions.
3. Employ Java standard library functions.
4. Apply utility and input/output functions.
5. Develop java based applications.

Unit I - INTRODUCTION 9

Overview of Java – Data types, operators, control flows –Class fundamentals, objects and constructors –Method overloading- argument passing, Returning objects, recursion – Method Overriding and Dynamic Method dispatch- Abstract class.

Unit II - PACKAGES, EXCEPTIONS AND THREADS 9

Packages and access protection – Interfaces and extending interfaces – Exception fundamentals and types – Try, catch, throw, throws and finally; Chained Exceptions – Thread model, Creating threads and thread priorities – Synchronization – Interthread communication.

Unit III - JAVA UTILITIES 9

String Handling – String Buffer class and functions – Library Functions – Math – Process – Clone – System Functions.

Unit IV - COLLECTIONS AND I/O STREAMS 9

Collections – Classes and Interfaces – Iterators and User defined collections – String Tokenizer – Java I/O classes and Interfaces - Streams – Byte Streams - Character Streams – File concepts.

Unit V - EXPLORING SWING 9

Java Swing – Features –Components and Containers – Event handling – Exploring Swing – Menus – Java Database Connectivity.

Lab Component **Total: 30**

Implement the following concepts using Java for any scenario in the given list of applications:

1. Program using control flow and function overloading
2. Implementing method overriding and abstraction
3. Creating packages and user-defined exceptions
4. Implementing synchronization and inter thread communication
5. Working with String operations
6. Using Library and System functions

BoS Chairman

7. Working with Collection classes and Iterators
8. Accessing files using I/O methods in java
9. Creating GUI using java Swing
10. Implementing database connectivity using java

The suggested applications are:

1. Online Course Registration System.
2. Hospital Management System
3. Online Examination Management System
4. Library Management System
5. Payroll system for a company
6. Travel management System
7. Hotel management System
8. Student Information System
9. Online Polling System
10. Inventory Control system

Course Outcomes

At the end of the course the student will be able to:

1. Identify the distinct properties and features of object orientation using java.
2. Illustrate name spaces, concurrency and handle exceptional conditions in programs.
3. Employ Java standard library functions for solving complex problems.
4. Apply Java utility, input/output functions for operating with file manipulators.
5. Develop Java based applications using user interfaces and database connectivity.

Text Books:

1. Herbert Schildt, "Java the Complete Reference", Mcgraw Hill Education, Ninth Edition, 2014.
2. Mahmoud Parsian, "JDBC Metada, MySQL and Oracle Recipes: A Problem-Solution Approach", Apress Publications, 2006.

Reference Books:

1. Bart Baesens, Aimee Backiel, Seppe Vanden Brocke, "Beginning Java Programming: The Object Oriented Approach", John Wiley & Sons, 2015.
2. Daniel Liang, "Introduction to Java Programming, Comprehensive Version", Pearson Education, Ninth Edition, 2014.

Web References:

1. Oracle, Java tutorials URL: https://docs.oracle.com/javase/tutorial/java/index.html
2. Java Beginners Tutorial URL: http://javabeginnerstutorial.com/core-java/
3. W3Schools, Java Programming URL: http://www.w3schools.in/java-tutorial/

BoS Chairman

Course Code: 16CSL31	**Course Title:** DATA STRUCTURES AND ALGORITHM ANALYSIS - I LABORATORY	
Core	**L: T: P: C**	0: 0:4: 2
Type: Practical	Total Contact Hours:	**60**

Course Objectives

The course is intended to:

1. Develop recursive and non-recursive algorithms
2. Implement applications of linear data structures
3. Compare the efficiency of Brute-Force and Divide & Conquer approaches.
4. Implement Hashing and String matching techniques.

LIST OF EXPERIMENTS:

1. Implementation of simple recursive and non-recursive algorithms.
2. Implementation of List application.
3. Implementation of Stack application.
4. Implementation of Queue application.
5. Empirical analysis of Searching techniques.
6. Empirical analysis of Sorting techniques.
7. Visualization of Searching& Sorting Algorithms.
8. Implementation of Closest Pair and Convex Hull problems.
9. Implementation of Hashing & String Matching algorithms.

Course Outcomes

At the end of the course the student will be able to:

1. Develop recursive and non-recursive algorithms for solving simple problems.
2. Implement linear data structures using array and linked list representations and use these in various applications.
3. Compare the efficiency of Brute-Force and Divide & Conquer approaches for Searching, Sorting and Geometric problems.
4. Implement Hashing and String matching techniques for efficient data access.

BoS Chairman

Course Code : 16EEL32	Course Title : DIGITAL SYSTEM DESIGN LABORATORY	
Core	L : T : P: C	0 : 0 : 4 : 2
Type: Practical	Total Contact hours:	60

Course Objectives

The course is intended to:

1. Design combinational logic circuits.
2. Design counters using sequential logic circuits.
3. Construct different types of shift registers.
4. Write VHDL programs for sequential and combinational circuits.

LIST OF EXPERIMENTS:

1. Study of Gates & Flip-flops
2. Half Adder and Full Adder
3. Magnitude Comparator (2-Bit)
4. Encoders and Decoders
5. Multiplexer and Demultiplexer
6. Code Converter
7. Synchronous Counters
8. Ripple Counter
9. Mod - N Counter
10. Shift Register - SISO & SIPO
11. Verilog HDL based design of combinational circuits and sequential circuits.

Course Outcomes

At the end of the course the student will be able to:

1. Design combinational circuits using logic gates.
2. Design counters and implement them using sequential logic.
3. Construct different types of shift registers.
4. Write VHDL programs for designing combinational and sequential circuits.

BoS Chairman

Course Code : 16PSL31	Course Title : PERSONAL EFFECTIVENESS	
Core	L : T : P: C	0 : 0 : 2 : 1
Type: PS	Total Contact hours:	30

Course Objectives

The course is intended to:

1. Identify the strengths, weaknesses and opportunities.
2. Set goals for academics, career, and personal aspirations.
3. Establish the road map for goals.
4. Apply time management techniques.
5. Create time and pursue activities of self-interest.

UNIT I THE IMPORTANCE OF ENVISIONING 8

Importance of positive self-perception – Principle of dual creation (Everything gets created twice – Envisioning) - Understanding vision and mission statements - Writing personal mission statements – 'Focus' as a way of life of most successful people – Importance of goal setting –Importance of planning and working to time.

UNIT II FUNDAMENTAL PRINCIPLES OF GOAL SETTING AND WORKING TO TIME 8

Clarifying personal values, interests and orientations – Awareness of opportunities ahead – Personal SWOT analysis - Principles driving goal setting: Principle of response and stimuli, Circle of influence and circle of concern, what you see depends on the role you assume.

UNIT III GOAL SETTING AND ACTION ORIENTATION 6

Potential obstacles to setting and reaching your goals - Five steps to goals setting: SMART goals, Inclusive goals, Positive stretch, Pain vs. gain, Gun-point commitment – Importance of action orientation - Converting goals to actionable tasks – Establishing road map – Using Gantt chart for planning and progress.

UNIT IV TIME MANAGEMENT - TOOLS AND TECHNIQUES 8

Pareto 80-20 principle of prioritization – Time quadrants as a way to prioritize weekly tasks – The glass jar principle - Handling time wasters – Assertiveness, the art of saying 'NO' – Managing procrastination.

UNIT V PUTTING INTO PRACTICE 8

Practicals: Using the weekly journal – Executing and achieving short term goals – Periodic reviews.

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Course handouts (compiled by PS team, MCET)

1. Learner's workbook
2. Personal efficiency Journal
3. Reading material for Personal Effectiveness

Further Reading:

1. Stephen R Covey, "First things first", Simon & Schuster, Aug 1997.
2. Sean Covey, "Seven habits of highly effective teenagers", Simon & Schuster, 2004.
3. College student's guide to time management (e-book)
4. Michael S Dobson, Susan B Wilson, "Goal setting" (e-book)

Modality on Tests and Examinations

S.No	Test/Examination	Criterion		Reduced to marks	Remarks
1	Knowledge test (KT)	Best out of 'n' tests (each conducted for 20 marks) Minimum two tests to be conducted		20 marks	After initial orientation
2	Scenario based knowledge test (SKT)	Best out of the two tests (Maximum for each test is 80 marks)		20 marks	Immediately before and after Reinforcement Workshop
3	Comprehensive Examination	Work book Journal work Viva voce	= 20 marks = 40 marks = 40 marks	60 marks	Conducted at the End of semester by a panel of Internal faculty members
		Total	= 100 marks		
		Mark will be entered in Examination Portal for 100 marks			
		Total marks for the course		100 marks	
		Condition for passing the course		50 marks as a whole	

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No. of hours & credits:

Enablement through learning workshops	Trained Internal faculty	2 days7 hours each	14 hours
Progress monitoring (face to face interaction with student and checking workbook/Journal)	Internal faculty	1 hour per week	10 hours
Mid semester reinforcement-workshop	Trained Internal faculty	1 day	6 hours
		Total	30 hours
		No. of credits	1

Course Outcomes

At the end of the course the student will be able to:

1. Identify the strengths, weaknesses and opportunities.
2. Set well-articulated goals for academics, career, and personal aspirations.
3. Establish the road map to realize the goals.
4. Apply time management techniques to complete planned tasks on time.
5. Create time and pursue activities of self-interest that add value.

END OF SEMESTER III

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BoS Chairman

SEMESTER IV

Course Code: 16CST41	Course Title: DATABASE SYSTEMS	
Core	L: T: P: C	3: 0: 0: 3
Type: Theory	Total Contact Hours:	45

Prerequisites: The student should have undergone the course(s):
16MAT34 Discrete Mathematics

Course Objectives

The course is intended to:

1. Describe the functions and architecture of database management system
2. Design a relational database using ER model and normalization
3. Write SQL Queries using DDL, DML and DQL commands
4. Explain the concurrency control and recovery mechanisms
5. Describe the features of distributed databases

Unit I - INTRODUCTION TO DBMS 9

File System-Database System-File System Vs DBMS-Roles in DBMS Environment-Data Models and Conceptual Modeling-Functions of DBMS-Components of DBMS-Multiuser DBMS architecture.

Unit II - RELATIONAL MODEL, ER MODEL AND NORMALIZATION 9

Relational Model: Terminology- Integrity Constraints – Views-Relational Algebra-ER Modeling: Concepts-Relationship Types – Attributes-Structural Constraints-Problems with ER Model-Normalization: Data Redundancy and update anomalies-Functional Dependencies-1NF, 2NF, 3NF, BCNF.

Unit III - SQL & QUERY PROCESSING 9

SQL: Terminology -Data Manipulation-Data Types-Data Definition – Views-Access Control-Query Processing: Decomposition-Heuristical approach to query optimization-Cost Estimation for Relational Algebra Operations.

Unit IV - TRANSACTION AND CONCURRENCY CONTROL 9

Transaction: Properties-Concurrency Control: Locking methods, Deadlock,Timestampordering,Multi-version timestamp ordering-optimistic techniques-Database Recovery: Transaction and recovery-Recovery facilities,Recovery Techniques.

BoS Chairman

Unit V - DISTRIBUTED DATABASES 9

Distributed Systems - Homogenous and Heterogeneous DDBMS – Distributed Data storage – Distributed Transactions – Commit Protocol – Concurrency Control in Distributed databases – Deadlock Handling- Distributed Query Processing.

Course Outcomes

At the end of the course the student will be able to:

1. Describe the functions and architecture of database management system with its components.
2. Design a relational database using ER model and normalization for real world problems.
3. Write SQL Queries using DDL, DML and DQL commands for efficient retrieval of data from databases.
4. Explain the concurrency control and recovery mechanisms for managing multiple transactions in transaction management component.
5. Describe the features of distributed databases using its functions and architecture.

Text Books:

1. Thomas Connolly, Carolyn Begg, "Database Systems: A practical approach to design, Implementation and Management", Pearson, New Delhi, 2014.
2. A Silberschatz, H Korth, S Sudarshan, "Database System and Concepts", Sixth Edition McGraw-Hill, New Delhi, 2010.

Reference Books:

1. Ramez Elmasri,Shamkant B. Navathe, "Fundamentals of Database Systems", Sixth Edition, Pearson,New Delhi,2010.
2. C.J. Date, A. Kannan and S. Swamynathan, —An Introduction to Database Systemsll, Pearson Education, Eighth Edition, 2006.

Web References:

1. http://www.cs.utexas.edu/~mitra/csSpring2009/cs327/lectures/
2. https://www.cse.iitb.ac.in/~sudarsha/db-book/slide-dir/
3. http://nptel.ac.in/courses/106106093/18

BoS Chairman

Course Code: 16MAT44	**Course Title:** PROBABILITY AND QUEUEING THEORY	
Core	**L: T: P: C**	3 : 2 : 0 : 4
Type: Theory	Total Contact Hours:	**75**

Prerequisites: The student should have undergone the course(s):
16MAT14 Engineering Mathematics I
16MAT24 Engineering Mathematics II

Course Objectives

The course is intended to:

1. Use basic laws of Probability.
2. Calculate the moments of random variables.
3. Apply the discrete and continuous probability distributions.
4. Use sample mean and variance.
5. Calculate characteristics of queuing systems.

Unit I - PROBABILITY THEORY **9+6**

Probability theory, Introduction, Axioms of probability, Conditional probability, Baye's theorem.

Unit II - RANDOM VARIABLES **9+6**

Random Variables, Discrete random variables, Probability mass function, Cumulative distribution function, Expectations, Variances and moments of discrete random variables, Continuous random variables, Probability density functions, Expectations and variances of continuous random variables, Moment generating function.

Unit III - STANDARD DISTRIBUTIONS **9+6**

Discrete Distributions- Binomial, Poisson and Geometric distributions, Properties, Moment generating functions.
Continuous Distributions - Normal, Uniform and Exponential distributions, Properties, Moment generating functions.

Unit IV - TEST OF HYPOTHESES **9+6**

Sampling distributions, Estimation of parameters, Statistical hypothesis, Large sample test based on Normal distribution for single mean and difference of means, Tests based on t, Chi-square and F distributions for mean, variance and proportion, Contingency table (test for independent), Goodness of fit.

BoS Chairman

Unit V - QUEUING THEORY **9+6**

Markovian models, Infinite capacity single server, Infinite capacity multiple Server, Finite capacity single server, Finite capacity multiple server, Little's formula.

Course Outcomes

At the end of the course the student will be able to:

1. Use basic Probability laws.
2. Calculate the moments of the discrete and continuous random variables.
3. Apply the discrete and continuous probability distributions to real life phenomena.
4. Use sample mean and variance to test small and large samples.
5. Calculate characteristics of different queuing systems.

Text Books:

1. J. Ravichandran, "Probability and Statistics for Engineers", Wiley India Publication, 2010.
2. T. Veerarajan, "Probability, Statistics and Random Process" Tata McGraw Hill, 2006.

Reference Books:

1. R.E. Walpole, R.H. Myers, S.L. Myers, and K. Ye, "Probability and Statistics for Engineers and Scientists", Eighth Edition, Pearson Education, Asia, 2007.
2. Murray R Spiegel, John J Schiller and R AluSrinivasan, "Schaum's Outlines of Probability and Statistics", Fourth Edition, Tata McGraw Hill, 2004.

Web References:

NPTEL Course Content URLs:

1. http://nptel.ac.in/downloads/111101004/
2. http://nptel.ac.in/courses/111105041/10
3. http://nptel.ac.in/courses/111104079/

BoS Chairman

Course Code: 16CST42	Course Title: COMPUTER ARCHITECTURE	
Core	L: T: P: C	3: 0: 0: 3
Type: Theory	Total Contact Hours:	45

Prerequisites: The student should have undergone the course(s):
16EET35 Digital System Design
16CST31 Operating Systems

Course Objectives

The course is intended to:

1. Describe the memory organization and various addressing modes.
2. Explain the various components of the processing unit and bus organization.
3. Illustrate the role of pipeline techniques.
4. Apply various solutions to overcome the data hazards.
5. Explain the architecture of Parallel Processing Models and Embedded Systems.

Unit I - MEMORY ORGANIZATION AND ADDRESSING 9

Basic Processor Architecture - Operational concepts –Performance -Memory Allocation –Memory Operations –Instructions and sequencing-Addressing modes.

Unit II - INPUT / OUTPUT AND BUS ORGANIZATION 9

Accessing I/O devices - Interrupts – DMA- Buses - Interface Circuits - Standard I/O interfaces - Single Bus Organization- Multiple Bus Organization - Superscalar operation.

Unit III - PIPELINING 9

Pipelining Concept - Pipeline Hazards - Pipelining Implementation -Extending the MIPS pipeline to handle MulticycleOperations - Overview of MIPS R4000 Pipeline

Unit IV - INSTRUCTION - LEVEL PARALLELISM 9

ILP Concepts and Challenges - Basic Compiler Techniques for Exposing ILP - Reducing Branch Costs with Prediction - Overcoming Data Hazards with Dynamic Scheduling – Tomasulo's Approach - Hardware Based Speculation - Exploiting ILP: MultipleInstructionIssues- StaticScheduling- Dynamic Scheduling

Unit V - PARALLEL PROCESSORS AND EMBEDDED SYSTEMS 9

Parallel processing - Array Processor - Structure of General Purpose Multiprocessors- Program Parallelism and shared variable - Processor families: overview of ARM Family and Intel Family - Embedded Systems:Microwave oven- Digital camera- Embedded processor chips – Microcontrollers for Embedded systems

BoS Chairman

Course Outcomes

At the end of the course the student will be able to:

1. Describe the memory organization and various addressing modes.
2. Explain the various components of the processing unit and bus organization.
3. Illustrate the role of pipeline techniques in designing high performance processors.
4. Apply various solutions to overcome the data hazards in Instruction Level Parallelism
5. Explain the architecture of Parallel Processing Models and Embedded Systems with real time examples

Text Books:

1. Carl Hamacher, ZvonokVranesicSafwatZaky, "Computer Organization", Fifth Edition,McGraw Hill, 2002.
2. John L. Hennessey and David A. Patterson, "Computer Architecture: A QuantitativeApproach", Fifth Edition, Elsevier, 2011.

Reference Books:

1. William Stallings, "Computer Organization and Architecture -Designing for Performance",Pearson Education, Ninth Edition, (Hardcover Revised) 2012.
2. S.S.S.P.Rao, "Basics of Computer Organisation and Architecture: Problems and Solutions", Alpha Science International Ltd, 2014.
3. David A. Patterson and John L. Hennessey, "Computer Organization and design, TheHardware/Software Interface", Fourth Edition, Morgan Kaufmann, 2009.
4. John P.Hayes, "Computer Architecture and Organization", Third edition, McGraw Hill, 2002.
5. B.Govindarajalu, "Computer Architecture and Organization", Second edition, McGraw Hill, 2010.

Web References:

1. http://www.technolamp.co.in/2011/04/computer-organization-carl-hamacher.html
2. http://www.cse.iitk.ac.in/users/karkare/courses/2011/cs220/html/notes.html
3. http://www.nptel.ac.in/courses/106102062/

BoS Chairman

Course Code: 16CST43	Course Title: SOFTWARE ENGINEERING	
Core	L: T: P: C	3: 0: 0: 3
Type: Theory	Total Contact Hours:	45

Course Objectives

The course is intended to:

1. Impart the knowledge on Software Life cycle models
2. Derive the requirements for a Software system
3. Select appropriate architecture and principles to design Software systems
4. Develop test plan for verifying and validating requirements
5. Elaborate on project management and current trends in Software Engineering

Unit I - SOFTWARE LIFE CYCLE MODELS 9

Software Engineering as a discipline, Software processes, Software Specification, Software design and implementation, Software evolution, Software prototyping, Waterfall Model, Incremental Model, Spiral Model, Agile Software Development, Case Study.

Unit II - REQUIREMENTS ENGINEERING AND ANALYSIS 9

User and system requirements, Functional and non-functional requirements, Requirements engineering processes, Software requirements document, Requirements elicitation and analysis, Requirements validation, Requirements management, Activity diagrams, Use case diagrams, Sequence diagrams, Class diagrams, State diagrams, UML, Context models, Interaction models, Structural models, Behavioral Models, Model-driven engineering.

Unit III - SOFTWARE DESIGN 9

Design process, Design Concepts - Abstraction, Patterns, Separation of Concerns, Modularity, Information Hiding, Functional Independence, Refinement, Cohesion, Coupling, Object-Oriented Design Concepts, Design Classes, Dependency Inversion - Architectural design and decisions, Architectural views, Layered architecture, Repository (data-centric) architecture, Client-server architecture, Pipe and filter architecture, Object-oriented design, Design Patterns, Transaction processing systems, Information Systems, Language processing systems.

Unit IV - DESIGN OF SPRINGS 9

Verification, Validation, Strategic approach to software testing, Strategic issues, Test Strategies for Conventional Software, Test Strategies for Object-Oriented Software, Testing OOA and OOD Models, Object-Oriented Testing Strategies, Object-Oriented Testing Methods, Testing Methods Applicable at the Class Level, Interclass Test-Case Design, Test Strategies for Web & MobileApps, Validation testing, System Testing, Debugging process, White box testing- Black box testing.

BoS Chairman

Unit V - ADVANCED TOPICS AND SOFTWARE MANAGEMENT 9

Software Reuse, CBSE, Service Oriented Architecture, Aspect-oriented Software Engineering, Software Risk Management, Software Scheduling, Software Configuration Management (SCM).

Course Outcomes

At the end of the course the student will be able to:

1. Impart the knowledge on Software Life cycle models for Software development process.
2. Derive the requirements for a Software system through Requirement Engineering process.
3. Select appropriate architecture and principles to design Software systems among different Software design concepts.
4. Develop test plan for verifying and validating requirements using Software Testing Methodologies.
5. Elaborate on project management and current trends in Software Engineering using Software Management Strategies.

