



SIR PADAMPAT SINGHANIA UNIVERSITY

Udaipur

SCHOOL OF ENGINEERING

**Course Curriculum of 4-Year B. Tech. Degree Programme
in
Cloud Technology & Information Security
(Batch- 2018-22)**

Credit Structure

B. Tech. Core		B. Tech. Elective	
Category	Credits	Category	Credits
Departmental Core Subjects	121	Departmental Electives	27
Humanities & Basic Sciences Subjects	28	Open Electives	13
Management Subjects	2		
Total	151	Total	40
Grand Total			191

Distribution of Total Credits & Contact Hours in all Semesters

S. No.	Semester Number	Credits/Semester	Contact hours/week
1	I	25	30
2	II	22	27
3	III	26	31
4	IV	23	27
5	V	24	28
6	VI	24	28
7	VII	33	35
8	VIII	14	18
Total		191	--

Course Structure: B. Tech. 2018-2022

Semester - I

S. No.	Course Code	Course Title	L	T	P	Credit(s)
1	CT-151	Problem Solving through Programming	3	0	2	5
2	CE-151	Engineering Mechanics	3	1	0	4
3	ME-151	Engineering Drawing & Computer Aided Drafting	0	1	1	2
4	HU-153	Professional Communication - I	2	0	0	2
5	CH-154	Chemistry – I	3	0	1	4
6	MA-151	Mathematics – I	3	1	0	4
7	PH-151	Physics – I	3	0	1	4
Total Credits						25
8	EP-199	Endeavour Project(Beyond the Syllabus)				
Total Contact hours/week						30

Semester - II

S. No.	Course Code	Course Title	L	T	P	Credit(s)
1	CT-152	Introduction to Web Technology	2	0	2	4
2	EC-152	Basics of Electrical & Electronics Engineering	3	0	1	4
3	HU-154	Professional Communication - II	1	1	0	2
4	CH-155	Chemistry - II	3	0	1	4
5	MA-152	Mathematics - II	3	1	0	4
6	PH-152	Physics - II	3	0	1	4
Total Credits						22
7	EP-199	Endeavour Project(Beyond the Syllabus)				3
Total Contact hours/week						27

Semester - III

S. No.	Course Code	Course Title	L	T	P	Credit(s)
1	CT-251	Discrete Mathematics & Graph Theory	4	0	0	4
2	CT-252	Computer Architecture & Organization	4	0	0	4
3	CT-253	Information Security Fundamentals	4	0	0	4
4	CT-254	Object Oriented Programming in Java	3	0	2	5
5	CT-255	Data Structures & Algorithms	3	0	2	5
6	CT-256	Software Engineering	3	0	1	4
Total Credits						26
7	EP-299	Endeavour Project(Beyond the Syllabus)				
Total Contact hours/week						31

Semester - IV

S. No.	Course Code	Course Title	L	T	P	Credit(s)
1	CT-257	Operating System	3	0	2	5
2	CT-258	Computer Networks	4	0	0	4
3	CT-259	RDBMS	3	0	2	5
4	CT-260	Hardware Architecture & Programming Concepts	4	0	0	4
5	CT-2XX	Departmental Elective - I	3	0	0	3
6	XX-XXX	Open Elective - I	X	X	0	2
Total Credits						23
7	EP-299	Endeavour Project(Beyond the Syllabus)				3
Total Contact hours/week						27

Semester - V

S. No.	Course Code	Course Title	L	T	P	Credit(s)
1	CT-351	Cloud Technology	3	0	2	5
2	CT-352	Principles of Virtualization	3	0	2	5
3	CT-3XX	Departmental Elective - II	4	0	0	4
4	CT-3XX	Departmental Elective - III	4	0	0	4
5	CT-3XX	Departmental Elective - IV	4	0	0	4
6	XX-XXX	Open Elective - II	X	X	0	2
Total Credits						24
7	EP-399	Endeavour Project(Beyond the Syllabus)				
Total Contact hours/week						28

Semester - VI

S. No.	Course Code	Course Title	L	T	P	Credit(s)
1	CT-353	Storage Technology	3	0	0	3
2	CT-354	Installation & Configuration of Server	3	0	2	5
3	CT-355	Cyber Forensics	3	0	2	5
4	CT-356	Mobile Wireless & VOIP Security	3	0	0	3
5	CS-3XX	Departmental Elective - V	4	0	0	4
6	CS-3XX	Departmental Elective - VI	4	0	0	4
Total Credits						24
7	EP-399	Endeavour Project(Beyond the Syllabus)				3
Total Contact hours/week						28

Semester - VII

S. No.	Course Code	Course Title	L	T	P	Credit(s)
1	CT-451	Data Center	3	0	0	3
2	CT-452	Cloud Computing Solutions	3	0	2	5
3	CT-453	Cloud Security	3	0	0	3
4	CT-454	Ethical Hacking	3	0	2	5
5	CT-456	Application, Web Security & SDLC	4	0	0	4
6	CT-450	Summer Internship/Industry Project	-	-	-	3
7	CT-455	Comprehensive Viva Voce	-	-	-	2
8	CT-460	Minor Project	0	0	3	3
9	BM-451	Ethics & IPR	2	0	0	2
10	XX-XXX	Open Elective - III	3	0	0	3
Total Credits						33
11	EP-499	Endeavour Project(Beyond the Syllabus)				
Total Contact hours/week						35

Semester - VIII

S. No.	Course Code	Course Title	L	T	P	Credit(s)
1	CT-4XX	Departmental Elective - VII	4	0	0	4