Text Books:

1. Roger S.Pressman and Bruce Maxim, "Software engineering- A practitioner's Approach", McGraw-Hill International Edition, Eighth edition, 2014.
2. Ian Sommerville, "Software Engineering", Pearson Education Asia, Ninth edition, 2011.

Reference Books:

1. Pankaj Jalote,"An Integrated Approach to Software Engineering", Springer Verlag, 1997
2. James F Peters and WitoldPedryez, "Software Engineering - An Engineering Approach", John Wiley and Sons, New Delhi, 2000
3. Ali Behforooz and Frederick J Hudson, "Software Engineering Fundamentals", Oxford University Press, New Delhi, 1996

Web References:

1. Roger S.Pressman online learning Center URL:http://www.mhhe.com/engcs/compsci/pressman/
2. Ian Sommerville's book website URL:http://iansommerville.com/software-engineering-book/
3. NPTEL Lecture Videos URL:http://www.nptel.ac.in/courses/106101061/

BoS Chairman

Course Code: 16CST44	Course Title: DATA STRUCTURES AND ALGORITHM ANALYSIS -II	
Core	L: T: P: C	3: 0: 0: 3
Type: Theory	Total Contact Hours:	45

Prerequisites: The student should have undergone the course(s):
16CST32 Data Structures and Algorithm Analysis -I

Course Objectives

The course is intended to:

1. Perform various operations on Binary trees and Heaps.
2. Implement operations on Search tree structures.
3. Perform operations on Graphs and Sets.
4. Apply Greedy strategy & Dynamic Programming techniques.
5. Compare the working of Backtracking & Branch and Bound techniques.

Unit I – TREE STRUCTURES 8

Tree – Preliminaries - Binary trees - Tree traversal – Application - Expression tree – Decision tree - Game tree - Binary heap - Heap sort.

Unit II - SEARCH TREE STRUCTURES 9

Binary search tree - AVL tree - B-Trees - k-d Tree – Tries.

Unit III - GRAPH 8

Graph – Definitions – Representation - Topological sort -Breadth-first traversal - Depth-first traversal – Biconnectivity - Euler circuits – Sets - Representation – Operations.

Unit IV - GREEDY METHOD AND DYNAMIC PROGRAMMING 10

Greedy technique -Dijikstra's algorithm - Prim's and Kruskal's algorithm - Huffman tree - Dynamic Programming - Binomial Coefficient - Floyd's and Warshall's algorithm - MultistageGraph - Optimal Binary Search Tree.

Unit V - BACKTRACKING & BRANCH AND BOUND 10

Limitations of Algorithm Power: P, NP and NP- Complete Problems.
Backtracking: n-Queens problem - Hamiltonian Circuit - Subset-Sum problem.
Branch and Bound: Assignment problem - Knapsack problem -Travelling salesman problem.

BoS Chairman

Course Outcomes

At the end of the course the student will be able to:

1. Perform various operations on Binary trees and Heaps for real world applications.
2. Implement operations on search tree structures for efficient storage and retrieval of data.
3. Perform operations on Graphs and Sets by using suitable storage organizations.
4. Apply Greedy strategy & Dynamic Programming techniques for solving optimization problems.
5. Compare the working of Backtracking & Branch and Bound techniques and choose the suitable technique for problem solving.

Text Books:

1. Mark A. Weiss., "Data Structures and Algorithm Analysis in Java", Third Edition, Pearson Education, 2011.
2. Anany Levitin, "Introduction to the Design & Analysis of Algorithms", Third Edition, Pearson Education, 2011.

Reference Books:

1. Ellis Horowitz, Sartaj Sahni, Sanguthevar Rajasekaran, "Fundamentals of Computer Algorithms", Second Edition, Galgotia Publications, 2010.
2. Adam Drozdek, "Data Structures and Algorithms in C++", Fourth Edition, Cengage Learning, 2013.
3. Cormen.T.H., Leiserson.C.E., Rivest. R.L. and Stein.C, "Introduction to Algorithms", PHI Pvt. Ltd., 2001.PHI Pvt. Ltd., 2001.

Web References:

1. http://nptel.ac.in/courses/106101060/
2. http://www.animatedrecursion.com/
3. http://www.claymath.org/millennium/P Vs NP/pvsnp.pdf
4. http://www.cut-the-knot.org/

BoS Chairman

Course Code:16CST45	Course Title: MOBILE APPLICATION DEVELOPMENT	
Core	L: T: P: C	3: 0: 2: 4
Type: Theory & Practical	Total Contact Hours:	75

Prerequisites: The student should have undergone the course(s):

16CST33 Java Programming

Course Objectives

The course is intended to:

1. Impart the fundamental knowledge about Mobile application Development.
2. Generate applications with Android development framework.
3. Design User Interface for an Android Application.
4. Demonstrate Android applications with Database connectivity.
5. Build the real time Android applications.

Unit I - COMPONENTS FOR APP DEVELOPMENT **9**

Mobile application concepts – Embedded systems interface - Market and business drivers – Publishing and delivery – Requirements gathering and validation.

Unit II - ANDROID DEVELOPMENT FRAMEWORK **9**

SDK Features-Development Framework –Types of Android Applications- Mobile and Embedded Device development- Android Development Tools – Manifest File Editor – Externalizing Resources – Android Application Life Cycle – Process States- Android Activities.

Unit III - ANDROID UI DESIGN **9**

UI design paradigm – Layout: Linear, Relative, Grid - To DO List - Fragments – Widget Toolbox – Customer Views – Adapters.

Unit IV - DATABASES AND CONTENT PROVIDERS **9**

Android database concepts - Working with SQLite - Content providers - searching the application - Searchable Earthquake Content Provider - Native Android Content Providers -notifications.

Unit V - ANDROID DEVELOPER TOOLS **9**

Tools – Views- Accessibility-App creation-Android developer tool window-GUI development –Internationalization-Case study: Tip Calculator - Twitter Search.

BoS Chairman

LAB COMPONENT 30

List of Experiments(Suggested application: Calculator,TwitterSearch,AlarmClock)

1. Installation of Android IDE
2. Write a program for implementing the concepts of UI
3. Create an application using Widget toolbox
4. Implement the concepts of Layout Managers
5. Implement the concepts of content providers
6. Write a program for displaying the notification message
7. Create an application with SQLite database
8. Create an application using Android developer tools

Course Outcomes

At the end of the course the student will be able to:

1. Impart the fundamental knowledge about Mobile application Development based on different requirement gathering process.
2. Generate applications with Android development framework using Android Tools.
3. Design User Interface for Android Application through UI concepts.
4. Demonstrate Android applications with Database connectivity using Database content providers.
5. Build the real time Android applications through Android developer tools.

Text Books:

1. AnubhavPradhan , Anil V Despande , "Composing Mobile Apps,Learn,Explore,Apply using Android ", First Edition, Wiley , 2014.
2. Reto Meier, "Professional Android 4 Application Development", Second Edition, Wrox , 2012.
3. Jeff McWherter , Scott Gowell, "Professional Mobile Application Development", Seventh Edition, Goodreads, 2012.

Reference Books:

1. G. Blake Meike, Laird Dornin, Masumi Nakamura, ZigurdMednieks, "Programming Android", Second Edition, O'Reilly, 2011.
2. Mark L. Murphym, "The Busy Coder's Guide to Android Development", Third Edition, Goodreads, 2011.
3. Ian G. Clifton, "Android User Interface Design", First Edition, Addison-Wesley, 2013.
4. Charlie Collins, Michael Galpin and Matthias Kappler, "Android in Practice", First Edition, DreamTech, 2012.

Web References:

1. Android Fundamentals URL: http://developer.android.com/guide/components/fundamentals.html
2. Android Developer's Blog URL: http://android-developers.blogspot.com/

BoS Chairman

Course Code: 16CSL41	**Course Title:** DATA STRUCTURES AND ALGORITHM ANALYSIS -II LABORATORY	
Core	**L: T: P: C**	0: 0:4: 2
Type: Practical	Total Contact Hours:	**60**

Course Objectives

The course is intended to:

1. Implement the tree data structure and its variants.
2. Implement graph traversal algorithms.
3. Develop algorithms using Greedy and Dynamic programming technique.
4. Devise algorithms using Backtracking, Branch and Bound approaches.

LIST OF EXPERIMENTS:

1. Implementation of Expression tree
2. Implementation of Heap sort
3. Implementation of Tree structure for dictionary search
4. Implementation of Graph traversal applications
5. Implementation of Greedy algorithms
6. Implementation of Dynamic programming algorithms
7. Implementation of Backtracking algorithms
8. Implementation of Branch and Bound algorithms
9. Mini Project

Course Outcomes

At the end of the course the student will be able to:

1. Implement the tree data structure and its variants and use these in various applications.
2. Implement graph traversal algorithms and deploy a suitable approach for solving graph problems.
3. Develop algorithms using Greedy and Dynamic programming technique for solving optimization problems.
4. Devise algorithms using Backtracking, Branch and Bound approaches for solving combinatorial problems.

BoS Chairman

Course Code: 16CSL42	Course Title: DATABASE SYSTEMS LABORATORY	
Core	L: T: P: C	0 : 0 : 4 : 2
Type: Practical	Total Contact Hours:	60

Course Objectives

The course is intended to:

1. Design an ER diagram for a given application
2. Write SQL queries to create and modify the table.
3. Construct the PL/SQL programs to retrieve the required data.
4. Develop a real time application with database connectivity

List of Experiments:

Implement the following concepts for the applications suggested below:

1. ER diagrams
2. DDL, DCL commands
3. SUB QUERY and COMPLEX QUERY using DML commands
4. Functions and Procedures
5. Cursors and Triggers
6. Mini Project

The suggested applications are (not limited to):

1. Library Management System
2. College Management System
3. Hospital Management System
4. Railway Reservation System
5. Hotel Management System
6. Employee Management System

Course Outcomes

At the end of the course the student will be able to:

1. Design an ER diagram for a given application by finding entities and its attributes using appropriate notations.
2. Write SQL queries to create and modify the table using DDL/DML/DCL commands for real world problems.
3. Construct the PL/SQL programs to retrieve the required data from the data base.
4. Develop a real time application with database connectivity using suitable frontend.

BoS Chairman

Course Code: 16PSL41	**Course Title:** ETHICAL AND MORAL RESPONSIBILITY	
Core	**L: T: P: C**	0 : 0 : 2 : 1
Type: PS	Total Contact Hours:	**30**

Course Objectives

The course is intended to:

1. Articulate the importance of ethical and moral responsibilities.
2. Explain the fundamental aspects of ethics and morality.
3. Validate one's appropriate and inappropriate behaviors.
4. Elaborate code of conduct.
5. Explain the importance of professional practices.

UNIT I ETHICAL PRACTICES – IMPORTANCE **8***

Why ethical practices; The current day scenario of ethical practices – parents, society, politics & business; Awareness of skewedness of information – news, advertisements and other media; The need for ethical and moral responsibility on a personal level; Handling oneself amidst peer pressure and societal pressure;

UNIT II ETHICAL PRACTICES – FUNDAMENTALS **6***

Morality & Ethics; Moral issues, inquiry, moral dilemmas; Moral autonomy – Kohlberg's theory and Gilligan's refinement; Theories on "right action" – virtue ethics, utilitarianism, duty ethics, rights ethics – resolving moral dilemmas; justifying moral obligations;

UNIT III CODES OF CONDUCT **8***

Importance of code of conduct and its role; Evolving draft Code of conduct for different roles – son/daughter, student, future employee & citizen; Reflection on real time incidences at the college.

Engineers as responsible experimenters; Faith of the Engineer (ABET); Pledge and Code of ethics as per National Society of Professional Engineers (NSPE); Code of Ethics of Institution of Engineers (India); Case studies and discussions in professional context

UNIT IV PROFESSIONAL PRACTICES AT WORK **8***

Transition from a student to a professional; Importance of professional practices at work; Integrity as the topmost virtue of a professional; Self-awareness: Where competence ends and professionalism takes over; Professional qualities;

Need to align oneself to culture & values of organizations; Need to embrace diversity in organizations.

*- Includes review sessions

Course handouts (compiled by PS team, MCET)

1. Instructor's Manual (for the faculty)
2. Learner's workbook (for the student)

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References:

1. Mike W Martin & Roland Schinzenger, "Ethics in Engineering", Latest Edition, Tata McGraw-Hill
2. Code of conduct document, MCET student handbook.
3. Gail D Baura, "Engineering Ethics – an industrial perspective", Academic Press, Elsevier,
4. Subrato Bagchi, "The professional – Defining the new standard of Excellence at work", Penguin Books India.

Assessments:

S.No	Test/ Examination	Criterion	Reduced Marks	Remarks
1	Continuous evaluation	Work book entry & self-analysis = 40 % Test (KT &SKT) = 20 % Evaluation of class response = 40 %	60 %	Test conducted just after CCET 3
2	Comprehensive Examination	Test (KT & SKT) = 50 marks Viva – voce = 50 marks	40 %	Conducted at the end of semester by the Execution Faculty member and another senior faculty involved in the course.
		Condition for clearing the course	50%	

No. of hours & credits:

Enablement through class room lecture, case discussions and group presentations	Conducted by trained internal faculty	30 hours – 1 credit
At least two guest lectures	Delivered by senior people from Industries/Government organizations	

Course Outcomes:

At the end of the course the student will be able to:

1. Articulate the importance of ethical and moral responsibilities.
2. Explain the fundamental aspects of ethical practices.
3. Validate one's appropriate and inappropriate behaviours in various roles.
4. Elaborate code of conduct of professional bodies.
5. Explain the importance of professional practices as a future employee/entrepreneur.

END OF SEMESTER IV

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BoS Chairman

SEMESTER V

Course Code: 16EET55	**Course Title:** MICROCONTROLLER AND SYSTEM INTERFACING	
Core	**L: T: P: C**	3: 0: 2: 4
Type: Theory	Total Contact Hours:	**75**

Prerequisites: The student should have undergone the course(s):
16GET26 C- Programming
16EET35 Digital System Design

Course Objectives

The course is intended to:

1. Describe the components and architecture.
2. Write 8051 Microcontroller programs.
3. Describe the Programmer Model and its architecture.
4. Explain the instruction sets of ARM Processor.
5. Demonstrate various applications with Microcontroller boards.

Unit I - 8051 MICROCONTROLLER **9**

8051 Architecture - I/O pins and Ports, External Memory - Timers and Counters – serial data communication- Interrupts - Instruction set - Addressing modes.

Unit II - INTRODUCTION TO EMBEDDED C PROGRAM **9**

Data types and time delay- I/O programming - logical operations - Data conversion - data serialization - programming to interface: LED- LCD- Keyboard - Timer - Serial communication.

Unit III - ARM ARCHITECTURE **9**

ARM Processor Fundamentals-Registers-Current Program Status Register -Pipeline-Exceptions, Interrupts and the Vector Table - Core Extensions - ARM7 CPU organization

Unit IV - ARM INSTRUCTION SETS **9**

Addressing Modes - ARM Instruction Set -Thumb instruction set – Data Processing Instruction – Branch Instruction- Load Store Instruction – Software Interrupt Instruction

Unit V - MICROCONTROLLERS BOARDS AND APPLICATIONS **9**

Embedded python programming- GPIO - LED interfacing- buzzer interfacing - sensor interfacing: IR sensor, Ultrasonic sensor - Relay interfacing - Wi-Fi applications.

LAB COMPONENT: **30 Hours**

Embedded C programming

1. Introduction to IDE
2. Interfacing LED and Switch
3. Interfacing LCD and Keyboard
4. Timer
5. Serial Communication

BoS Chairman

Embedded python programming:

1. Introduction to embedded python programming
2. Interfacing LED and Switch
3. Interfacing Sensors
    a. Ultrasonic Sensor
    b. IR Sensor
4. Interfacing Relay
5. Wifi Application

Course Outcomes

At the end of the course the student will be able to:

1. Describe the components and architecture of 8051 Microcontroller
2. Write 8051 Microcontroller programs using Embedded C.
3. Describe the ARM Processor's Programmer Model and its architecture
4. Explain the instruction sets of ARM Processor using simple programs.
5. Demonstrate various applications with Microcontroller boards for interfacing circuits.

Text Books:

1. Muhammad Ali Mazidi, Janice Gillispie Mazidi, Rolin D. McKinlay "The 8051 Microcontroller and Embedded Systems using Assembly and C", Second Edition, Eastern Economy Edition, 2006.
2. Andrew N Sloss, Dominic Symes, Chris Wright "ARM System Developer's Guide Designing and Optimizing System Software", Morgan Kaufmann Publisher, Elsevier-2004.
3. Tim Cox, "Raspberry Pi for Python Programmers Cookbook" Second Edition, Packt Publishing, 2016.

Reference Books:

1. Kenneth J.Ayala, "The 8051 Microcontroller Architecture, Programming and Applications" Fourth Edition, Penram International, 2008.
2. Steve Furber, "ARM System –On –Chip architecture", Addison Wesley, 2000.

Web References:

1. https://www.raspberrypi.org
2. http://nptel.ac.in/downloads/106108100/
3. http://www.nptel.ac.in/courses/Webcourse-contents/IISc-BANG/Microprocessors%20and%20Microcontrollers/New_index1.html

BoS Chairman

Course Code: 16CST51	**Course Title:** COMPUTER NETWORKS	
Core	**L: T: P: C**	3: 0: 0: 3
Type: Theory	Total Contact Hours:	**45**

Prerequisites: The student should have undergone the course(s):

16ECT34 Principles of Communication Engineering
16CST31 Operating Systems

Course Objectives

The course is intended to:

1. Characterize the functionalities of network layers.
2. Differentiate various encoding and medium access coordination services.
3. Design a network with appropriate addressing.
4. Illustrate the functionalities of transport layer protocols.
5. Demonstrate the working principles of application layer protocols and security algorithms.

Unit I - FOUNDATIONS OF NETWORKS **8**

Network Requirements –Components -Architecture – Socket implementation – Bandwidth and Latency –Delay X Bandwidth product –Application Performance needs.

Unit II - LINK LAYER **9**

Perspectives on Connecting – Encoding (NRZ, NRZI, Manchester, 4B/5B) –Error Detection (Parity, Internet Checksum, CRC) – Reliable transmission – Media access control – Framing: Ethernet – Wireless Network.

Unit III - NETWORK LAYER **10**

Internet Protocol (IP) – Service Model - Global Addresses - Datagram Forwarding in IP – Subnetting and Classless Addressing – ARP – DHCP – ICMP – Routing protocols: RIP and OSPF – IPv6 – Mobile IP.

Unit IV - TRANSPORT LAYER **9**

UDP: Segment format, Applications – TCP: Segment Format, Connection Establishment and Termination– TCP Congestion Control – Congestion Avoidance Mechanisms.

Unit V - APPLICATION LAYER AND SECURITY **9**

Electronic Mail: SMTP, MIME, IMAP – World Wide Web: HTTP – Web Services – Infrastructure Services: DNS, SNMP - Security: Firewalls – Cryptographic Building Blocks – Symmetric vs Public-Key Ciphers – Key Management.

BoS Chairman

Course Outcomes

At the end of the course the student will be able to:

1. Characterize the functionalities of various layers in network architecture.
2. Differentiate various encoding and medium access coordination services for node-to-node data transmission
3. Design a network with appropriate addressing using subnetting and routing algorithms.
4. Illustrate the functionalities of transport layer protocols for reliable data transmission.
5. Demonstrate the working principles of application layer protocols and security algorithms for end-to-end communication.

Text Book:

1. Larry L. Peterson and Bruce S. Davie, "Computer Networks – A Systems Approach", Fifth Edition, Morgan Kaufmann Publishers, 2012.

Reference Books:

1. James F. Kurose, Keith W. Ross, "Computer Networking – A Top Down Approach Featuring the Internet", Seventh Edition, Pearson Education, 2017.
2. William Stallings, "Data and Computer Communication", Tenth Edition, Pearson Education, 2013.

Web References:

1. http://ocw.mit.edu/courses/electrical-engineering-and-computer-science/6-829-computer-networks-fall-2002/
2. http://nptel.ac.in/courses/106105080/
2. http://nptel.ac.in/courses/106105081/
3. http://nptel.ac.in/courses/106106091/

BoS Chairman

Course Code: 16CST52	Course Title: DATA WAREHOUSING AND MINING	
Core	L: T: P: C	3: 0: 0: 3
Type: Theory	Total Contact Hours:	45

Prerequisites: The student should have undergone the course(s):
16CST41 Database Systems

Course Objectives

The course is intended to:

1. Apply the Data Pre-processing techniques.
2. Demonstrate various schemas and OLAP operations.
3. Generate Association rules using rule mining.
4. Construct classification models and evaluate their performance.
5. Illustrate the techniques for clustering the data.

Unit I - DATA PREPROCESSING AND ARCHITECTURE 9

KDD Process - Data - Patterns - Technologies - Applications - Issues in Data Mining - Data Objects and Attribute Types -Preprocessing: Cleaning - Integration - Reduction - Transformation- Discretization.

Unit II - DATA WAREHOUSING 9

Data Warehouse & Operational Database Systems -Multitier Architecture -Data Warehouse Models -Modeling: Data Cube and OLAP -Data Generalization by Attribute-Oriented Induction - Date Warehouse Design and Usage- Implementation.

Unit III - ASSOCIATION RULE MINING 9

Market Basket Analysis -Frequent Itemsets - Closed Itemsets and Association Rules - Frequent Itemset Mining Methods- Apriori Algorithm- FP Growth Algorithm - Vertical Data Format - Pattern Mining in Multilevel -Multi-Dimensional Space – Constraint - Based Frequent Pattern Mining.

Unit IV - CLASSIFICATION 9

General Approach to Classification - Decision Tree Induction -Bayes Classification - Classification by Back Propagation - Model Evaluation and Selection: Metrics for Evaluating Classifier Performance - Hold Out Method and Sub-sampling - Cross Validation -Bootstrapping.

Unit V - CLUSTERING 9

Cluster Analysis -Requirements for cluster Analysis -Partitioning methods - Hierarchical methods -Types of Outliers -Challenges of Outlier Detection - Outlier Detection Methods. Recent Trends: Spatial Data Mining - Multimedia Data Mining -Data Mining Applications.

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Course Outcomes

At the end of the course the student will be able to:

1. Apply the Data Pre-processing techniques for various data mining functionalities.
2. Demonstrate various schemas and OLAP operations in Data warehousing.
3. Generate Association rules using different types of rule mining process for interesting relations.
4. Construct classification models and evaluate their performance for data categorization.
5. Illustrate the techniques for clustering the data and detection of outliers for various types of data.

Text Book:

1. Jiawei Han, Micheline Kamber and Jian Pei, "Data Mining Concepts and Techniques", Third Edition, Elsevier, 2012.

Reference Books:

1. Margaret H. Dunham, "Data Mining: Introductory and Advanced Topics", Pearson Education, 2006.
2. Alex Berson and Stephen J. Smith, "Data Warehousing, Data Mining & OLAP", Tata McGraw Hill, 2008.
3. W.H.Inmon, "Building the Data Warehouse", Fourth Edition, Wiley, 2005.

Web References:

1. http://web.engr.illinois.edu/~hanj/bk3/bk3_slidesindex.htm
2. http://courses.cs.washington.edu/courses/csep521/07wi/prj/leonardo_fabricio.pdf
3. https://www.ibm.com/developerworks/library/ba-data-mining-techniques

BoS Chairman

Course Code:16CST53	Course Title: FORMAL LANGUAGES AND AUTOMATA THEORY	
Core	L: T: P: C	3: 0: 0: 3
Type: Theory	Total Contact Hours:	45

Prerequisites: The student should have undergone the course(s):
16CST44 Data Structures Algorithm and Analysis - II

Course Objectives

The course is intended to:

1. Identify the types of formal languages.
2. Construct Finite Automata from regular expressions.
3. Design Pushdown Automata for accepting context free languages.
4. Construct a Turing Machine for recognizing recursive languages.
5. Classify decidable and undecidable languages.

Unit I - FINITE AUTOMATA 8

Automata – Computability - Complexity - Chomsky hierarchy of languages - Finite Automata – Non-determinism – Finite Automata with Epsilon transitions – Equivalence of NFA and DFA – Minimization of DFA.

Unit II - REGULAR LANGUAGES 9

Regular Grammars - Regular Languages and Operations - Regular Expressions - Equivalence of Finite Automata and Regular Expressions: Thompson Construction – State Elimination Method - Closure Properties of Regular Languages –Pumping lemma for regular languages.

Unit III - CONTEXT FREE LANGUAGES 10

Context Free Grammars - Derivations, Parse Tree and Ambiguity – Simplification of Grammars – Normal Forms - CNF - Pushdown Automata - Language Acceptance of PDA – Equivalence of Pushdown Automata and CFG - Closure Properties of Context Free Languages.

Unit IV - TURING MACHINE 10

Turing Machine – Language Acceptance – Techniques for Turing Machine Construction – Storage in finite control – Subroutine – Checking off symbols – Multiple tracks – Variants of Turing Machines - Universal Turing Machine.

Unit V - COMPUTABILITY THEORY 8

Decidability: Decidable Languages - Undecidability - Reducibility: Undecidable Problems from Language Theory - Halting Problem - Post Correspondence Problem.

BoS Chairman

Course Outcomes

At the end of the course the student will be able to:

1. Identify the types of formal languages by analyzing their structure.
2. Construct Finite Automata from regular expressions for identifying regular languages.
3. Design Pushdown Automata for accepting context free languages.
4. Construct a Turing Machine for recognizing recursive languages.
5. Classify decidable and undecidable languages by using Reducibility.

Text Books:

1. John E.Hopcroft, Rajeev Motwani, Jeffrey D.Ullman, "Introduction to Automata Theory, Languages and Computation", Third Edition, Pearson Education Publishers, 2012.
2. Michael Sipser, "Introduction to the Theory of Computation", Third Edition, Cengage Learning, 2013.

Reference Books:

1. Kamala Krithivasan, R. Rama, "Introduction to Formal Languages, Automata Theory and Computation", Pearson Education, 2009.
2. K. L. P. Mishra, N. Chandrasekaran, "Theory of Computer Science: Automata, Languages and Computation", Third Edition, PHI, 2006.

Web References:

1. Course Material URL: http://www.ics.uci.edu/~goodrich/ teach/cs162/notes/
2. NPTEL Course Content URL: http://nptel.ac.in/courses/106106049/
3. JFLAP tool -Home URL: www.jflap.org/

BoS Chairman

Course Code: 16CST54	Course Title: WEB TECHNOLOGIES	
Core	L: T: P: C	3: 0: 0: 3
Type: Theory	Total Contact Hours:	45

Prerequisites: The student should have undergone the course(s):

16CST33 Java Programming

Course Objectives

The course is intended to:

1. Create a web application for developing dynamic web pages.
2. Validate web pages using JavaScript.
3. Design the relationship between metadata and XML.
4. Develop the applications using Server side scripting.
5. Implement the server side programs.

Unit I - XHTML **9**

XHTML: Linking - Images – Special Characters and Horizontal rules - Lists – Tables – Forms – Internal Linking – Meta Elements - Cascading style sheets: Inline style sheets – Embedded Style sheets – conflicting styles – External style sheets – CSS drop down menu – User style sheets.

Unit II - JAVA SCRIPT **9**

Java Script –Decision making - Control Statements - Functions – Objects - Typescript: Interface - Namespace-Modules.

Unit III - XML **9**

XML Markup - Namespaces - Document Type Definitions – Schema-Document Object Model-XML Path Language –Extensible Style Sheet Language – XLink - XPointer - XInclude – Xbase - Web services.

Unit IV - JSP-ASP **9**

JSP - Objects – Scripting – Standard Actions – Directives - ASP – Page and File System Objects –ADO – MVC ActiveX Components.

Unit V - SERVLETS **9**

HTTP Servlet – Servlet Life Cycle – Caching - Retrieving Information - HTML Information – Session Tracking - URL Rewriting- Cookies-Security - Applet Servlet Communication - Collaboration.

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Course Outcomes

At the end of the course the student will be able to:

1. Create a web application for developing dynamic web pages using XHTML.
2. Validate web pages using JavaScript for various form control elements
3. Design the relationship between metadata and XML using Schema, Style Sheet & XML Publishing.
4. Develop the applications using Server side scripting through JSP &ASP.
5. Implement the server side programs using servlets.

Text Books:

1. Harvey M. Deitel , Paul J. Deitel, "Internet and World Wide Web – How to Program", Fourth Edition, Pearson Education Asia, 2009.
2. Deitel & Deitel, Nieto, Lin, Sadhu, "XML: How To Program", Second Edition, Pearson Education Asia, 2009.
3. Jason Hunter, William Crawford, "Java Servlet Programming", Second Edition, O'Reilly Publication, 2010

Reference Books:

1. Eric Ladd, Jim O' Donnel, "Using HTML 4, XML and JAVA", Prentice Hall of India – QUE, 2001.
2. John Pollock, "Javascript - A Beginners Guide", Third Edition, Tata McGraw-Hill Edition, 2009.

Web References:

1. http://www.nptel.ac.in/courses/106105084/
2. http://xwiki.usc.edu/groups/instructionalmaterials/weblog/e5657/XHTML_and_CSS_tutorial.html
3. http://www.w3schools.com/html/html_xhtml.asp
4. https://www.ischool.utexas.edu/technology/tutorials/webdev/xml_dtds/xml.pdf
5. http://www.ceng.metu.edu.tr/~e1195288/JSP_tutorial.pdf
6. http://www.java-programming.info/tutorial/pdf/csajsp2/02-Servlet-Basics.pdf

BoS Chairman

Course Code: 16CSL51	Course Title: COMPUTER NETWORKS LABORATORY	
Core	L: T: P: C	0: 0: 4: 2
Type: Practical	Total Contact Hours:	60

Course Objectives

The course is intended to:

1. Design various LAN topologies.
2. Implement client server communication.
3. Implement routing protocols and congestion control techniques.
4. Demonstrate network monitoring and secured data transmission.

List of Experiments

The following experiments are to be implemented in JAVA or simulated using network simulator tools

1. Simulation of IEEE LAN topologies.
2. TCP socket programming.
3. UDP socket programming.
4. Remote Method Invocation and Remote Procedure Call.
5. Study of router configuration.
6. Implementation of routing protocols.
7. Dynamic host configuration protocol.
8. TCP congestion control algorithms.
9. Implementation of SNMP protocol.
10. Implementation of encryption and decryption algorithms.

Course Outcomes

At the end of the course the student will be able to:

1. Design various LAN topologies for network analysis.
2. Implement client server communication using socket programming.
3. Implement routing protocols and congestion control techniques for reliable data transmission.
4. Demonstrate network monitoring and secured data transmission using SNMP and security algorithms.

BoS Chairman

Course Code: 16CSL52	Course Title: WEB TECHNOLOGIES LABORATORY	
Core	L: T: P: C	0 : 0 : 4 : 2
Type: Practical	Total Contact Hours:	60

Course Objectives

The course is intended to:

1. Create and validate the dynamic websites.
2. Design a real time XML document structure.
3. Develop a server side scripting application.
4. Develop a servlet based applications.

List of Experiments:

1. Create a website using HTML tags and Cascading style sheets.
2. Implement the java script functions and objects.
3. Implement the Client Side Scripting for Validating the Web Form Controls.
4. Implement the concepts of XML Schema and DTD.
5. Implement the concepts of XML Style Sheet and XLink.
6. Implement the concepts of JSP Objects.
7. Implement the concepts of ASP objects.
8. Implement the ActiveX components.
9. Implement the HTTP Servlets.

Course Outcomes

At the end of the course the student will be able to:

1. Create and validate the dynamic websites using HTML tags and JavaScript.
2. Design a real time XML document structure using Schema and Style sheet.
3. Develop a server sidescripting application throughJSP&ASP technologies.
4. Develop a servlet based applications through client server application.

BoS Chairman

Course Code: 16PSL51	**Course Title:** TEAMNESS AND INTER-PERSONAL SKILLS (Common to all Branches)	
Core	**L: T: P: C**	0 : 0 : 2 : 1
Type: PS	Total Contact Hours:	**30**

Course Objectives:

The course is intended to:

1. Be aware of attitudinal, behavioral and emotional aspects of self.
2. Learn continuously and be in harmony with self.
3. Understand others' preferences, values, roles & contexts.
4. Identify barriers to harmonious relationships.
5. Work collaboratively as a team.

Unit I - HARMONY WITH SELF

Importance of learning about self continuously; Approaches to learn about self: introspection, being open to feedback, critical incidences as opportunities; Understanding life stages and challenges associated with them; Healthy ways of handling self in response to life's challenges;

Instruments/inventories to understand self and others: A) Know your temperament, B) Mayer Briggs Type Indicator, C) Interpersonal Needs Inventory

Unit II - HARMONY WITH OTHERS

Importance of living in harmony with others; What it takes to live in harmony with others; Understanding preferences, values, roles and contexts of others; Approaches to navigating through differences between self and others;

Barriers to harmonious relationships - Perceptions, Judgments, and Emotional instability; Ways to handle each of the barriers; Importance of reaching-out to others

Unit III - GROUP DYNAMICS AND CONFLICTS RESOLUTION

Group dynamics: overt and covert processes at micro and macro levels; Understanding the basis of conflicts; Understanding one's own conflict handling style; Methods to handling conflicts effectively.

Unit IV - WORKING IN TEAMS

Effectiveness in communication; Forming – storming – norming and performing model; Competition vs collaboration – impact of both on team tasks; TEAM Questionnaire – components of a healthy team and approaches to improving them.

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Mode of delivery:

1. A 2-day learning workshop

    1. Activities (experiential learning)
    2. Audio visuals (affective learning)
    3. Case discussions (cognitive learning)
    4. Instruments/questionnaires (reflective learning)

Guided by Learner's workbook.

2. Continuous learning guided by learning journal, and reviews by faculty

3. Half-day reinforcement session towards the end of the semester

Evaluation:

Sl. No.	Evaluation	Criterion	Total marks		Remarks
1	Continuous Evaluation	KT SKT Evaluation during workshop Weekly review of journal	KT SKT Work book Journal	- 10 marks - 15 marks - 20 marks - 30 marks	KT=Knowledge Test SKT=Scenario based Knowledge Test
			Total	- 75 marks	
2	End semester Evaluation	Comprehensive Examination and Viva voce	KT & SKT, short questions Viva voce	- 10 marks - 15 marks	Conducted for 25 marks
			Total	- 25 marks	
		Total marks for the course	100 marks		
		Condition for clearing the course	50 marks as a whole; but student should have attended the ESE.		

Course Outcomes:

At the end of the course the student will be able to:

1. Be aware of attitudinal, behavioral and emotional aspects of self.
2. Prefer to learn continuously about self and be in harmony with self.
3. Understand others' preferences, values, roles & contexts and be in harmony with others.
4. Identify barriers to harmonious relationships and derive ways to handle them.
5. Work collaboratively as a team to deliver expected outcomes.

END OF SEMESTER V

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BoS Chairman

SEMESTER VI

Course Code: 16CST61	**Course Title:** ARTIFICIAL INTELLIGENCE	
Core	**L: T: P: C**	3: 0: 2: 4
Type: Theory	Total Contact Hours:	**75**

Prerequisites: The student should have undergone the course(s):
16CST44 Data Structures and Algorithm Analysis - II

Course Objectives

The course is intended to:

1. Describe the agent type and behavior.
2. Compare the efficiency of various searching techniques.
3. Apply Inference rules to the given Knowledge Base
4. Choose the appropriate planning technique.
5. Explain the application of Artificial Intelligence techniques.

Unit I - PROBLEM SOLVING AGENTS **9**

Foundation and History of artificial Intelligence - Agents and Environments - Nature of Environments - Structure of Agents - Problem Solving agents - Measuring problem solving performance - Uninformed search strategies.

Unit II- PROBLEM AND SEARCHING **10**

Informed Search strategies : Greedy BFS, A* search - Local search algorithms - Online search agent - Adversarial search – Optimal decision in games - Constraint Satisfaction Problem – Inference in CSP - Backtracking search for CSP.

Unit III- KNOWLEDGE AND REASONING **10**

Logical Agents - Propositional Logic – Theorem Proving - Resolution - Forward and Backward chaining - First Order Logic - Syntax and Semantics of FOL - using First Order Logic - Knowledge Engineering in FOL - Inference in FOL - Unification and Lifting - Forward and Backward chaining – Resolution.

Unit IV - PLANNING **8**

Classical Planning - Planning as State space search - Planning Graphs - Planning and acting in Real world and Non deterministic domains - Hierarchical planning - Multiagent planning.

Unit V- APPLICATIONS **8**

Natural Language processing - Language Model - Text Classification - Information Retrieval - Information Extraction - Speech Recognition – Robotics : Hardware, Software Architecture, Application Domains.

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LAB COMPONENT: **30 HOURS**

1. Choose the suitable searching technique for the given problem.
   (Find the shortest route from source to destination, 8 Puzzle problem , Vacuum cleaner agent problem, wolf-goat-cabbage problem etc.,)
2. Demonstrate Min-Max algorithm (Two player game)
3. Implement constraint satisfaction problem.
   (Job Shop scheduling, TSP, Knapsack, Sudoku etc.,)
4. Study and implementation of Prolog Syntax.
5. Construction of Knowledge Base and Inferring using Unification algorithm.
   (Consider a family tree. Convert English to Prolog facts and Rules. Accept queries from the user and display the output.)
6. Demonstrate backtracking for the given problem.
   (N Queens, Subset Sum, Graph Coloring etc.,)
7. Develop simple AI applications.
   (Build a Chabot, Spam filtering in email, Speech Recognition, Question Answering System etc.,)

Software Required:

- Python /Java
- Prolog

Course Outcomes

At the end of the course the student will be able to:

1. Describe the types and behavior for a given problem solving agent.
2. Compare the efficiency of various searching techniques in solving a problem.
3. Apply Inference rules to the given Knowledge Base for theorem proving.
4. Choose the appropriate planning technique to solve the given problem.
5. Explain the application of Artificial Intelligence techniques in Real world systems.

Text Book:

1. Stuart Russell, Peter Norvig, "Artificial Intelligence – A Modern Approach", Third Edition, Pearson Education, 2014.

BoS Chairman

Reference Books:

1. Elaine Rich and Kevin Knight, "Artificial Intelligence", Third Edition, Tata McGraw-Hill, 2004.
2. Patrick Henry Winston, "Artificial Intelligence", Third Edition, Pearson Education,

Web References:

1. Tool : SWI-Prolog
   http://www.swi-prolog.org/download

   http://www.swi-prolog.org/pldoc/man?section=quickstart
2. AIMA (Artificial Intelligence: A Modern Approach)
   http://aima.cs.berkeley.edu/ - Text Book followed

   http://aima.cs.berkeley.edu/code.html - online code repository C++, Java, Python,
3. Learn and explore the concepts in AI –AIspace tool developed at Laboratory of Computational Intelligence at University of British Columbia.
   http://www.aispace.org/index.shtml
4. Video Lecture by Prof P. Dasgupta
   http://nptel.ac.in/video.php?subjectId=106105079
5. Video Lecture by Prof. Patrick Henry Winston
   http://ocw.mit.edu/courses/electrical-engineering-and-computer-science/6-034-artificial-intelligence-fall-2010/

BoS Chairman

Course Code: 16CST62	Course Title: BIG DATA TECHNOLOGIES	
Core	L: T: P: C	3: 0: 0: 3
Type: Theory	Total Contact Hours:	45

Prerequisites: The student should have undergone the course(s):
16CST31 Operating Systems
16CST41 Database Systems

Course Objectives

The course is intended to:

1. Describe the significance of Big data.
2. Illustrate the basic file system operations using big data framework.
3. Compare Map Reduce and YARN.
4. Use advanced features in Map Reduce.
5. Develop applications using big data analytics tools.

Unit I - BIG DATA REVOLUTION 9

Data base Revolutions- Google, Big data and Hadoop: Big data Revolution-Pioneer of Big data- Case Studies.

Unit II - BIG DATA FRAMEWORK 9

Hadoop Framework: Design of Hadoop Distributed File System (HDFS) - HDFS Concepts- CLI- File systems –Interfaces- Basic File System operations— The Java Interface- Data Flow- Parallel Copying with Distcp- Hadoop Archives- Hadoop I/O: Data Integrity- Compression- Serialization- File-Based Data Structures.

Unit III – MAP REDUCE PROGRAMMING 9

Map Reduce: Analysis with Hadoop- Anatomy of Job Run- Scaling Out-Hadoop Streaming-Hadoop Pipes- Classic versus YARN Map Reduce: Failures- Scheduling- Shuffle and Sort- Map Reduce Types and Formats: Types- Input Formats-Output Formats.

Unit IV – MAP REDUCE ADVANCED FEATURES 9

Map Reduce Features –Counters: Built in counters and User defined counters- Sorting: Partial sort- Total sort -Secondary sort- Joins: Map side join- Reduce side Join- Side Data Distribution-Map Reduce Library Classes.

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Unit V – BIG DATA ANALYTICS TOOLS **9**

Hive: Comparison with Traditional Databases- HiveQL- Tables- Querying Data- User-defined Functions- HBase: Hbasics- Concepts- HBase versus RDBMS.

Course Outcomes

At the end of the course the student will be able to:

1. Describe the significance of big data with revolutions in databases.
2. Illustrate the basic file system operations using big data framework for working in distributed environment.
3. Compare Map Reduce and YARN for all Internals processes.
4. Use advanced features Map Reduce in Map Reduce for real world problems.
5. Develop applications using big data analytics tools for real world scenarios.

Text books:

1. Guy Harrison, "Next Generation Databases- NoSQL, New SQL and Big Data", APress Media, Springer Science and Business Media, 2015.
2. Tom White, "Hadoop: The Definitive Guide", O'Reilly Publication and Yahoo! Press, Fourth Edition, 2015.

Reference Books:

1. Viktor Mayer-Schönberger and Kenneth Cukier, "Big Data: A Revolution That Will Transform How We Live, Work, and Think", Mariner Books Publishers, 2014.
2. ArvindSathi, "Big Data Analytics: Disruptive Technologies for Changing the Game (Paperback)", Mc Press, 2012.
3. "Hadoop in Action" by Chuk Lam, Manning Publications, 2010.

Web References:

1. Amazon S3, URL: http://aws.amazon.com/s3/
2. Welcome to Apache™ Hadoop®! URL: https://hadoop.apache.org/
3. Fay Chang, Jeffrey Dean, "Big table: A Distributed Storage System for Structured data" URL: http://static.googleusercontent.com/media/research.google.com/

BoS Chairman

Course Code: 16CST63	**Course Title:** OBJECT ORIENTED ANALYSIS AND DESIGN	
Core	**L: T: P: C**	3 : 0 : 2 : 4
Type: Theory & Practical	Total Contact Hours:	**75**

Prerequisites: The student should have undergone the course(s):

16CST33- Java Programming

Course Objectives

The course is intended to:

1. Apply object oriented concepts.
2. Develop requirement specification of any problem.
3. Analyze classes with appropriate relationships.
4. Design classes, interface and subsystems.
5. Develop functional object-oriented software.

Unit I - OBJECT ORIENTED APPROACH **8**

Need for Object Oriented Approach – OO Concepts – The System life cycle – Methodologies – Engineering the System Requirements – Requirements Elicitation methods – Validation.

Unit II - USE CASE MODELING **9**

Unified Modeling Language – Architecture – Unified Process – Requirements workflow – Defining requirements – Use case Modeling – Actor and Use Case Generalization – Use Case Relationships.

Unit III - ANALYSIS MODELING **10**

The Analysis Workflow – Classes and Objects – Finding Analysis classes – Relationships – Inheritance and Polymorphism – Analysis packages – Use Case Realization – Activity Diagrams.

UNIT IV - DESIGN MODELING **9**

The Design workflow – Designing Classes – Refining analysis relationships – Interface and Subsystems – Design realization – Basic and Advanced State Charts .

UNIT V - IMPLEMENTATION AND DEPLOYMENT **9**

Implementation workflow – Components – Dealing with Persistent data – Implementing in a Relational Database – Testing object oriented software – Deployment.

BoS Chairman

LAB COMPONENT: **30 Hours**

1. Develop requirement specification using object oriented concepts and validate it.
2. Apply Use case modeling for the given requirement specification.
3. Identify the conceptual classes with its relationships and develop a domain model with UML Class diagram.
4. Using the identified scenarios, draw relevant activity diagram.
5. Using the identified scenarios, find the interaction between objects and represent using UML Sequence diagrams.
6. Using the identified scenarios, draw relevant state chart diagram.
7. Develop and validate the User interface.
8. Generate a functional code using UML design
9. Implement the application with database connectivity
10. Deploy and Test the functional software

Suggested Areas for Implementation:

Passport Automation System, Book Bank, Exam Registration, Stock Maintenance System, Online Course Reservation System, E-ticketing, Credit Card Processing, E-book Management System, Recruitment System, Library Management System, Student Information System, etc..,

Course Outcomes

At the end of the course the student will be able to:

1. Apply object oriented concepts for gathering & validating user requirement specifications.
2. Develop requirement specification of any problem using Use Case Modeling..
3. Analyze classes with appropriate relationships in problem statement using activity diagrams.
4. Design classes, interface and subsystems by using Interaction and state charts diagrams.
5. Develop functional object-oriented software with necessary deployment

Text Books:

1. Carol Britton, Jill Doake, "Object Oriented Systems Development: A Gentle Introduction", McGraw Hill Publishing Company, 2012.
2. Jim Arlow, IlaNeustadt, "UML2 and The Unified Process: Practical Object Oriented Analysis and Design", Pearson Education, 2015.

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Reference Books:

1. Mike O'Docherty, "Object Oriented Analysis and Design: Understanding System Development with UML 2.0", John Wiley & Sons, 2015.
2. Craig Larman, "Applying UML and Patterns: An Introduction to Object Oriented Analysis and Design and Iterative Development", Third Edition, Addison Wesley Professional, 2015.
3. Alan Dennis, Wixom, Tegarden, "Systems Analysis and Design: An Object-Oriented Approach with UML", Fifth Edition, John Wiley, 2015.

Web References:

1. NPTEL Course on Object Oriented Analysis and Design
   URL:http://nptel.ac.in/courses/106105153/
2. IISC Bangalore, System Analysis and Design Course
   URL:http://freevideolectures.com/Course/3432/System-Analysis-and-Design
3. Nancy Conner, UML Course URL: https://www.vtc.com/products/UML_tutorials.html

BoS Chairman

Course Code: 16CST64	**Course Title:** OPEN SOURCE SOFTWARE DEVELOPMENT	
Core	**L: T: P: C**	3: 0: 0: 3
Type: Theory	Total Contact Hours:	**45**

Prerequisites: The student should have undergone the course(s):
16CST33 Java Programming
16CST41 Database Systems

Course Objectives

The course is intended to:

1. Design an open source database for any given application.
2. Develop the Groovy code for an application.
3. Design MVC based web application.
4. Create an application using Grails.
5. Build a web application using AngularJS.

Unit I - OPEN SOURCE SOFTWARE & DATABASE DESIGN **9**

OPEN SOURCE SOFTWARE: Open Source Initiatives – definition-Open Source Licenses- Legal Issues-Contractual Protections - MYSQL: Data types –Stored Programs querying- MongoDB : Schemaless Database, collections, documents, fields, Establish relationships - Create, retrieve, update and delete documents

Unit II - OPEN SOURCE PROGRAMMING LANGUAGE **9**

Groovy as extension of Java - Datatypes, control structures, special loops & operators- List, Map, String, Date – Closure- Object Oriented groovy-Builders, Meta Programming

Unit III - OPEN SOURCE FRAMEWORK **9**

Essence of Grails- Dynamic and Static scaffolding –Domain classes, GORM, controllers- Views

Unit IV - WEB SERVICES **9**

REST services–Ajax--Services –Configuration – Grails Build systems –Plugins

Unit V - FRONT END FRAMEWORK **9**

AngularJS Directives and Controllers- Unit Testing- Forms, Inputs, and Services- AngularJS Services- Server Communication- Working with Filters

BoS Chairman

Course Outcomes

At the end of the course the student will be able to:

1. Design a database for any given application using open source tools.
2. Develop the Groovy code for an application using OOP concepts.
3. Design web application through Grails MVC framework.
4. Create an application using web services in Grails.
5. Build a single page robust web application using AngularJS.

Text Books:

1. Michael R.Overly, "The Open Source Handbook", First Edition, BNA Company, 2003.
2. Paul Dubios, "MYSQL – Developers Library", Fourth Edition, Addison-Wesley Professional, 2008.
3. Kristina Chodorow, Michael Dirolf, "MongoDB: The Definitive Guide Powerful and Scalable Data Storage", Second Edition, O'Reilly Publication, 2010.
4. Bashar Jawad, "Groovy and Grails Recipes", First Edition, APress Publication, 2008.
5. Brown, Jeff Scott, Rocher, Graeme, "The Definitive Guide to Grails 2", First Edition, Apress, 2013.
6. Shyam Seshadri & Brad Green, "AngularJS Up & Running", First Edition, O'Reilly Publication, 2015.

Reference Books:

1. Andrey Adamovich and Luciano Fiandesio, "Groovy 2 Cook Book", 2nd Edition Packt Publishing, 2013.
2. Burt Beckwith, "Programming Grails", O'Reilly Media, Inc., First Edition, 2013.
3. Kyle Banker, Peter Bakkum, Shaun Verch, Tim Hawkins, Doug Garrett, "MongoDB in Action",Second Edition, Manning Publications Company, 2015.
4. Chandermani,"AngularJS by Example", First Edition, Packt Publishing Ltd, 2015.

Web References:

1. MongoDB: http://www.w3resource.com/mongodb/introduction-mongodb.php
2. Groovy on Grails: http://grails.asia/grails-tutorial-for-beginners-setup-your-windows-development-environment.

BoS Chairman

Course Code: 16CSL61	**Course Title:** BIG DATA TECHNOLOGIES LABORATORY	
Core	**L: T: P: C**	0 : 0 : 4 : 2
Type: Practical	Total Contact Hours:	**60**

Course Objectives

The course is intended to:

1. Implement basic operations in HDFS.
2. Develop simple programs using Map Reduce.
3. Develop applications using advanced Map Reduce features.
4. Implement various data analytics applications.

List of Experiments:

1. Implementation of simple Commands in HDFS.
2. Implementation of File System Commands in HDFS
3. Implementation of Parallel Copying in HDFS.
4. Implementation of simple programs in Map Reduce.
5. Implementation of programs using advanced concepts in Map Reduce.
6. Running basic commands in HIVE.
7. Perform advanced analysis using HIVEQL using real world applications.
8. Implementation of large database operations with HBASE for real world applications.[Sample Applications : Sales Data & Telecom Data]

Course Outcomes

At the end of the course the student will be able to:

1. Implement basic operations in HDFS for working in distributed environment.
2. Develop simple programs using Map Reduce for real world applications.
3. Develop applications using advanced Map Reduce features for real world problems.
4. Implement various data analytics applications using HIVE and HBASE.

BoS Chairman

Course Code: 16CSL62	**Course Title:** OPEN SOURCE SOFTWARE DEVELOPMENT LABORATORY	
Core	**L: T: P: C**	0 : 0 : 4 : 2
Type: Practical	Total Contact Hours:	**60**

Course Objectives

The course is intended to:

1. Create a Database for an application.
2. Implement the concepts of OOP using Groovy.
3. Develop an application using MVC architecture in Grails Framework.
4. Implement web application through MVC using AngularJS.

List of Experiments:

1. Create a database for a real time applications using MYSQL.
2. Implementation of Database using MONGO.
3. Implement text parsing and regular expressions using Groovy.
4. Create a simple web application using Grails framework.
5. Create a single web application using AngularJS

Course Outcomes

At the end of the course the student will be able to:

1. Create a database for real time applications using MYSQL and MongoDB.
2. Implement the OOP principles using GROOVY.
3. Develop an application in GRAILS framework.
4. Implement web application through MVC using AngularJS

BoS Chairman

Course Code: 16PSL61	**Course Title:** CAMPUS TO CORPORATE	
Core	**L: T: P: C**	0 : 0 : 2 : 1
Type: PS	Total Contact Hours:	**30**

Course Objectives

The course is intended to:

1. Display gratitude and social responsibility.
2. Understand various business environments.
3. Explain the transition from a campus mindset to corporate mindset.
4. Be prepared to the work culture.
5. Choose to be presentable and agile.

Unit I - GRATITUDE AND SOCIAL RESPONSIBILITY

Importance of gratitude; Finding opportunities to give back to society; Responsible behavior in public places; Volunteerism during calamities; Social relevancy during engineering design and manufacturing – how social issues could be tackled by engineering solutions.

Unit II - THE WORLD OF BUSINESS (get to the specifics of behavioral responses to certain specific contexts)

World of business - Perceptions vs reality; Various business types - B2B, B2C, & other business models; Various industry verticals – fundamentals, dynamics & nuances; Nature of work as per various functions – Sales & Marketing, Service, Research & Development, Production etc; Self-reflective questionnaire to identify the fitment to a particular field/function.

Unit III - TRANSITION FROM A CAMPUS MINDSET TO CORPORATE MINDSET

ROCK as an acronym (Responsibility, Ownership, Contribution, Knowledgeable (continuous learning)); Responsibility – ways in which responsibility should be demonstrated; Ownership – owning one's career, owning mistakes, desisting from complaining; Contribution – focus on creating value, giving more than receiving (salary & perks); Knowledgeable(continuous learning) – learning just begins after campus, aspects of learning mindset, various opportunities to learn and how they can be utilised at work.

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Unit IV - PREPAREDNESS TO ADAPT TO WORK CULTURE

Skills to get through selection process – Interview conversations, resume writing, group discussion & presentation;

Handling Cultural differences; Handling Gender dynamics; Alignment to Ethics and values; Alignment to work processes & code of conduct; Handling multiple (often conflicting) demands; Handling peer influence; Conducting sensitively with subordinates, peers & boss;Managing personal finance; Maintaining work-life balance – work & social life, hobbies etc;

Unit V - PRESENTABLE AND AGILE

Dressing & grooming – Reasons for good dressing & grooming; Professional etiquette – what is etiquette, professional etiquette vs social etiquette, Aspects of professional etiquette; Wellness – Healthy eating habits, Importance of sleep, Importance of fitness; Importance of cleanliness of surroundings – desk, work area, place of stay (5S);

Mode of delivery:

1. A 2-day learning workshop guided by Learner's workbook.
2. Continuous learning guided by learning journal, and reviews by faculty

Assessments and Evaluation:

Assessment	Details	Weightage	Administration	By Whom	When
Workbook record assessment	Assess the necessary elements to be entered in the workbook	20%	Individual workbooks reviewed by the faculty		Immediately after the learning workshop
Initial Knowledge Test and Scenario based knowledge test	Multiple choice questions (20)	25%	Pen and paper,	Internal team	Immediately after the learning workshop
Review of student journal	Student held journal for the whole semester	30%	Individual journals reviewed by the faculty	Trained faculty members	Once in a week

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Final Knowledge test and Scenario based knowledge test	Multiple choice questions (40)	10%		Internal team	End of semester
Review of student journal by external expert		15%	Student journal comprehensive review	Trained faculty members	End of semester

Course Outcomes

At the end of the course the student will be able to:

1. Display gratitude and social responsibility.
2. Understand various business environments – industry & function wise.
3. Explain the transition from a campus mindset to corporate mindset.
4. Be prepared to adapt to the future work culture.
5. Choose to be presentable and agile.

END OF SEMESTER VI

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BoS Chairman

SEMESTER VII

Course Code: 16CST71	**Course Title:** CLOUD TECHNOLOGY	
Core	**L: T: P: C**	3: 0: 0: 3
Type: Theory	Total Contact Hours:	**45**

Prerequisites: The student should have undergone the course(s):
16CST42 - Computer Architecture
16CST51 - Computer Networks

Course Objectives

The course is intended to:

1. Describe the core features of Parallel and distributed Computing.
2. Summarize the significance of elastically scalable systems in Cloud Computing.
3. Explain the cloud design principles, architecture and enabling technologies.
4. Illustrate the application of Cloud in business and scientific domains.
5. Outline secure software development for Cloud.

Unit I - DISTRIBUTED AND CLOUD COMPUTING **9**

Defining a Cloud - Cloud Computing Reference Model -Characteristics and Benefits - Building Cloud Computing Environments - Computing Platforms and Technologies - Parallel vs. Distributed Computing - Elements of Parallel Computing - Elements of Distributed Computing - Technologies for Distributed Computing.

Unit II - VIRTUALIZATION AND ARCHITECTURE **10**

Characteristics of Virtualized Environments - Taxonomy of Virtualization Techniques - Virtualization and Cloud Computing - Pros and Cons of Virtualization–Types of Virtualization: Full Virtualization and Para Virtualization - Cloud Architectural Model - Types of Clouds.

Unit III - CLOUD PLATFORMS ARCHITECTURE **9**

Data Center Design and Interconnection of networks - Architectural Design of Compute and Storage Clouds - Public Cloud Platforms- Inter-cloud Resource Management.

Unit IV - CLOUD APPLICATIONS **8**

Scientific Applications - Business and Consumer Applications - Energy Efficiency in Clouds - Market Based Management of Clouds - Federated Clouds / InterCloud - Third Party Cloud Services.

Unit V - CLOUD SECURITY **9**

Objectives – Services – Design Principles- Secure Cloud software requirements: Secure development practices, Approaches to Cloud software recommend engineering, Policy implementation, NIST33 security principles – Disaster recovery.

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Course Outcomes

At the end of the course the student will be able to:

1. Describe the core features of Parallel and distributed Computing in Cloud.
2. Summarize the significance of elastically scalable systems in Cloud Computing using virtualization concept.
3. Explain the design principles, architecture and enabling technologies of cloud platform.
4. Illustrate the applications of Cloud in business and scientific domains by exploring various case studies.
5. Outline software development for Cloud using secure software design principles.

Text Books:

1. Dr. Rajkumar Buyya, Dr. Christian Vecchiola, Dr. S Thamarai Selvi, "Mastering Cloud Computing", Tata McGraw Hill Education Private Limited, 2013. (UNIT I,II,IV)
2. Kai Hwang, Geoffrey C. Fox, Jack J. Dongarra, "Cloud Computing – From Parallel processing to the Internet of Things", Morgan Kaufmann Publishers, 2012 (UNIT III)
3. Ronald L. Krutz, Russell Dean Vines, "Cloud Security A comprehensive guide to secure Cloud Computing", Wiley India Pvt. Ltd, Reprint 2016. (UNIT – V)

Reference Books:

1. Dr. Kris Jamsa, "Cloud Computing: SaaS, PaaS, Iaas, Virtualization, Business Models, Mobile, Security and more", Jones & Bartlett Learning, 2013.
2. Toby Velte, Anthony Velte, Robert Elsenpeter, "Cloud Computing, A Practical Approach" McGraw-Hill Osborne Media; First edition, 2009.

Web References:

1. http://www.ibm.com/developerworks/library/os-Cloud-virtual1/
2. http://docs.hpCloud.com/pdf/static/Eucalyptus_3.4/faststart-guide-3.4.2.pdf

BoS Chairman

Course Code: 16CST72	Course Title: CRYPTOGRAPHIC TECHNIQUES	
Core	L: T: P: C	3: 0: 0: 3
Type: Theory	Total Contact Hours:	45

Prerequisites: The student should have undergone the course(s):
16MAT24 Engineering Mathematics - II

Course Objectives

The course is intended to:

1. Employ classical encryption techniques.
2. Implement symmetric key algorithms and stream ciphers.
3. Apply number theory concepts.
4. Apply hash functions and digital signature.
5. Construct key management and user authentication protocols.

Unit I – OVERVIEW OF CLASSICAL ENCRYPTION **8**

Basic concepts, Security attacks, services and mechanisms, Characteristics of good ciphers, Security Standards, Classical encryption techniques: Symmetric cipher model, Substitution techniques, and Transposition techniques.

Unit II - SYMMETRIC AND STREAM CIPHERS **10**

Block cipher principles, Data Encryption Standard (DES), Fields and finite field arithmetic, Advanced Encryption Standard (AES), Block cipher modes of operation, Principles of random number generation, random number generators, Stream ciphers, RC4.

Unit III - ASYMMETRIC CIPHERS **9**

Number theory concepts: Euclidean algorithm - Modular arithmetic - Prime numbers - Fermat's and Euler's theorem, Discrete logarithms, Principles of public-key cryptosystems, RSA algorithm, Diffie-Hellman key exchange, ElGamal cryptographic system.

Unit IV - HASH FUNCTIONS AND DIGITAL SIGNATURES **9**

Hash function: Applications, Requirements, Secure Hash Algorithm (SHA), Message authentication codes: Requirements, functions, Hash based Message Authentication Codes (HMAC) - Digital signature: Properties, ElGamal digital signature scheme, Digital Signature Standard (DSS).

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Unit V – KEY MANAGEMENT AND USER AUTHENTICATION 9

Key management and distribution - X.509 certificate – Public key infrastructure - User authentication – Kerberos protocol.

Course Outcomes

At the end of the course the student will be able to:

1. Employ classical encryption techniques for providing confidentiality service.
2. Implement symmetric key algorithms and stream ciphers for encrypting text and multimedia data.
3. Apply number theory concepts to design asymmetric key algorithms for providing confidentiality and key exchange services.
4. Apply hash function and digital signature for protecting digital documents.
5. Construct key management and user authentication protocols for providing key sharing and authentication services.

Text Book:

1. William Stallings, "Cryptography and Network Security - Principles and Practices", Pearson Education, Sixth Edition, 2014.

Reference Books:

1. Behrouz A Forouzan and Debdeep Mukhopadhyay, "Cryptography and Network Security", Tata McGraw Hill, New Delhi, 2011.
2. Atul Kahate, "Cryptography and Network Security", Tata Mcgraw Hill, New Delhi, 2013.
3. Douglas R Stinson, "Cryptography - Theory and Practice", Chapman and Hall / CRC Press, New York, 2013.

Web References:

1. http://nptel.ac.in/courses/106105031/
2. https://www.cs.auckland.ac.nz/~pgut001/tutorial/
3. https://www.khanacademy.org/computing/computer-science/cryptography

BoS Chairman

Course Code: 16CSL71	Course Title: CLOUD TECHNOLOGY LABORATORY	
Core	L: T: P: C	0 : 0 : 4 : 2
Type: Practical	Total Contact Hours:	60

Course Objectives

The course is intended to:

1. Implement the core concepts of Cloud Computing.
2. Create elastically scalable systems in Cloud.
3. Compare Cloud Computing solutions provided by the Industry.
4. Demonstrate various applications projects using Cloud Technology.

Area of Experiments:

1. Configure a network adapter connection in Oracle Virtual Box.
2. Installation of Single node / Multi node setup using DevStack.
3. Perform various operations of Cloud using Horizon.
4. Application migration using AWS.
5. Deploying an application using Google App Engine.
6. Creating a Web App using Microsoft Azure.
7. Mini Project

Course Outcomes

At the end of the course the student will be able to:

1. Implement the core concepts of Cloud Computing by configuring network adapter connection.
2. Create elastically scalable systems in Cloud using virtualization concepts.
3. Compare Cloud Computing solutions provided by the Industry through different technologies.
4. Demonstrate various applications projects using Cloud Technology by deploying in the Public Cloud.

BoS Chairman

Course Code: 16CSL72	**Course Title:** CRYPTOGRAPHIC TECHNIQUES LABORATORY	
Core	**L: T: P: C**	0 : 0 : 4 : 2
Type: Practical	Total Contact Hours:	**60**

Course Objectives

The course is intended to:

1. Demonstrate the working of classical and symmetric encryption techniques.
2. Implement the random number generators and stream ciphers.
3. Develop public key cryptosystems.
4. Implement digital signature and authentication protocols.

List of Experiments:

The following experiments are to be implemented.

1. Traditional substitution techniques.
2. Traditional transposition techniques.
3. DES and AES algorithms.
4. Random number generators and stream cipher.
5. Extended Euclidean, Fermat's and Euler's theorems.
6. RSA algorithm.
7. Diffie-Hellman key exchange algorithm.
8. Hash and MAC functions.
9. Digital Signature algorithm.
10. User authentication protocol.

Course Outcomes

At the end of the course the student will be able to:

1. Demonstrate the working of classical and symmetric encryption techniques for providing confidentiality service.
2. Implement random number generators and stream ciphers for encrypting data.
3. Develop public key cryptosystems using the number theory concepts.
4. Implement digital signature and authentication protocols for secure data exchange.

BoS Chairman

ELECTIVES

Course Code: 16CSE01	**Course Title:** PYTHON PROGRAMMING (Common to CSE, EEE and E&I)	
Elective	**L: T: P: C**	3: 0: 0: 3
Type: Theory	Total Contact Hours:	**45**

Prerequisites: The student should have undergone the course(s):
16GET16 Fundamentals of Computing and Programming
16CST33 Java programming

Course Objectives

The course is intended to:

1. Identify various syntax and operators in python programming.
2. Illustrate control flow, library functions and file operations.
3. Implement object oriented features in python.
4. Apply database connectivity technique.
5. Design user interfaces.

Unit I - PROGRAMMING CONSTRUCTS **9**

Basics: Data Types – Declaring variables - Usage of Operators- Special functions - Python standards in Coding. Sequential Statements - Control statements - Performing Iterations – Strings - Tuples-Sets - Dictionary.

Unit II - FUNCTIONS **9**

Functions: Defining & Calling function- Passing arguments to functions: Mutable & Immutable Data Types - Different types of arguments-Recursion-Scope of variables. Standard Library: Math, String, List, Date & Time Modules. Files: Open- Close- Write-Read.

Unit III - OOP IN PYTHON **9**

Classes - Objects – Modifiers - Method Invocation – Inheritance – Polymorphism - Packages - Scopes and Namespaces - Interface - Exception Handling.

Unit IV - DATABASE PROGRAMMING **9**

DBM files - Pickled objects - Shelve files - Object Oriented Database - SQL Database interfaces - Building record dictionaries - loading database tables from files.

Unit V - GUI PROGRAMMING AND DATA VISUALIZATION **9**

GUI basics-Working with TKinter library- Adding widgets-Binding Events- Message and Entry- Check and Radio button- Menus and list-Canvas-Introduction to Matplotlib - Line and Bar plot - Scatter plot - pie chart-working with multiple figures - 3D plots - Plotting using files.

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Course Outcomes

At the end of the course the student will be able to:

1. Identify various syntax and operators in python programming for writing simple programs.
2. Illustrate control flow, library functions and file operations using user-defined and pre-defined functions.
3. Implement object oriented features in python for writing reusable codes.
4. Apply database connectivity technique for real time applications.
5. Design user interfaces using python based GUI components.

Text Books:

1. Peter Wentworth, Jeffrey Elkner, Allen B. Downey, and Chris Meyers, "How to Think Like a Computer Scientist: Learning with Python", Third Edition, O'Reilly, 2014.
2. MarkLutz,"Powerful Object Oriented Programming Python", Fourth Edition, O'Reilly, 2012.

Reference Books:

1. Mark Lutz, "Learning Python, Powerful OOPs", O'Reilly, 2011.
2. Zelle, John M, "Python Programming: An Introduction to Computer Science", Franklin Beedle & Associates, 2003.
3. Budd, Timothy, "Exploring Python", McGraw-Hill Science, 2009.
4. Matplotlib for Python Developers: "Effective techniques for data visualization with Python", second Edition, Kindle Edition.

Web References:

1. Python tutorial URL:https://docs.python.org/3/tutorial/
2. Advanced Python URL:https://www.learnpython.org/
3. Python basic tutorial URL:www.pyschools.com/
4. Data Visualization https://www.datacamp.com/courses/introduction-to-data-visualization-with-python/

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Course Code: 16CSE02	**Course Title:** WEB TECHNOLOGIES II	
Elective	**L: T: P: C**	3: 0: 0: 3
Type: Theory	Total Contact Hours:	**45**

Prerequisites: The student should have undergone the course(s):

16CST54 Web Technologies

Course Objectives

The course is intended to:

1. Use HTML elements to enhance web pages.
2. Design interactive web applications.
3. Develop web page using basic scripting concepts.
4. Construct web applications using Modules and Packages.
5. Create applications using React components.

Unit I - HTML 5 **9**

Text –Text Organization in HTML – Links and URLs –Tables – Images, Colors and Canvas - Multimedia

Unit II – Dynamic HTML **9**

Javascript Functions, Events, Image Maps and Animations – Browser Object – Document Object – Validation, Errors, Debugging, Exception Handling and Security.

Unit III – Node.js **9**

Node.js Development Setup – Understanding Node.js – Variables – Functions – Performance – Internals - Javascript

Unit IV – Modules & Packages **9**

File Based Module System –Globals – Core Modules – Reusing Node.js code – Packages – Node Modules – JSON - NPM

Unit V – React.js **9**

Generate & Enhance HTML – Declarative User Interfaces – React Components – Readability – Reusability – Composability – Component creation – Component life cycle

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Course Outcomes

At the end of the course the student will be able to:

1. Use HTML elements to enhance web pages using HTML 5.
2. Design interactive web applications using Javascript.
3. Develop web page using basic scripting concepts through Node.js
4. Construct web applications using Modules and Packages in Node.js.
5. Create applications using React components through React js.

Text Books:

1. "HTML 5 Black Book; Covers CSS 3, JavaScript, XML, XHTML, AJAX, PHP and jQuery", Secnd Edition, DT Editorial Services, 2014
2. Basarat Ali Syed, "Beginning Node.js", First Edition, Apress, 2014
3. Samer Buna, "React.js Succinctly", Syncfusion, 2016

Reference Books:

1. Eric Freeman & Elisabeth Robson, "Head First HTML5 Programming", O'Reilly, 2011
2. Dane Cameron, "HTML5,JavaScript,and jQuery", Wrox, 2015
3. Fernando Monteiro, "Node.js 6.X Blueprints", PACKT Publishing, 2016
4. Artemij Fedosejev, " React.js Essentials", 1st Edition, Kindle Edition, 2015

Web References:

1. http:// http://www.html-5.com/index.pdf
2. https://developer.mozilla.org/en-US/docs/Web/Guide/HTML/HTML5
3. https://docs.launchdarkly.com/docs/node-sdk-reference
4. https://docs.marklogic.com/guide/node-dev.pdf
5. https://dzone.com/articles/reactjs-for-noobs

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Course Code: 16CSE03	Course Title: USER INTERFACE DESIGN	
Elective	L: T: P: C	3: 0: 0: 3
Type: Theory	Total Contact Hours:	45

Course Objectives

The course is intended to:

1. Explain the principles and process of UI design
2. Illustrate the significance of various types of Interfaces and Emotions
3. Describe Interaction design, Evaluation and Testing process
4. Explain about Mobile Information Architecture, Applications and Design elements
5. Design the webpages by selecting appropriate Interaction methods

Unit I - PRINCIPLES AND PROCESS 9

Characteristics of good design-Graphical User Interface-Direct Manipulation- Web User Interface-Principles of User Interface Design-User Interface Design Process-Human Characteristics in Design

Unit II - EMOTIONS AND INTERFACES 9

Emotions and the User Experience – Expressive Interfaces – Frustrating Interfaces – Persuasive Technologies and Behavioural Change – Anthropomorphism and Zoomorphism – Models of Emotion – Interfaces.

Unit III - DESIGN AND TESTING 9

Process of Interaction Design– Requirements Gathering – Analysis – Interpretation and Presentation -Evaluation Types – The Evaluation Framework – Usability Testing – prototypes-Kinds of Test.

Unit IV - MOBILE HCI 9

Mobile Ecosystem: Platforms–Application frameworks– Types of Mobile Applications– Mobile Information Architecture– Mobile Design–Elements of Mobile Design–Case study: Mobile 2.0.

Unit V - WEB HCI 9

Drag & Drop, Direct Selection, Contextual Tools, Overlays, Inlays and Virtual Pages, Process Flow, In Page Editing, Static Invitations, Dynamic Invitations

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Course Outcomes

At the end of the course the student will be able to:

1. Explain the principles and process of UI design for developing an Interface.
2. Illustrate the significance of various types of Interfaces and Emotions for designing an user Interface.
3. Describe Interaction design, Evaluation and Testing process to solve Real World Problems.
4. Explain about Mobile Information Architecture, Applications and Design elements for Creating an Application.
5. Designing the webpages by selecting appropriate Interaction methods for building an Application.

Text Books:

1. Wilbert O.Galitz, "The Essential Guide to User Interface Design", Third Edition, John Wiley & Sons, 2007.
2. Yvonne Rogers , Helen Sharp, Jenny Preece, "Interaction Design: Beyond Human - Computer Interaction", Third Edition, John Wiley & Sons, 2011.
3. Brian Fling, "Mobile Design and Development", O'Reilly Media Inc., 2009.
4. Bill Scott and Theresa Neil, "Designing Web Interfaces", O'Reilly, 2009.

Reference Books:

1. Jenifer Tidwell, "Designing Interfaces", Second Edition, O'Reilly Publications, 2011.
2. Marc Silver,"Exploring Interface Design", Delmar Cengage Learning, 2005.

Web References:

1. Interaction Design URL:http://www.idc.iitb.ac.in/academics/Interaction-design-course-content.html.
2. User interface design for the mobile web :https://www.ibm.com/developerworks/library/wa-interface/
3. Designing web applications URL:http://nathanbarry.com/webapps/
4. 10 Great Sites for UI Design Patterns URL:https://www.interaction-design.org/literature/article/10-great-sites-for-ui-design-patterns.
5. User Interface Design and Implementation URL:http://ocw.mit.edu/courses/electrical-engineering-and-computer-science/6-831-user-interface-design-and-implementation spring-2011/lecture-notes.

BoS Chairman

Course Code: 16CSE04	Course Title: ADVANCED DATA STRUCTURES AND ALGORITHMS	
Elective	L: T: P: C	3: 0: 0: 3
Type: Theory	Total Contact Hours:	45

Prerequisites: The student should have undergone the course:

16CST44 Data Structures and Algorithm Analysis-II

Course Objectives

The course is intended to:

1. Develop algorithms for efficient search.
2. Construct range trees and Voronoi diagrams.
3. Construct geometric data structures.
4. Solve problems using Randomized and Approximation Algorithms.
5. Explain the working of Parallel and Online algorithms.

Unit I - SEARCH DATA STRUCTURES 9

Splay Trees - Red Black Trees – Treaps-Suffix Arrays and Trees.

Unit II - RANGE SEARCH 9

1-Dimensional Range Searching – Range Trees – Higher-Dimensional Range Trees – Voronoi diagram.

Unit III - GEOMETRIC DATA STRUCTURES 9

Interval Trees – Priority Search Trees – Segment Trees – Quad Trees.

Unit IV - RANDOMIZED AND APPROXIMATION ALGORITHMS 9

Randomized Algorithms: Random Number Generators- Skip Lists-Primality Testing Approximation Algorithms: Node cover Problem-Euclidean Traveling salesperson Problem - Bin packing Polynomial Time Approximation Schemes: 0/1 Knapsack Problem.

Unit V - PARALLEL AND ONLINE ALGORITHMS 9

Parallel Algorithms: Parallelism-PRAM-Handling Write Conflicts-Merging and Sorting. Online algorithms: Euclidean Spanning tree-Bipartite matching-Convex hull problem.

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Course Outcomes

At the end of the course the student will be able to:

1. Develop algorithms for efficient search using Tree data structures.
2. Construct range trees and Voronoi diagrams for spatial search.
3. Construct geometric data structures and perform spatial search operations.
4. Solve problems using Randomized and Approximation Algorithms to achieve better efficiency in real time applications.
5. Explain the working of Parallel and Online algorithms for solving various problems.

Text Books:

1. Mark Allen Weiss, "Data Structures & Algorithms in Java", Third Edition, Pearson Education, 2012.
2. R.C.T. Lee,S.S.Tseng, R.C.Chang, Y.T.Tsai, "Introduction to the Design and Analysis of Algorithms A Strategic Approach", Tata McGraw Hill, 2012.
3. Sara Baase,Allen Van Gelder , "Computer Algorithms Introduction to Design and Analysis", Third Edition, Pearson Education, 2003.
4. Mark de Berg, Otfried Cheong, Marc van Kreveld, Mark Overmars, "Computational Geometry Algorithms and Applications", Third Edition, Springer, 2008.

Reference Books:

1. Peter Brass, "Advanced Data Structures", Cambridge University Press, 2008.
2. Dinesh P.Mehta, Sartaj Sahni, "Handbook of Data Structures and Applications", Chapman & Hall/CRC, 2005.

Web References:

1. Adrian Vladu and Cosmin Negruşeri, Suffix arrays – a programming contest approach, 2005. URL: http://web.stanford.edu/class/cs97si/suffix-array.pdf
2. Applications of Computational Geometry – Geometry in Action.URL: https://www.ics.uci.edu/~eppstein/geom.html.
3. DataStructureVisualizations.URL:https://www.cs.usfca.edu/~galles/visualization/Algorithms.html.
4. MIT Course Content URL: https://ocw.mit.edu/courses/electrical-engineering-and-computer-science/6-851-advanced-data-structures-spring-2012/

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Course Code: 16CSE05	Course Title: ADVANCED JAVA PROGRAMMING	
Elective	**L: T: P: C**	3: 0: 0: 3
Type: Theory	Total Contact Hours:	**45**

Prerequisites: The student should have undergone the course(s):
16CST33 Java Programming
16CST51 Computer Networks

Course Objectives

The course is intended to:

1. Design TCP and UDP client/server applications.
2. Use java beans for encapsulating objects.
3. Utilize Java Swing and JavaFx controls
4. Identify suitable collections and framework.
5. Build distributed applications.

Unit I – NETWORKING **9**

New Input/Output classes – NIO fundamentals – Path interface – Files class – NIO system – Networking classes and interfaces – InetAddress – TCP/IP client sockets – URL classes – HttpURL – Cookies – TCP/IP server sockets – Datagrams.

Unit II – JAVA BEANS AND GENERICS **9**

Advantages – Introspection - Bound and constrained properties – Persistence - Customizers - Java beans API – Bean example— Generic classes – Generic methods.

Unit III – GUI PROGRAMMING **9**

Exploring Swing controls – Swing Menus – JavaFX concepts – JavaFX controls – JavaFX menus

Unit VI – COLLECTIONS AND FRAMEWORK **9**

Collection interfaces – Collection Classes – Iterator – Spliterators – Storing user defined classes in collections – Spring: container, core modules, eco systems, wiring beans, advanced wiring, aspect-oriented spring, Building web application: spring MVC.

Unit V – REMOTE METHOD INVOCATION **9**

J2EE platform – Application servers - Developing applications: remote interfaces, stubs and skeletons, Registering remote objects, writing RMI clients, Pushing data from RMI Servlet – RMI over Inter-ORB Protocol.

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Course Outcomes

At the end of the course the student will be able to:

1. Design TCP and UDP client/server applications using java socket classes.
2. Use java beans for encapsulating several objects in to a single object.
3. Utilize Java Swing and JavaFx controls for developing rich internet applications.
4. Identify suitable collections and framework for implementing data structures and operations.
5. Build distributed applications using remote method invocation.

Text Books:

1. Herbert Schildt, "Java: The Complete Reference", Tata McGraw Hill, Ninth Edition, New Delhi, 2014. (Unit I to IV)
2. J. McGovern, R. Adatia, Y. Fain, et al, "Java 2 Enterprise Edition 1.4 Bible", Wiley-Dream Tech India Pvt. Ltd. (Unit V)

Reference Books:

1. Craig Walls, "Spring in Action", Fourth Edition, Manning, 2014.
2. Deitel H M and Deitel P I, "Java - How to Program", Pearson Education, 2013.
3. Darren Broemmer, "J2EE Best Practices: Java Design Patterns, Automation and Performance", Wiley Dream Tech, 2003.

Web References:

1. http://nptel.ac.in/courses/106101060/
2. http://pages.di.unipi.it/corradini/Didattica/PR2-B 14/Java%20Collections%20Framework.pdf
3. https://beginnersbook.com/java-collections-tutorials/

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Course Code: 16CSE06	**Course Title:** GRAPHICS AND VISUALIZATION	
Core	**L: T: P: C**	3: 0: 0: 3
Type: Theory	Total Contact Hours:	**45**

Prerequisites: The student should have undergone the course(s):
16MAT14 - Engineering Mathematics I
16EGL21 - Engineering Graphics

Course Objectives

The course is intended to:

1. Develop interactive computer graphics.
2. Demonstrate the basic principles of implementing graphical output primitives and their attributes.
3. Implement 2D transformation and viewing operations.
4. Design a 3D object and perform transformation and viewing operations.
5. Identify suitable surface detection, lightning and rendering methods.

UNIT I - GRAPHICS SOFTWARE STANDARDS AND PRIMITIVES **8**

Coordinate Representations - Graphics Functions - Software Standards - Introduction to OpenGL - Coordinate reference frame - Specifying 2D using OpenGL - OpenGL Point Functions - OpenGL Line Functions - Fill Area Primitives - Polygon Fill Area - OpenGL polygon Fill Area Functions.

UNIT II - OUTPUT PRIMITIVES AND ATTRIBUTES **10**

Line Drawing Algorithms - DDA Line Drawing Algorithm - Bresenhams Line Drawing Algorithm- Circle Drawing Algorithm - Ellipse Drawing Algorithm.
Point attributes - Line attributes - Fill Area attributes - Character attributes - OpenGL Functions.

UNIT III - 2D TRANSFORMATION AND VIEWING **9**

Basic Transformations - Homogeneous Representation - Composite Transformation - Other Transformations - OpenGL functions.
Viewing Pipeline - Clipping Window - Window to Viewport transformation - OpenGL 2D viewing Functions - Clipping Algorithms: Point Clipping - Line Clipping - Cohen Sutherland Line Clipping Algorithm - Polygon Clipping - Sutherland Hodgeman and Weiler Atherton Method - Text Clipping.

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UNIT IV - 3D TRANSFORMATIONS AND VIEWING 9

3D Object Representation - OpenGL Functions- Quadric and Cubic Surfaces- Bezier and Spline Curves-3D Transformation- OpenGL Functions.
3D Viewing - 3D Viewing Concepts - 3D Viewing Pipeline - Projection Transformations - Orthogonal Projections - Oblique Parallel Projections - Perspective Projections - OpenGL Functions.

UNIT V - VISUALIZATION OF 3D OBJECTS 9

Visible Surface Detection Methods: Classification - Back face detection - Depth Buffer Method - A Buffer Method - Scan Line Method - Depth Sorting Method - BSP Tree Method - Oct Tree Method - Comparison.
Illumination and Surface Rendering: Light Sources - Surface Lightning Effects - Surface Rendering-OpenGL Functions.

Course Outcomes

At the end of the course the student will be able to:

1. Develop Interactive Computer Graphics using basic OpenGL functions.
2. Demonstrate the basic principles in implementing graphical output primitives and their attributes for the given scenario.
3. Implement 2D Transformations and Viewing operations for the given 2D object.
4. Design a 3D object and perform Transformation and Viewing Operations using OpenGL built-in functions.
5. Identify suitable surface detection, lightning and rendering methods for displaying the real world objects.

Text Book:

1. Donald D. Hearn, M. Pauline Baker, Warren Carithers, "Computer Graphics with OpenGL", Fourth Edition, Sixth Impression, 2016.

Reference Books:

1. D. F. Rogers and J. A. Adams, "Mathematical Elements for Computer Graphics", Second Edition, McGraw-Hill, 2013.
2. F. S. Hill Jr., "Computer Graphics using OpenGL", PH, 2007
3. Edward Angel, "Interactive Computer Graphics A Top-Down Approach with OpenGL", Fifth Edition, Addison-Wesley, 2008.
4. Mason Woo, Jackie Neider, Tom Davis, Dave Shreiner , "OpenGL Programming Guide: The Official Guide to Learning OpenGL, Version 1. 2, Open GL Architecture Review Board", First Indian Reprint, Pearson Education, 2000.

Web References:

1. http://www.glprogramming.com/red/
2. http://nehe.gamedev.net/

BoS Chairman

Course Code: 16CSE07	Course Title: MULTIMEDIA SYSTEMS AND APPLICATIONS	
Elective	L: T: P: C	3: 0: 0: 3
Type: Theory	Total Contact Hours:	45

Course Objectives

The course is intended to:

1. Describe the multimedia components, authoring tools and various forms of representing the data.
2. Differentiate the lossless and lossy image compression algorithms.
3. Illustrate the steps involved in video compression techniques.
4. Justify the significance of databases and OO Framework.
5. Demonstrate the components in multimedia application designing.

Unit I - MULTIMEDIA AUTHORING AND DATA REPRESENTATION **8**

Introduction - components of Multimedia - Multimedia and Hypermedia - WWW - Multimedia software tools - Multimedia authoring and Tools - Graphics and Data Representations - Image data types - Popular File formats.

Unit II - MULTIMEDIA DATA COMPRESSION **10**

Memory Concepts – Arithmetic – Decision making - Control Statements – Counter, Sentinel and Nested controlled repetition – Assignment, Increment, Decrement, Logical Operators - Functions – Arrays - Objects.

Unit III - VIDEO COMPRESSION TECHNIQUES **9**

Basic Video compression Techniques - Video compression based on motion compensation - search for motion vectors - H.261 - MPEG Video Coding – MPEG -1 and 2.

Unit IV - MULTIMEDIA DBMS AND PROGRAMMING **9**

Multimedia specific properties of MMDBMS - Data modeling in MMDBMS – Implementation - Abstraction levels - requirement for Programming Languages - Object Oriented Application development - Object Oriented Frameworks and Class Libraries.

Unit V - MULTIMEDIA APPLICATION DESIGN **9**

Design specific properties of Images - Visualization - symbols - Illustrations - Image production techniques - User Interfaces - Multimedia Learning - Applications: Media preparation - Editing - Integration - Transmission – Usage - Electronic Books and Magazines - Kiosks - Tele shopping - Entertainment.

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Course Outcomes

At the end of the course the student will be able to:

1. Describe the multimedia components, authoring tools and various forms of representing the data in multimedia systems.
2. Differentiate the lossless and lossy image compression algorithms using various parameters.
3. Illustrate the steps involved in video compression techniques for the given scenario.
4. Justify the significance of databases and OO Framework in multimedia systems.
5. Demonstrate the components in designing multimedia applications.

Text Books:

1. Ze-Nian Li, Mark S. Drew, "Fundamentals of Multimedia", Pearson Education, 2007.
2. Ralf Steinmetz, KlaraNahrstedt, " Multimedia Applications", Springer, 2007.

Reference Books:

1. John. F. Koegel Buford, "Multimedia Systems", Pearson Education, 2009.
2. TayVaughon, "Multimedia making it works", McGraw-Hill Education, 2011.
3. Ralf Steinmetz and KlaraNahrstedt, "Multimedia: Computing, Communications and Applications", Pearson Education, 2009.

Web References:

1. http://link.springer.com/book/10.1007%2F978-3-662-08878-4
2. http://nptel.ac.in/syllabus/syllabus_pdf/106105035.pdf
3. http://insy.ewi.tudelft.nl/content/image-and-video-compression-learning-tool-vcdemo
4. https://www.w3.org/standards/agents/authoring

BoS Chairman

Course Code: 16CSE08	Course Title: SOFT COMPUTING	
Elective	**L: T: P: C**	3: 0: 0: 3
Type: Theory	Total Contact Hours:	**45**

Prerequisites: The student should have undergone the course(s):
16MAT24 Engineering Mathematics - II

Course Objectives

The course is intended to:

1. Construct feed forward neural networks using supervised learning.
2. Develop neural networks based on associative memory.
3. Build unsupervised learning networks using competitive strategy.
4. Model inference systems using fuzzy rules.
5. Develop genetic algorithms.

Unit I – SUPERVISED LEARNING NETWORKS **10**

Evolution of computing - soft computing constituents - Biological neural networks - Artificial neurons - Applications. Supervised Learning Networks: Activation functions, Learning rules, Perceptron networks, Adaline, Madaline, Back propagation networks.

Unit II - ASSOCIATIVE MEMORY NETWORKS **8**

Associative memories - Autoassociative memory network - Heteroassociative memory network - Bi-directional associative memory - Discrete Hopfield network.

Unit III - UNSUPERVISED LEARNING NETWORKS **8**

Neural network based on competition – Maxnet - Hamming network - Self-Organizing feature maps - Learning vector quantization.

Unit IV - FUZZY SYSTEMS **10**

Classical sets – Fuzzy Sets – Classical relations - Fuzzy relations - Membership Functions - Defuzzification - Fuzzy rules - Fuzzy reasoning - Fuzzy inference systems – Neuro-fuzzy systems.

Unit V - GENETIC ALGORITHMS **9**

Introduction – Traditional optimization and search techniques – Genetic algorithm and search space - Simple genetic algorithm – Operators in genetic algorithm – Solving Travelling Salesman Problem.

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Course Outcomes

At the end of the course the student will be able to:

1. Construct feed forward neural networks using supervised learning for solving classification problems.
2. Develop neural networks based on associative memory for retrieving patterns.
3. Build unsupervised learning networks using competitive strategy for solving clustering problems.
4. Model inference systems using fuzzy rules for solving uncertainty problems.
5. Develop genetic algorithm for solving optimization problems.

Text Book:

1. S.N. Sivanandam, S.N. Deepa, "Principles of Soft Computing", Second Edition, John Wiley & Sons, New Delhi, 2016.

Reference Books:

1. Laurene Fausette, "Fundamentals of Neural Networks: Architectures, Algorithms and Applications", Pearson Education, 2007.
2. Eiji Mizutani, Chuen Tsai Sun, Jyh Shing Roger Jang, "Neuro-Fuzzy and Soft Computing: A Computational Approach to Learning and Machine Intelligence", Pearson Education, 2008.
3. S. N. Sivanandam, S. Sumathi and S. N. Deepa, "Introduction to Fuzzy Logic using MATLAB", Springer, 2007.

Web References:

1. https://onlinecourses.nptel.ac.in/noc18_cs13
2. http://uni-obuda.hu/users/fuller.robert/soft-computing.pdf
3. https://swayam.gov.in/course/4574-introduction-to-soft-computing

BoS Chairman

Course Code: 16CSE09	Course Title: MACHINE LEARNING TECHNIQUES	
Elective	L: T: P: C	3: 0: 0: 3
Type: Theory	Total Contact Hours:	45

Prerequisites: The student should have undergone the course(s):

16CST52 Data Warehousing and Mining
16MAT24 Engineering Mathematics - II

Course Objectives

The course is intended to:

1. Describe various machine learning approaches.
2. Utilize regression and classification algorithms.
3. Develop resampling and model selection methods.
4. Model data classification using support vector machines.
5. Make use of neural network and deep learning algorithms.

Unit I – INTRODUCTION 8

Statistical Learning - Function Estimation - Supervised and Unsupervised learning – Classification and Regression – Assessing model accuracy.

Unit II – REGRESSION AND CLASSIFICATION 10

Simple Linear regression - Multiple linear regression – Qualitative Predictors - Extensions of the Linear Model - Basics of Classification - Logistic regression - Linear discriminant analysis.

Unit III – RESAMPLING AND MODEL SELECTION 9

Resampling: Cross Validation, Bootstrapping – Linear Model Selection: Subset Selection, Shrinkage methods, Dimension Reduction methods – High Dimensional data.

Unit IV - SUPPORT VECTOR MACHINES 9

Maximal margin classifier - Support vector classifiers - Support Vector Machines (SVM) - SVMs with more than two classes - Relationship to logistic regression.

Unit V - NEURAL NETWORKS AND DEEP LEARNING 9

Basics of neural networks – Perceptron network – Back propagation networks (BPN) – Deep Networks: Architectural Principles, Building blocks - Convolutional neural networks (CNNs) - Recurrent network.

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Course Outcomes

At the end of the course the student will be able to:

1. Describe various machine learning approaches used in solving complex problems.
2. Utilize regression and classification algorithms for data modelling and prediction.
3. Develop resampling and model selection methods to construct optimal models for high-dimensional data spaces.
4. Model data classification using support vector machines for solving multi-class problems.
5. Make use of neural network and deep learning algorithms for classification and prediction.

Text Books:

1. James G, Witten D, Hastie T and Tibshirani R, "An Introduction to Statistical Learning with Applications in R", Springer, 2013.
2. Josh Patterson and Adam Gibson, "Deep Learning: A Practitioner's Approach", First Edition, O'Reilly, 2017.

Reference Books:

1. S.N. Sivanandam, S.N. Deepa, "Principles of Soft Computing", Second Edition, John Wiley & Sons, New Delhi, 2016.
2. Christopher M. Bishop, "Pattern Recognition and Machine Learning", Springer Verlag, 2011.
3. Alpaydin Ethem, "Introduction to Machine Learning", Second Edition, MIT Press, 2014.

Web References:

1. https://onlinecourses.nptel.ac.in/noc17_cs26
2. http://www.ics.uci.edu/~mlearn/MLRepository.html
3. https://www.kaggle.com/kanncaa1/machine-learning-tutorial-for-beginners

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Course Code: 16CSE10	Course Title: INFORMATION RETRIEVAL TECHNIQUES	
Elective	L: T: P: C	3: 0: 0: 3
Type: Theory	Total Contact Hours:	45

Course Objectives

The course is intended to:

1. Describe the architecture of a Search Engine.
2. Perform Web crawling and apply text processing operations.
3. Explain the stages involved in Query processing.
4. Evaluate the efficiency of various IR models.
5. Develop Community search, Filtering and Recommendation solutions.

Unit I - SEARCH ENGINE AND INFORMATION RETRIEVAL **7**

Search engine and information retrieval, Search Engine Architecture- Building Blocks: Text Acquisition, Text Transformation, Index Creation, User Interaction, Ranking, Evaluation

Unit II - CRAWLING AND TEXT PROCESSING **10**

Web Crawler-Focused Crawling-Distributed Crawling-Document Feeds-Conversion and storage- Document Parsing: Tokenizing, Stop Word Elimination, Stemming-Document Structure and Mark up-Link Analysis: PageRank, Link Quality-Information Extraction

Unit III - QUERY PROCESSING **9**

Model of Ranking-Inverted Indexes-Compression-Index Construction-Query processing-Query Transformation and Refinement: Query Expansion, Relevance Feedback-Search Interfaces: Result Pages and Snippets, Clustering the Results

Unit IV - INFORMATION RETRIEVAL MODELS **10**

Boolean Retrieval-Vector Space Model-Probabilistic Models-Ranking based on Language Models-Complex Queries and combining Evidence-Search Engine Evaluation: Effectiveness Metrics, Efficiency Metrics

Unit V - APPLICATIONS **9**

Social Search-User Tags and Manual Indexing-Community Search: Finding Communities, Community-Based Question Answering, Collaborative Searching-Filtering and Recommending: Document Filtering, Collaborative Filtering

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Course Outcomes

At the end of the course the student will be able to:

1. Describe the architecture of a Search Engine with an emphasis on the role of each component.
2. Perform Web crawling and apply text processing operations for building an Information store.
3. Explain the stages involved in Query processing for efficient Information retrieval.
4. Evaluate the efficiency of various IR models by using suitable metrics.
5. Develop Community search, Filtering and Recommendation solutions for real world applications.

Text Book:

1. Bruce Croft, Donald Metzler, Trevor Strohman, "Search Engines: Information Retrieval in Practice", Pearson Education, 2011.

Reference Books:

1. Christopher D. Manning and Prabhakar Raghavan, "Introduction to Information Retrieval", Cambridge University Press, 2008.
2. Ricardo Baeza-Yates, Berthier Ribeiro-Neto, "Modern Information Retrieval", Second Edition, Pearson Education, 2011.

Web References:

1. Search Engines: Information Retrieval in Practice
   URL: https://ciir.cs.umass.edu/irbook/
2. Introduction to Information Retrieval URL: http://nlp.stanford.edu/IR-book /html / htmledition/ irbook.html
3. Modern Information Retrieval URL: http://www.mir2ed.org/

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Course Code: 16CSE11	**Course Title:** SOCIAL NETWORK ANALYTICS	
Elective	**L: T: P: C**	3: 0: 0: 3
Type: Theory	Total Contact Hours:	**45**

Prerequisites: The student should have undergone the course(s):
16CST52 – Data Warehousing and Mining

Course Objectives

The course is intended to:

1. Describe the mining features and measures.
2. Design network models and data mining algorithms.
3. Illustrate community mining and interactions.
4. Implement social mining algorithms.
5. Analyze social media.

Unit I - ESSENTIALS **8**

Social Media Mining – Challenges – Graph Essentials – Special Graphs – Graph Algorithms – Network Measures – Centrality – Transitivity and Reciprocity – Similarity.

Unit II - MODELS AND MINING **8**

Network Models – Properties of Real-World Networks – Random Graphs – Small-World Model – Preferential Attachment Model – Social Data Mining Process.

Unit III - COMMUNITIES AND INTERACTIONS **9**

Community Analysis – Community Detection – Evolution – Evaluation – Information Diffusion in Social Media – Herd Behavior – Information Cascades – Diffusion of Innovations – Epidemics.

Unit IV - APPLICATIONS **10**

Influence and Homophily – Recommendation in Social Media – Classical Recommendation Algorithms – Recommendation Using Social Context – Evaluating Recommendations – Behavior Analytics – Individual Behavior – Collective Behavior.

Unit V - MINING SOCIAL WEB **10**

Mining Twitter – Exploring Twitter – Analyzing and Examining Tweets – Mining Facebook – Exploring social graph – Analyzing graph connections – Mining Google+ – Computing Document Similarity – Querying human language data.

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Course Outcomes

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

1. Describe the mining features and measures for social media analysis.
2. Design network models and data mining algorithms for social networks.
3. Illustrate community mining and interactions in social media.
4. Implement social mining algorithms using real time applications.
5. Analyze social media using data mining algorithms and evaluation metrics.

Text Books:

1. Reza Zafarani, Mohammad Ali Abbasi, Huan Liu, "Social Media Mining: An Introduction", Cambridge University Press, First Edition, 2014.
2. Matthew A. Russell, "Mining the Social Web", Second Edition, O'Reilly Media Inc., 2013.

Reference Books:

1. Peter Mika, "Social Networks and the Semantic Web", Springer Science, 2007.
2. Maksim Tsvetovat and Alexander Kouznetsov, "Social Network Analysis for Startups", O'Reilly Media Inc., 2011.
3. Charu. C.Aggarwal, "Social Network Data Analytics", Springer, 2011.

Web References:

1. NPTEL – Social Networks course. URL: http://nptel.ac.in/courses/106106169/
2. MIT Open Courseware. URL: https://ocw.mit.edu/courses/media-arts-and-sciences/mas-961-networks-complexity-and-its-applications-spring-2011/index.htm

BoS Chairman

Course Code: 16CSE12	Course Title: ADVANCED COMPUTER ARCHITECTURE	
Elective	L: T: P: C	3: 0: 0: 3
Type: Theory	Total Contact Hours:	45

Prerequisites: The student should have undergone the course(s):
16CST42 Computer Architecture

Course Objectives

The course is intended to:

1. Describe the design principles of Computer architecture
2. Apply virtual memory and cache concepts for optimization and protection
3. Use the pipelining concepts
4. Demonstrate Data level parallelism
5. Illustrate the principles of thread level parallelism

Unit I – FUNDAMENTALS OF COMPUTER DESIGN 9

Classes of Computers – Computer Architecture – Trends – Dependability – Measuring, Reporting, and Summarizing Performance – Quantitative Principles of Computer Design – Instruction Set Principles and Examples – Classifying Instruction Set Architectures – Memory Addressing.

Unit II - MEMORY HIERARCHY DESIGN 9

Introduction – Advanced Optimizations of Cache Performance – Memory Technology and Optimizations – Protection: Virtual Memory and Virtual Machines – The Design of Memory Hierarchies.

Unit III - INSTRUCTION-LEVEL PARALLELISM 9

Pipelining Concepts – Pipeline Hazards – Implementation of Pipelining – ILP : Concepts and Challenges – Basic Compiler Techniques for Exposing ILP – Advanced branch Prediction – Dynamic Scheduling – Hardware-Based Speculation – Exploiting ILP – Advanced Techniques for Instruction Delivery and Speculation – Limitations of ILP.

Unit IV - DATA-LEVELPARALLELISM 9

Vector Architecture – SIMD Instruction Set Extensions for Multimedia – Graphics Processing Units –Detecting and Enhancing Loop-level parallelism – Warehouse Scale Computers: Programming Models, Workloads and Architecture – Physical Infrastructure and costs.

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Unit V - THREAD-LEVEL PARALLELISM 9

Centralized Shared Memory Architectures – Performance of Symmetric Shared Memory Multiprocessors – Distributed Shared Memory and Directory Based Coherence – Synchronization.

Course Outcomes

At the end of the course the student will be able to:

1. Describe the design principles of Computer architecture for Instruction set classification.
2. Apply virtual memory and cache concepts for optimization and protection of Memory Hierarchy.
3. Use the pipelining concepts for solving Instruction level parallelism.
4. Demonstrate Data level parallelism with programming models.
5. Illustrate the principles of thread level parallelism with memory based architectures.

Text Book:

1. John L. Hennessey and David A. Patterson, "Computer Architecture – A Quantitative Approach", Fifth Edition, Morgan Kaufmann, 2012.

Reference Books:

1. Kai Hwang, Naresh Jotwani, "Advanced Computer Architecture", Second Edition, Tata McGraw-Hill, 2010.
2. Richard Y. Kain, "Advanced Computer Architecture - A Systems Design Approach", Prentice Hall, 2011.

Web References:

1. Book URL: https://users.dimi.uniud.it/~antonio.dangelo/OpSys/materials/Computer_Architecture.pdf
2. NPTEL Course Content URL: http://www.nptel.ac.in/courses/106102062/
3. Computer Organization Notes URL: http://www.cse.iitk.ac.in/users/karkare/courses/2011/cs220/html/notes.html

BoS Chairman

Course Code: 16CSE13	Course Title: COMPILER DESIGN	
Elective	L: T: P: C	3: 0: 0: 3
Type: Theory	Total Contact Hours:	45

Prerequisites: The student should have undergone the course(s):

16CST53 Formal Language and Automata Theory

Course Objectives

The course is intended to:

1. Explain the building blocks of System software.
2. Describe the phases of a compiler and the role of Lexical analyzer.
3. Design and implement different types of parsers.
4. Generate intermediate code for the given source code.
5. Produce efficient target code.

Unit I - SYSTEM SOFTWARE 9

System Software - Basic assembler functions - Program relocation - Literals – Symbol-defining statements – Expressions - One pass assemblers and Multi pass assemblers - Basic loader functions - Design of an Absolute Loader - Relocation – Program Linking - Basic macro processor functions - Macro Definition and Expansion.

Unit II - COMPILER PHASES AND LEXICAL ANALYSIS 9

Compilers –Phases of a compiler - Analysis of the source program – Grouping of Phases – Compiler construction tools.
Lexical Analysis– Role of Lexical Analyzer – Input Buffering – Specification of Tokens- Recognition of Tokens - LEX -Implementation of lexical analyzer using LEX

Unit III - SYNTAX ANALYSIS 10

The role of a parser – Context free grammar – Top down Parsing – Bottom up parsing – LR parsers – Construction of a simple SLR, CLR and LALR parsing table - YACC

Unit IV - INTERMEDIATE CODE GENERATION 8

Intermediate languages – Declarations – Assignment statements – Boolean expressions – Case statements – Back patching – Procedure calls.

Unit V - CODE GENERATION AND OPTIMIZATION 9

Code Generation: Issues in the design of code generator – The target machine – Runtime Storage management – Basic Blocks and Flow Graphs - DAG representation of basic blocks – Generating code from DAGS – A simple code generator.

Code Optimization: Principal Sources of Optimization – Optimization of basic Blocks – Peephole Optimization - Loops in flow graphs.

BoS Chairman

Course Outcomes

At the end of the course the student will be able to:

1. Explain the building blocks of System software involved in program translation and execution.
2. Describe the phases of a compiler and the role of Lexical analyzer in program compilation.
3. Design and implement different types of parsers for syntax analysis.
4. Generate intermediate code for the given source code using Syntax Directed Translation and Back Patching.
5. Produce efficient target code using code generation and optimization techniques.

Text Books:

1. Leland L. Beck, "System Software – An Introduction to Systems Programming", Third Edition, Addison-Wesley, 2007.
2. Alfred V. Aho, Monica S.Lam, Ravi Sethi, Jeffrey D. Ullman, "Compilers Principles, Techniques, and Tools", Second Edition, Pearson Education, 2014.

Reference Books:

1. D. M. Dhamdhere, "Systems Programming and Operating Systems", Second Edition, Tata McGraw-Hill, 2000.
2. Steven S. Muchnick, "Advanced Compiler Design & Implementation", Morgan Kaufmann Publishers, 2000.
3. C. N. Fisher and R. J. LeBlanc, "Crafting a Compiler with C", Pearson Education, 2000.

Web References:

1. Introduction to Machine Independent Optimization URL: http://nptel.ac.in/courses/106108052/17
2. Static Single Assignment Form URL: http://nptel.ac.in/courses/106108052/31.
3. Compiler Design Course Material URL: https://www.cs.cmu.edu/~fp/courses/15411-f08/

BoS Chairman

Course Code: 16CSE14	Course Title: SOFTWARE DEFINED NETWORKS	
Elective	L: T: P: C	3: 0: 0: 3
Type: Theory	Total Contact Hours:	45

Prerequisites: The student should have undergone the course(s):

16CST51 Computer networks

Course Objectives

The course is intended to:

1. Explain the evolution of software defined networking.
2. Utilize the concepts of open flow and SDN controllers to provide services.
3. Identify SDN Solutions for data centers.
4. Build the SDN Frameworks to model and deploy services.
5. Describe SDN applications using open SDN controllers.

Unit I - INTRODUCTION **10**

History of Software Defined Networking (SDN) – Modern Data Center – Traditional Switch Architecture – Purpose of SDN – Evolution of SDN – Working of SDN – Centralized and Distributed Control and Data Planes.

Unit II - OPEN FLOW & SDN CONTROLLERS **9**

Open Flow Specification – Drawbacks of Open SDN - SDN via APIs - SDN via Hypervisor Based Overlays – SDN via Networking Device – SDN Controllers : General Concepts.

Unit III - DATA CENTERS **9**

Multitenant and Virtualized Multitenant Data Center – SDN Solutions for the Data Center Network – VLANs – EVPN – VxLAN – NVGRE.

Unit IV - SDN FRAMEWORK **9**

SDN Frameworks – Open Daylight Controller – Floodlight Controller – Bandwidth Calendaring – Data Center Orchestration.

Unit V - SDN APPLICATIONS AND OPEN SOURCE **8**

SDN in Other Environments – SDN Applications- SDN Open Source: Open Source Environment, OpenFlow Source Code, Network Virtualization, Simulation, Testing, and Tools, Open Source Cloud Software.

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Course Outcomes

At the end of the course the student will be able to:

1. Explain the evolution of software defined networking for understanding network programmability.
2. Utilize the concepts of open flow and SDN controllers to provide services for realizing a distributed control plane
3. Identify SDN Solutions for data centers using a different kind of SDN Controllers
4. Build the SDN Frameworks to model and deploy services for ensuring syntactic and semantic correctness,
5. Describe SDN applications using open SDN controllers for different environments

Text Books:

1. Thomas D. Nadeau, Ken Gray, "SDN: Software Defined Networks", First edition O'Reilly Media, 2013.
2. Paul Goransson and Chuck Black, "Software Defined Networks: A Comprehensive Approach", First Edition, Morgan Kaufmann, 2014.

Reference Books:

1. SiamakAzodolmolky, "Software Defined Networking with Open Flow", First edition Packet Publishing, 2013.
2. VivekTiwari,"SDN and Open Flow for Beginner", Amazon Digital Services, Inc., 2013.
3. Fei Hu, "Network Innovation through Open Flow and SDN: Principles and Design", CRC Press, 2014.

Web References:

1. https://www.udemy.com/sdn-openflow-nfv-introduction/
2. http://www.cs.fsu.edu/~xyuan/cis5930/index.html
3. https://www.coursera.org/learn/sdn

BoS Chairman

Course Code: 16CSE15	Course Title: DISTRIBUTED COMPUTING	
Elective	**L: T: P: C**	3: 0: 0: 3
Type: Theory	Total Contact Hours:	**45**

Prerequisites: The student should have undergone the course(s):

16CST31 Operating Systems
16CST51 Computer Networks

Course Objectives

The course is intended to:

1. Describe the issues involved in designing an operating system.
2. Explain the various communication techniques used for information exchange.
3. Solve the synchronization issues using different algorithms.
4. Use process allocation and scheduling mechanism to resolve process management issues.
5. Interpret the various components of file system in distributed systems.

UNIT I - INTRODUCTION **9**

Introduction - Goals – Evolution of Distributed Computing Systems - Hardware Concepts - Software concepts - Design issues.

UNIT II - COMMUNICATION OF DISTRIBUTED SYSTEMS **9**

ATM Networks - Client server model - Remote Procedure calls: Dynamic binding and Implementation issues - Group Communication.

UNIT III - SYNCHRONIZATION IN DISTRIBUTED SYSTEMS **9**

Clock synchronization - Mutual exclusion - Election algorithms - Atomic transactions: Transaction model, Implementation and Concurrency control – Deadlocks in distributed systems.

UNIT IV - PROCESSES AND PROCESSORS IN DISTRIBUTED SYSTEMS **9**

Threads - System models - Processor allocation: Design & implementation issues, Processor allocation algorithms and Scheduling Fault tolerance.

UNIT V - DISTRIBUTED FILE SYSTEMS **9**

Distributed File Systems Design - DFS Implementation: System structure, Caching, Replication - DFS Trends – CASE STUDY: Introduction to amoeba.

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Course Outcomes

At the end of the course the student will be able to:

1. Describe the issues involved in designing an operating system for distributed system.
2. Explain the various communication techniques used for information exchange using remote procedure call mechanism.
3. Solve the synchronization issues using different algorithms in distributed system.
4. Use process allocation and scheduling mechanism to resolve process management issues distributed environment.
5. Interpret the various components of file system in distributed systems using case studies.

Text Books:

1. Andrew S Tanenbaum, "Distributed Operating Systems", Fifth Edition, Pearson Education,2008.
2. Mukesh Singal Niranjan G Shivrartri, "Advanced Concepts in Operating Systems", McGraw-Hill, 2001.

Reference Books:

1. Pradeep K Sinha, "Distributed Operating System: Concepts and Design", Wiley Publications, 1996.
2. Georde Coulouris, Jean Dollimore, Tim Kindberg, "Distributed Systems Concepts and Design", Fourth Edition,, Pearson Education, 2009.
3. Andrew S. Tanenbaum, Maarten van Steen, "Distributed Systems: Principles and Paradigms", Prentice Hall, 2002.

Web References:

1. http://www.e-reading.link/book.php?book=143358.
2. https://www.coursera.org/learn/distributed-programming-in-java.
3. https://disco.ethz.ch/courses/podc_allstars/lecture/podc.pdf.

BoS Chairman

Course Code: 16CSE16	Course Title: NETWORK AND INTERNET SECURITY	
Elective	L: T: P: C	3: 0: 0: 3
Type: Theory	Total Contact Hours:	45

Prerequisites: The student should have undergone the course(s):

16CST51 Computer Networks
16CST72 Cryptographic Techniques

Course Objectives

The course is intended to:

1. Describe intrusion detection techniques and firewalls.
2. Make use of IP security and Web security protocols.
3. Identify suitable e-mail security protocols.
4. Utilize wireless security protocols.
5. Identify security services in cloud environment.

Unit I – NETWORK SECURITY 8

Threats in networks - Network security controls – Intruders - Intrusion detection - Password management - Malicious software - Firewalls: Characteristics – Types - Firewall basing - Firewall location and configurations.

Unit II - IP AND WEB SECURITY 10

IP security: IP security policy, Encapsulating Security Payload - Web security: Secure Socket Layer, Transport Layer Security – HTTPS - Secure Shell (SSH).

Unit III - ELECTRONIC MAIL SECURITY 9

Store and forward, Security services, Source authentication, Message integrity, Non-Repudiation, Proof of submission and delivery, Pretty Good Privacy (PGP), Secure/Multipurpose Internet Mail Extension (S/MIME).

Unit IV - WIRELESS NETWORK SECURITY 9

IEEE 802.11 wireless LAN overview - IEEE 802.11i wireless LAN security - Wireless Application Protocol - Wireless Transport Layer Security - WAP end-to-end security.

Unit V - CLOUD COMPUTNG SECURITY 9

Cloud Information Security Objectives, Cloud Security Services, Cloud Security Design Principles - Penetration Testing Tools and Techniques - Cloud Computing Risk Issues: CIA Triad, Privacy and Compliance Risks, Threats to Infrastructure, Data, and Access Control, Cloud Service Provider Risks.

BoS Chairman

Course Outcomes

At the end of the course the student will be able to:

1. Describe intrusion detection techniques and firewalls for preventing security attacks.
2. Make use of IP security and Web security protocols for providing data security services.
3. Identify suitable security protocols for securing e-mail services.
4. Utilize wireless security protocols for protecting data in wireless environment.
5. Identify security services in cloud environment for secure data sharing.

Text Books:

1. William Stallings, "Cryptography and Network Security – Principles and Practice", Fifth Edition, Pearson Education, 2013.
2. Ronald L Krutz and Russell Dean Vines, "Cloud Security- A Comprehensive Guide to Secure Cloud Computing", Wiley, 2016.

Reference Books:

1. Bernard Menezes, "Network Security and Cryptography", Cengage Learning, 2014.
2. Chalie Kaufman, Radia Perlman, Mike Speciner, "Network Security: Private Communication in a Public World", Pearson Education, 2007
3. Bruce Schneier, "Applied Cryptography: Protocols, Algorithms and Source Code in C", John Wiley and Sons, 2013.

Web References:

1. http://nptel.ac.in/courses/106105162/
2. https://www.tutorialspoint.com/internet_security/index.htm
3. https://training.apnic.net/wp-content/uploads/sites/2/2016/12/TSEC01.pdf

BoS Chairman

Course Code: 16CSE17	Course Title: AD-HOC & SENSOR NETWORKS	
Elective	L: T: P: C	3: 0: 0: 3
Type: Theory	Total Contact Hours:	45

Prerequisites: The student should have undergone the course(s):

16CST51 Computer Networks

Course Objectives

The course is intended to:

1. Differentiate the characteristics of various routing protocols.
2. Describe the functionalities of MAC and TCP.
3. Illustrate the working of sensor network.
4. Compare the functionalities of routing algorithms.
5. Use the best solutions for security issues.

Unit I - ROUTING IN ADHOC NETWORKS 9

Mobile Adhoc Networks – Challenges in MANET – Routing: Topology and Position based – QoS Routing – Broadcast Strom – Multicasting and Geo-casting.

Unit II - ACCESS CONTROL 9

IEEE802.11: Medium Access control protocols – Enhancement in MAC – Wireless PANS – Enhancement to Bluetooth – Cognitive Radio and Networks – TCP over Adhoc Networks.

Unit III - SENSOR NETWORKS 9

Sensor Networks – Applications – Design Considerations – Issues – Clustering of nodes – MAC layer – Self Organizing for WSN.

Unit IV - ROUTING IN WSN 9

Routing Layer – Flat and Hierarchical Routing – Operation and Location based Routing – High level Application layer support – Sensor Networks in Controlled Environment and Actuators.

Unit V - SECURITY 9

Security in Adhoc and sensor networks – Key Management – Secure Routing – WSN Security – Intrusion Detection Systems – Integrating MANETs, WLANs and Cellular Networks.

BoS Chairman

Course Outcomes

At the end of the course the student will be able to:

1. Differentiate the characteristics of various routing protocols in Adhoc Networks.
2. Describe medium access control and TCP functionalities over Adhoc Networks.
3. Illustrate the working of sensor network with real time applications.
4. Compare the functionalities of routing algorithms in Sensor networks.
5. Use appropriate solutions for security issues in Wireless Sensor Networks.

Text Book:

1. Carlos De Morais Cordeiro, Dharma Prakash Agrawal, "Ad Hoc & Sensor Networks: Theory and Applications", World Scientific Publishing Company, 2011.

Reference Books:

1. C.Siva Ram Murthy, B.S.Manoj, "Ad Hoc Wireless Networks: Architectures and Protocols", Prentice Hall Professional Technical Reference, 2008.
2. Feng Zhao, Leonides Guibas, "Wireless Sensor Networks", Elsevier Publication, 2002.
3. Holger Karl, Andreas Willig, "Protocols and Architectures for Wireless Sensor Networks", Wiley, 2005.
4. Kazem Sohraby, Daniel Minoli, TaiebZnati, "Wireless Sensor Networks-Technology, Protocols and Applications", John Wiley, 2007.

Web References:

1. NPTEL Course Content. URL: http://nptel.ac.in/courses/108102045/27
2. Libelium Learning. URL: http://www.libelium.com/video-wsn-introduction/
3. Radio Electronic Notes. URL: http://www.radio-electronics.com/info/wireless/wi-fi/ieee-802-11-standards-tutorial.php

BoS Chairman

Course Code: 16CSE18	Course Title: HIGH SPEED NETWORKS	
Elective	L: T: P: C	3: 0: 0: 3
Type: Theory	Total Contact Hours:	45

Prerequisites: The student should have undergone the course(s):

16CST51 Computer Networks

Course Objectives

The course is intended to:

1. Characterize various congestion control techniques.
2. Illustrate the architecture and operational concepts in high speed networks.
3. Describe the technical aspects of mobile technologies.
4. Explain the functionalities of various advanced WLANs and interconnectivity.
5. Describe recent technologies of high speed wireless networks.

Unit I - NETWORK TECHNOLOGIES 9

Frame relay – ATM – Protocol Architecture – Logical Connection – ATM Cells – ATM Adaptation layer – TCP Traffic Control: Flow Control – TCP Congestion Control – Performance of TCP over ATM – Traffic and congestion control in ATM.

Unit II - LTE AND LTE ADVANCED 9

LTE Architecture and Protocols – Control and User plane – Radio resource management – Authentication and Authorization – MAC layer and physical layer – HetNet – Small cell concepts – Femtocell and Picocell architecture – Heterogeneous networks.

Unit III - 5G AND SMALL CELL 9

LTE advanced to 5G – D2D communication – LTE – WiFi integration – 5G Characteristics – LTE Femtocell deployment – Access control strategy – Challenges and Technical issues, Security and privacy challenges – Mobility, The backhaul network – Cognitive radio.

Unit IV - WIRELESS STANDARDS 9

Wireless PAN – IEEE 802.15 – Bluetooth – UWB – WiGig – Advanced Standards: IEEE802.11a, b and g – WiMax: IEEE 802.16e – IEEE 802.16m and h standards – WRAN and Interconnection.

Unit V - APPLICATIONS 9

Adhoc Networks – Routing – Quality of service in adhoc networks – Mesh network and VANET – Wearable D2D networks – Network virtualization – Mobile Edge Computing.

BoS Chairman

Course Outcomes

At the end of the course the student will be able to:

1. Characterize various congestion control techniques in TCP and ATM networks.
2. Illustrate the architecture and operational concepts of Long Term Evolution and Advanced-LTE standards.
3. Describe the technical aspects of 5G and small cell technologies.
4. Explain the functionalities of various advanced Wireless LAN standards and their interconnectivity.
5. Describe recent technologies of high speed wireless networks used in real time applications.

Text Books:

1. William Stallings, "High Speed Networks and Internets – Performance and Quality of Service", Second Edition, Pearson Education, 2010.
2. Khaldoun Al Agha, Guy Pujolle, Tara Ali-Yahiya, "Mobile and Wireless Networks", John Wiley & Sons, 2016.

Reference Books:

1. Kwang-Cheng Chen, Ramjee Prasad, "Cognitive Radio Networks", Wiley Publications, 2009.
2. James P. G. Sterbenz, Joseph D. Touch, "High Speed Networking – A Systematic Approach to High-Bandwidth Low-Latency Communication", John Wiley Publications, 2002.
3. Benny Bing, "High Speed Wireless ATM and LANs", Artech House Publications, 2000.

Web References:

1. William Stallings, Technical Resources and Course Web Site for High-Speed Networks and Internet. URL: http://www.williamstallings.com/HsNet2e.html
2. Classle Learning – High speed Networks-problems and solutions. URL: https://www.classle.net/content-page/high-speed-networks-problems-n-solutions
3. Johns Hopkins University, High-Speed Networking Technologies. URL: https://ep.jhu.edu/programs-and-courses/605.473-high-speed-networking-technologies

BoS Chairman

Course Code: 16CSE19	Course Title: SOFTWARE QUALITY ASSURANCE AND TESTING	
Elective	**L: T: P: C**	3: 0: 0: 3
Type: Theory	Total Contact Hours:	**45**

Course Objectives

The course is intended to:

1. Explain various models and approaches involved in Quality Control.
2. Describe quality related activities to ensure software quality.
3. Identify the appropriate software testing strategies for designing test case.
4. Choose a suitable type of software testing at the appropriate stage.
5. Perform various testing activities to enhance the performance.

Unit I - SOFTWARE QUALITY AND CONTROL **9**

Software Quality – Views of Quality-Hierarchical models of Boehm and McCall – Measuring Quality – Software Metrics – Metrics cited in the literature – Gilb's Approach – CASE Tools – Quality Management System – Element of a QMS.

Unit II - SOFTWARE QUALITY ASSURANCE **9**

Software Quality Assurance – Components of SQA System – Reviews – Supporting Quality Devices – Documentation Control – SQA Unit and other actors in the SQA system.

Unit III - TESTING STRATEGIES FOR TEST CASE DESIGN **10**

Introduction to Testing Design Strategies – Black Box Approach: Random Testing, Equivalence Class Partitioning, Boundary Value Analysis, Cause-and-Effect Graphing, State Transition Testing – White Box Approach: Test Adequacy Criteria, Coverage and Control Flow Graphs, Covering Code Logic, Data Flow and White Box Test Design, Loop Testing, Mutation Testing.

Unit IV - LEVELS OF TESTING **9**

Need for Levels of Testing – Unit Test – Integration Test – System Test: Functional Testing, Performance Testing, Stress Testing, Configuration Testing, Security Testing, Recovery Testing – Regression Testing: Alpha, Beta, and Acceptance Tests.

Unit V - TEST PLANNING, DOCUMENTATION & ORGANIZATION **8**

Test Plan – Components – Attachments – Locating Test Items – Reporting Test Results – Three Critical Groups in test planning and policy development – Building a Testing Group – Structure of the Test Group – Integrating Testing Activities into the Software Life Cycle.

BoS Chairman

Course Outcomes

At the end of the course the student will be able to:

1. Explain various models and approaches involved in Quality Control for measuring software quality.
2. Describe quality related activities to ensure software quality in any software related process.
3. Identify the appropriate software testing strategies for designing test case for any given problem.
4. Choose a suitable type of software testing at appropriate stage for any given application.
5. Perform various testing activities to enhance the performance of any given system.

Text Books:

1. Alan Gilles, "Software Quality: Theory and Management", 3rd Edition, Thomson Computer Press, 2011 (Unit: I)
2. Daniel Galin, "Software Quality Assurance - From theory to implementation", Pearson Education, 2016 (Unit: II)
3. Ilene Burnstein, "Practical Software Testing - A Process Oriented Approach", Springer, 2010(Unit: III - V)

Reference Books:

1. Srinivasan Desikan, Gopalaswamy Ramesh, "Software Testing: Principles and Practice", Pearson Education, 2008
2. Aditya P.Mathur, "Foundations of Software Testing", Second Edition, Pearson Education, 2013
3. Renu Rajani, Pradeep Oak, "Software Testing – Effective Methods, Tools and Techniques", Second Edition, Tata McGraw Hill, 2017.

Web References:

1. NPTEL Course Content URL: http://nptel.ac.in/courses/106101061/18
2. Tutorials point Course Content URL: https://www.tutorialspoint.com/software_testing/index.htm

BoS Chairman

Course Code: 16CSE20	Course Title: SOFTWARE PROJECT MANAGEMENT	
Elective	L: T: P: C	3; 0: 0: 3
Type: Theory	Total Contact Hours:	45

Course Objectives

The course is intended to:

1. Describe the activities of Project Management.
2. Choose the appropriate process model.
3. Estimate the software development effort.
4. Evaluate the overall duration of the project.
5. Devise a work plan, schedule, visualize and assess the state of a project.

Unit I - PROJECT EVALUATION AND MANAGEMENT 9

Importance of Software Project Management – Types of Project – Contract and Technical Project Management – Activities – Plans, Methods and Methodologies- Categorizing Software Projects – Stakeholders – Setting Objectives- Project Success and Failure –Management Control –Portfolio Management – Evaluation Techniques – Risk Evaluation – Programme Management.

Unit II - PROJECT PLANNING AND SELECTION OF APPROACHES 9

Stepwise Project Planning–Build or Buy- Choosing Methodologies and Technologies – Software Process and Models – Prototyping – Categorizing Prototypes – Incremental Delivery – Atern/Dynamic System Development –RAD – Agile Methods – Extreme Programming(XP) - SCRUM – Managing Iterative Process – Selecting Appropriate Process Model.

Unit III - SOFTWARE EFFORT ESTIMATION 9

Estimation – Problems in Estimation – Basis for Estimation – Software Effort Estimation Techniques – Bottom Up Estimating – Top Down Approach and Parametric Models – Expert Judgment – Estimating by Analogy – Albercht Function Point Analysis – Function Points Mark II – COSMIC Full Function Points –Parametric Productivity Model – Capers Jones Estimating Rules Of Thumb.

Unit IV - ACTIVITY PLANNING AND RISK MANAGEMENT 9

Objectives of Activity Planning– Project Schedules – Project and Activities - Sequencing and Scheduling Activities – Network Planning Model – Forward Pass – The Backward Pass – Activity Float – Project Duration – Critical Activities – Activity on Arrow Networks - Risk – Categories of Risk – Identification – Assessment – Planning – Management – Evaluating Risk – Applying PERT – Monte Carlo Simulation –Critical Chain Concepts.

BoS Chairman

Unit V - RESOURCE ALLOCATION, MONITORING AND CONTROL **9**

Identifying Resource Requirements – Scheduling Resources – Creating Critical Paths – Counting the Cost – Publishing Resource Schedule – Cost Schedules – Scheduling Sequence – Creating Framework – Collecting Data – Visualizing Progress – Cost Monitoring – Earned Value Analysis–Managing Contracts- Types of Contract-Stages in Contract Placement-Contract Management-Acceptance.

Course Outcomes

At the end of the course the student will be able to:

1. Describe the activities of Project Management by classifying projects.
2. Choose the appropriate process model for a project.
3. Estimate the software development effort using various models.
4. Evaluate the overall duration of the project by categorizing and prioritizing risks.
5. Devise a work plan, schedule, visualize and assess the state of a project using resource allocation.

Text Book:

1. Bob Hughes, Mike Cotterell, Rajib Mall, "Software Project Management", Fifth Edition, Tata McGraw Hill Publishers, 2014.

Reference Books:

1. Gopalswamy Ramesh, "Managing Global Software Projects", Tata McGraw Hill Publishers, 2007
2. Watts S Humphery, "Managing Software Process", Addison–Wesley Pearson Education, 2010.
3. Walker Royce, "Software Project Management, A Unified framework", Pearson Education, 2006.

Web References:

1. Project Management URL http://www.inf.ed.ac.uk/teaching/courses/seoc/2006_2007/notes/LectureNote07_ProjectManagement.pdf
2. Software Project Management URL: https://www.classle.net/#!/classle/large-content/software-project-managment-lecture-slides/
3. Project Risk Management URL: http://nptel.ac.in/courses/106101061/38/

BoS Chairman

Course Code: 16CSE21	Course Title: AGILE SOFTWARE DEVELOPMENT	
Elective	L: T: P: C	3: 0: 0: 3
Type: Theory	Total Contact Hours:	45

Course Objectives

The course is intended to:

1. Describe the various activities involved in the agile software development process.
2. Illustrate the benefits of Scrum.
3. Explain the different kinds of roles and practices followed in Scrum framework.
4. Analyze the responsibilities and performances of Scrum team structures.
5. Illustrate the User stories in agile software development.

Unit I - AGILE DEVELOPMENT **9**

Agility – Cost of Change – Agile Process – Principles and Human Factors – Extreme Programming (XP): Values, XP Process, and Industrial XP – Agile Process Models: Adaptive Software Development (ASD) – Scrum – DSDM – Crystal – Feature Driven Development – LSD – Agile Modeling – Agile Unified Process.

Unit II - SCRUM OVERVIEW **9**

Advantages of Agile Development: Higher Productivity, Lower Costs, Faster Time to Market, Higher Quality – Introduction to Scrum – Adapting to Scrum – Awareness – Desire – Ability – Promotion – Transfer – Integrating all Together - Patterns for adopting Scrum.

Unit III - SCRUM PRACTICES AND ROLES **10**

Individual Roles – Scrum Master – Product Owner – Changed Roles: Analysts, Project Managers, Architects, Functional Managers, Programmers, DB Administrators, Testers, User Experience Designers - Technical Practices – Strive for Excellence - Test-driven development – Refactoring – Collective Ownership – Continuous Integration – Pair Programming –Technical Practices: Strive for Technical Excellence ,Intentional yet Emergent – Guiding the Design.

Unit IV - SCRUM TEAMWORK **8**

Team Structures – Small Team Productivity – Feature Teams – Component Teams – Guidelines for Good Team Structure – Team Responsibility – Foster Team Learning – Self-Organizing Team – Influencing Evolution: Selecting Environment, Defining Performance, Manage Meaning, Energizing the System.

BoS Chairman

Unit V - SPRINT AND PRODUCT BACKLOG 9

Sprint - Deliver working software- Deliver something valuable – Prepare for next- Work together- Time boxes - Planning meeting - Review meeting - retrospective -Product Backlog - Documents to Discussions - Written Documentation Disadvantages – User Stories -Progressively Refine Requirements – Emergent Requirements – Backlog Iceberg – Refining User Stories – Specify by Example.

Course Outcomes

At the end of the course the student will be able to:

1. Describe the various activities involved in the agile software development process through various methodologies.
2. Illustrate the benefits of Scrum for measuring the product quality.
3. Explain the different kinds of roles and practices followed in Scrum framework for agile development.
4. Analyze the responsibilities and performances of Scrum team structures for effective software development.
5. Illustrate the User stories in agile software development using sprint and product backlog.

Text Books:

1. Roger S. Pressman, "Software Engineering - A Practitioner's Approach", Seventh Edition, McGraw-Hill International Edition, 2010.
2. Mike Cohn, "Succeeding with Agile: Software Development Using Scrum", Addison-Wesley, 2009.

Reference Books:

1. Ken Schwaber, "Agile Project Management with Scrum (Microsoft Professional)", Microsoft Press, 2004.
2. Thomas Stober, Uwe Hansmann, "Agile Software Development - Best Practices for large Software Development Projects", Springer, 2010.

Web References:

1. http://highered.mcgraw-hill.com/sites/0073375977/information_center_view
2. http://www.slideshare.net/rodrigorac2/succeeding-with-agile-software-development-using-scrum-addisonwesley-2010
3. http://agilemethodology.org
4. http://www.agilosoftware.com

BoS Chairman

Course Code: 16CSE22	Course Title: BUSINESS INTELLIGENCE	
Elective	L: T: P: C	3: 0: 0: 3
Type: Theory	Total Contact Hours:	45

Prerequisites: The student should have undergone the course(s):

16CST52 Data Warehousing and Mining

Course Objectives

The course is intended to:

1. Explain the usage of Business Intelligence systems and technology.
2. Describe the functionalities of various components of Decision Support System.
3. Design Dashboard and Scorecard.
4. Illustrate the characteristics, roles and approaches of Knowledge management.
5. Summarize the impacts of Management Support Systems.

Unit I - INTRODUCTION TO BI 9

Business View of Information Technology Applications-Types of Digital Data - Getting started with BI - BI Component Framework - BI Users- BI Applications-BI Roles and Responsibilities- Best practices in BI/DW-The Complete BI Professional – Tools-Data Profiling.

Unit II - DECISION SUPPORT SYSTEMS (DSS) 9

DSS configuration - Description - Characteristics - Capabilities -Classifications - Components - Data Management Subsystems - Model Management Subsystems - The User Interface (DIALOG) Subsystem - Knowledge Based Management Subsystem - DSS User - Hardware.

Unit III - BUSINESS PERFORMANCE MANAGEMENT (BPM) 9

BPM Cycle - Performance Measurement- BPM Methodologies - Architecture and Applications -Performance Dashboards and Scorecards - Case Study.

Unit IV - KNOWLEDGE MANAGEMENT (KM) 9

Introduction – Organizational Learning and Transformation–KM Activities – Approaches– Information Technology and Roles of People in KM– Knowledge Management Systems Implementation – Ensuring the Success of Knowledge Management Efforts.

Unit V - MANAGEMENT SUPPORT SYSTEMS (MSS) 9

Reality Mining - Virtual Worlds - Web 2.0 Revolution - Virtual Communities - Online Social Networking - Cloud Computing and BI - MSS Impacts on Organization &Individual.

BoS Chairman

Course Outcomes

At the end of the course the student will be able to:

1. Explain the usage of Business Intelligence systems and technology to support decision making.
2. Describe the functionalities of various components of Decision Support System in making Business Decisions.
3. Design Dashboard and Scorecard for any given application.
4. Illustrate the characteristics, roles and approaches of Knowledge management for effective functioning of an organization.
5. Summarize the impacts of Management Support Systems on Organization and Individual.

Text Books:

1. R N Prasad, Seema Acharya, "Fundamentals of Business Analytics", Wiley, 2011.
2. Efraim Turban, Ramesh sharda, Dursun Delen "Decision Support and Business Intelligence Systems", Ninth Edition, Pearson Education Inc., 2014

Reference Books:

1. Vicki L. Sauter, "Decision Support Systems for Business Intelligence",Wiley, 2011.
2. David Loshin, "Business Intelligence: The Savvy Manager's Guide", Second Edition, Morgan Kaufman, 2012.
3. Carlo Vercellis, "Business Intelligence: Data Mining and Optimization for Decision Making", Wiley, 2009.

Web References:

1. http://campusconnect.infosys.com/HomeDownloads/BI_old/BI_Def_Concepts.pdf
2. http://campusconnect.infosys.com/homedownloads/BI/BiFramework.pdf
3. https://www.tutorialspoint.com/management_information_system/decision_support_system.htm

BoS Chairman

Course Code: 16CSE23	Course Title: ENGINEERING ECONOMICS AND FINANCIAL ACCOUNTING	
Elective	L: T: P: C	3: 0: 0: 3
Type: Theory	Total Contact Hours:	45

Prerequisites: The student should have undergone the course(s):
16CST43 SOFTWARE ENGINEERING

Course Objectives

The course is intended to:

1. Define and describe the basic terminologies and concepts related to economics.
2. Outline the various functions of production and analyze using pricing methods.
3. Perform cost estimation for material, labor, and different type of jobs.
4. Understand and use the various costing methods for operations, processes, and other factors.
5. Employ techniques such as balance sheet, average rate of return, payback period, and net present value for accounting.

Unit I - INTRODUCTION **9**

Objectives of Managerial Economics, Firm, Cost Estimation, Costing, Cost Accounting, Factors Influencing Managerial Decisions & Theoretical Concepts, Classification and Elements of cost

Unit II - PRODUCTION ANALYSIS AND PRICING **9**

Production Function-Least Cost Combination of Inputs-Factor Productivities & Return to Scale-Determinants of Price-Pricing under different objectives and Market Structures-Price Discrimination & Pricing methods in practice

Unit III - ESTIMATION **9**

Estimation of Material, Labor and Overhead Cost, Allocation of Overheads. Estimation for different types of jobs

Unit IV - COSTING **9**

Job Costing - Operating Costing - Process Costing - Standard Costing (Variance Analysis) GDP

Unit V - ACCOUNTING **9**

Balance Sheet - Profit & Loss Statement - Evaluation of Investment decisions – Average Rate of Return-Payback Period-Net Present Value & IRR

BoS Chairman

Course Outcomes

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

1. Define and describe the basic terminologies and concepts related to economics.
2. Outline the various functions of production and analyze using pricing methods.
3. Perform cost estimation for material, labor, and different type of jobs.
4. Understand and use the various costing methods for operations, processes, and other factors.
5. Employ techniques such as balance sheet, average rate of return, payback period, and net present value for accounting.

Text Books:

1. Jawaharlal, "Cost Accounting", Tata McGraw-Hill Company, 1996.
2. T.P. Banga & S.C. Sharma, "Mechancial Estimating and Costing", Khanna Publishers, 1984

Reference Books:

1. James.C.Van Home, "Fundamentals of fincancial Management", PHI, 2004.
2. V.L.Mote, Samuel Paul & G.S.Gupta, "Managerial Economics-Concepts & Cases", TMH, 1989.
3. Ramachandran Aryasry & VV. Ramana Murthy, "Engg Economics & Financial Accounting", Tata McGraw-Hill, 2004

Web References:

1. Engineering Economics Tutorials URL:
   http://web.stevens.edu/ecosys/eng_eco/index.html
2. NPTEL Course Content URL:
   http://www.nptel.ac.in/syllabus/syllabus.php?subjectId=110101003
3. NPTEL Course Content URL:
   http://www.nptel.ac.in/syllabus/syllabus.php?subjectId=110101005

BoS Chairman

Course Code: 16CSE24	Course Title: PRINCIPLES OF MANAGEMENT	
Elective	L: T: P: C	3: 0: 0: 3
Type: Theory	Total Contact Hours:	45

Course Objectives

The course is intended to:

1. Describe the functions of management in a business organization.
2. Analyze different forecasting techniques
3. Identify various types of organizational structures and patterns.
4. Describe various leadership functions and Motivational Techniques.
5. Illustrate the role of Information technology for performance control

Unit I - INTRODUCTION 9

Historical developments –approaches to management– Management and Administration – Development of Management Thought – Contribution of Taylor and Fayol's – Functions of Management – Types of Business Organization.

Unit II - MANAGERS & ENVIRONMENT 9

Social responsibility–Planning – Objectives – Setting Objectives – Process of Managing through Objectives – Strategies- Policies and Planning Premises- Forecasting Techniques – Decision making.

Unit III - FUNCTIONAL AREA ORGANIZATION 9

Formal and Informal Organization – Organization Chart – Structure and Process – Departmentalization by difference strategies – Line and Staff authority – Benefits and Limitations – De-Centralization and Delegation of Authority – Staffing – Selection Process – Techniques.

Unit IV - MOTIVATION & DIRECTIONS 9

Objectives– Human Factors– Harmonizing Objectives – Leadership Types of Leadership Motivation – Hierarchy of needs– Motivational Techniques – Communication-Types.

Unit V - CONTROLLING STRATEGIES 9

System and Process of Controlling – Requirements for effective control – The Budget as Control Technique – Information Technology– Computers in handling the information – Control of Overall Performance – Direct and Preventive Control –Globalization and Liberalization – International Management and Global theory of Management

BoS Chairman

Course Outcomes

At the end of the course the student will be able to:

1. Describe the functions of management in a business organization and differentiate it with administration.
2. Analyze different forecasting techniques to set objectives and make decisions.
3. Identify various types of organizational structures and patterns for effective management.
4. Describe various leadership functions and Motivational Techniques for performance improvement.
5. Illustrate the role of Information technology for performance control in organizations and impact of globalization.

Text Books:

1. Harold Koontz, Heinz Weihrich, "Essentials of Management", Seventh Edition, Tata McGraw- Hill 2007.
2. Tripathy PC, Reddy PN, "Principles of Management", Tata McGraw Hill, 1999.

Reference Books:

1. Stephen P.Robins & Mary Coulter, "Fundamentals of Management", Seventh Edition, Pearson Education, 2011.
2. JAF Stoner, Freeman R.E and Daniel R Gilbert, "Management", Sixth Edition, Pearson Education, 2004.

Web References:

1. http://www.managementstudyguide.com/management_principles.html
2. http://study.com/academy/course/principles-of-management-course.html
3. http://www.buisnessmanagementideas.com/management/5-functional-areas-of-management-buisness-management/512
4. http://www.leadership-toolbox.com/characteristic-of-leadership.html
5. http://discovery.bitspilani.ac.in/dlpd/courses/coursecontent/courseMaterial/mgtszc211/principles_of_management_notes.pdf

BoS Chairman

OPEN ELECTIVES

Course Code: 16OET19	**Course Title:** HUMAN COMPUTER INTERFACE DESIGN	
Open Elective	**L: T: P: C**	3: 0: 0: 3
Type: Theory	Total Contact Hours:	**45**

Course Objectives

The course is intended to:

1. Describe the fundamental HCI concepts.
2. Apply the various modes of user interactions.
3. Design the user interface prototype.
4. Apply the standards and principles of User Interface.
5. Implement the universal design principles.

Unit I – HCI FOUNDATIONS **9**

Human: Input - Output Channel - Human Memory - Thinking: Reasoning and Problem Solving - Emotion - Psychology - Computer: Text Entry devices-Display Devices-Pointing Devices-Memory-Processing and Networks.

Unit II – INTERACTION AND PARADIGMS **9**

Interaction : Modes of Interaction – Frameworks and HCI – Ergonomics – Interaction Styles – Windows Icon Pointer and Menus Interfaces – Interactivity – Context – Paradigms

Unit III – DESIGN PROCESS **9**

Process of Design - User Focus – Scenarios – Navigation Design – Screen design and Layout – Prototyping – HCI Software Life Cycle – Usability Engineering – Iterative Design and Prototyping – Design Rationale.

Unit IV – IMPLEMENTATION **9**

Principles – Standards – Guidelines – Golden Rules – Patterns – Implementation elements – Programming – Toolkits – UI Management Systems – Evaluation Techniques

Unit V – UNIVERSAL DESIGN AND USER SUPPORT **9**

Universal design Principles – Multimodal Interaction – Designing for Diversity – Requirements and approaches for User Support – Help Systems – Designing user Support systems.

Course Outcomes

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

1. Describe the fundamental HCI concepts for interface design.
2. Apply the various modes of user interactions suitable for the given context.
3. Design the user interface prototype with appropriate life cycle model.

BoS Chairman

4. Apply the standards and principles for effective implementation of user interface.
5. Implement the universal design principles to support effective user experience.

Text Book:

1. Alan Dix, Janet Finlay, Gregory Abowd, Russell Beale, "Human Computer Interaction", Third Edition, Perason Education, 2004

Reference Books:

1. Gerard Jounghyun Kim, "Human Computer Interaction: Fundamentals and Practice", CRC Press, 2015.
2. Julie A.Jacko, "The Human Computer Interaction Handbook: Fundamentals, Evolving Technologies and Emerging Applications", Third Edition, CRC Press, 2012.

Web References:

1. NPTEL Videos: Human Computer Interaction. URL: http://nptel.ac.in/courses/106103115/
2. MIT OpenCourseWare: User Interface Design and Implementation. URL: https://ocw.mit.edu/courses/electrical-engineering-and-computer-science/6-831-user-interface-design-and-implementation-spring-2011/

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Course Code: 16OET20	Course Title: COMPUTER FORENSICS	
Open Elective	L: T: P: C	3: 0: 0: 3
Type: Theory	Total Contact Hours:	45

Course Objectives

The course is intended to:

1. Describe the cyber security policy and its evolution.
2. Summarize the scope and laws of computer forensics.
3. Explain the process of acquiring and documenting computer forensic evidence.
4. Describe the steps involved in investigating network forensics.
5. Comprehend the steps involved in investigating mobile forensics.

Unit I - CYBER SECURITY **9**

Cyber Security – Cyber Security policy – Domain of Cyber Security Policy: Laws and Regulations, Enterprise Policy, Technology Operations, Technology Configuration - Strategy Versus Policy – Cyber Security Evolution: Productivity, Internet, E-commerce, Counter Measures, Challenges.

Unit II - SCOPE AND LAWS OF COMPUTER FORENSICS **9**

Scope of computer forensics: Introduction, Types of Evidence, Investigator skills, Importance, History of Computer Forensics, Law Enforcement Training – Operating systems and file systems.

Unit III - ACQUIRING EVIDENCE AND DOCUMENTATION **9**

Lab Requirements - Private Sector Computer Forensics Laboratories - Computer Forensics Laboratory Requirements - Extracting Evidence from a Device - Documenting the Investigation.

Unit IV - NETWORK FORENSICS **9**

Tools - Networking Devices - Understanding the OSI Model - Advanced Persistent Threats - Investigating a Network Attack.

Unit V - MOBILE FORENSICS **9**

Cellular Network - Handset Specifications - Mobile Operating Systems - Standard Operating Procedures for Handling Handset Evidence - Handset Forensics - Case studies.

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Course Outcomes

At the end of the course the student will be able to:

1. Describe the cybersecurity policy and its evolution for the purpose of computer forensics.
2. Summarize the scope and laws of computer forensics for cyber security professionals.
3. Explain the process of acquiring and documenting computer forensic evidence for investigation.
4. Describe the steps involved in investigating network forensics for attacks.
5. Comprehend the steps involved in investigating mobile forensics with case studies.

Text Book:

1. Darren R. Hayes, "A Practical Guide to Computer Forensics Investigations", First Edition, Pearson, 2014.

Reference Books:

1. Bill Nelson, Amelia Phillips, Christopher Steuart, "Computer Forensics and Investigations", Third Edition, Cengage learning, 2010.
2. Kevin Mandia, Chris Prosise, Matt Pepe, "Incident Response and Computer Forensics", Second Edition, Tata McGraw -Hill, 2006.

Web References:

1. http://dst.gov.in/basic-research-cyber-security
2. https://www.sans.org/reading-room/whitepapers/incident/developing-computer-forensics-team-628
3. https://www.cybrary.it/cyber-security/

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Course Code: 16OET21	Course Title: GREEN COMPUTING	
Open Elective	L: T: P: C	3: 0: 0: 3
Type: Theory	Total Contact Hours:	45

Course Objectives

The course is intended to:

1. Describe the significance of green computing.
2. Explain consumption related issues.
3. Describe the energy management and recycling methods.
4. Explain virtualization concepts and their evaluation metrics.
5. Exhibit greening the information systems.

Unit I - GREEN IT **9**

Growing Significance of Green IT and Green Data Centers, Basic steps toward Green IT – Organizational Issues in Addressing the Problem - Product End of Life - Asset Disposal - Procurement Policies - Supply-Chain Issues - Important Steps for Green IT - Data Center Energy - Efficiency Considerations.

Unit II - CONSUMPTION ISSUES **9**

Role of electric utilities - Power Problems - Monitoring Power Usage - Reducing Power Use - Low-Power Computers and components – Cooling Costs - Reducing Cooling Costs - Optimizing Airflow - Datacenter Design.

Unit III - ENERGY MANAGEMENT AND RECYCLING **9**

Process Reengineering - Teleworkers and Outsourcing - Paperless Office - Intranets - Electronic Data Interchange - Recycling: Problems - Means of Disposal, Life Cycle, Recycling Companies, Hard Drive Recycling, CDs and DVDs - Hardware Considerations: Energy Star, Servers and Remote Desktop.

Unit IV - VIRTUALIZING IT SYSTEMS AND METRICS **9**

Consolidation and Virtualization - Server Virtualization - Storage Virtualization - Client Virtualization - Creating Virtual Servers - Blade Servers and Virtualization - Impacts of Server Virtualization on Data Storage –Metrics: SPEC, EPA and LEED Green Building Rating System.

Unit V - GREENING INFORMATION SYSTEMS **9**

Initial Improvement Calculations – Changing Business Processes – Technology Infrastructure - Organizational Checkups – Equipment Checkups – Certifications – Case Study: Pacific Gas and Electric Company, Energy Impact of the UPS.

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Course Outcomes

At the end of the course the student will be able to:

1. Describe the significance of green computing with concerns and policies.
2. Explain consumption related issues based on power and space utility.
3. Describe the energy management and recycling methods.
4. Explain virtualization concepts in greening IT systems and their evaluation metrics with examples.
5. Exhibit greening the information systems with real time examples.

Text Books:

1. Toby Velte, Anthony Velte, Robert Elsenpeter, "Green IT", Tata McGraw Hill, 2008.
2. John Lamb, "The Greening of IT", Pearson Education, 2009.

Reference Books:

1. Alvin Galea, Michael Schaefer, Mike Ebbers, "Green Data Center: steps for the Journey", Shoff/IBM redbook, 2011.
2. BhuvanUnhelkar, "Green IT Strategies and Applications-Using Environmental Intelligence", CRC Press, June 2011.
3. Carl speshock, "Empowering Green Initiatives with IT", John Wiley & Sons, 2010.

Web References:

1. Course Material URL:https://www.techopedia.com/definition/14753/green-computing
2. NPTEL course content
   URL:http://nptel.ac.in/courses/110108056/module5/Lecture28.pdf
3. Projects and Major research output developed by C-DAC
   URL:http://meity.gov.in/content/green-computing.

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Course Code: 16OET26	Course Title: AUGMENTED REALITY AND VIRTUAL REALITY	
Open Elective	L: T: P: C	3: 0: 0: 3
Type: Theory	Total Contact Hours:	45

Course Objectives

The course is intended to:

1. Describe the fundamentals of XR.
2. Explain the basics of Augmented Reality.
3. Outline the Virtual Reality Architecture and Modeling.
4. Apply the design principles of Augmented Reality apps.
5. Develop Virtual Reality applications.

Unit I - XR OVERVIEW **9**

XR Terms: VR, AR, and MR Foundations; Industrial applicability of XR, Overview on Supported Hardware and Software, Applications: Engineering, Architecture, Education, Medicine, Entertainment, Science and Training.

Unit II - AR PRINCIPLES **9**

AR Definition, Displays: Multimodal Displays, Spatial Display Model, Visual Displays, Tracking, Calibration and Registration - Mobile Sensors - Computer Vision for AR.

Unit III - VR IO, MODELING AND APPLICATIONS **9**

VR Definition, Input Devices: Trackers, Navigation and Gesture Interfaces, Output Devices: Graphics, Three Dimensional Sound and Haptic Displays, Computer Architecture for VR, Modeling, Traditional Applications.

Unit IV - AR APPLICATION DEVELOPMENT **9**

Mobile Application for Image Tracking, Image Dataset Generation, Setting up AR Environment, Animation and transformation (Scale, Move, Rotate, Transform), Build Generation for iOS and Android.

Unit V - VR APPLICATION DEVELOPMENT **9**

Virtual Environment Placement, SDK import and setup, 3D walkthrough, Object Grabbing, Transformation, Hand Avatar manipulation, World space menu creation.

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Course Outcomes

At the end of the course the student will be able to:

1. Describe the fundamentals of XR with example applications.
2. Explain the basics of augmented reality with real time examples.
3. Outline the Virtual Reality Architecture and Modeling for real time applications.
4. Apply the design principles and practices of augmented reality apps for Industrial sectors.
5. Develop the virtual reality applications by choosing appropriate tools.

Text Books:

1. Grigore C. Burdea, Philippe Coiffet, "Virtual Reality Technology", John Wiley & Sons, Inc., Second Edition, 2008.
2. Dieter Schmalstieg, Tobias Hollerer, "Augmented Reality: Principles and Practice", Pearson Education (US), Addison-Wesley Educational Publishers Inc, First Edition, 2016.

Reference Books:

1. Steve Aukstakalnis, "Practical Augmented Reality: A Guide to the Technology Applications, and Human Factors for AR and VR", Addison-Wesley Professional, First Edition, 2016.
2. Robert Scoble, Shel Israel, "The Fourth Transformation: How Augmented Reality & Artificial Intelligence Will Change Everything" , Patrick Brewster Press, First edition, 2016.
3. Tony Parisi, "Learning Virtual Reality: Developing Immersive Experiences and Applications for Desktop, Web, and Mobile", O'Reilly Media, First edition, 2015.

Web References:

1. Build Virtual Worlds
   URL:https://developers.google.com/vr/
2. Quick Start for unreal
   URL:https://developers.google.com/ar/develop/unreal/quickstart
3. Quick Start for Unity Android
   URL:https://developers.google.com/ar/develop/unity/quickstart-android.
4. Unity User Manual
   URL:https://docs.unity3d.com/Manual/UnityManual.html

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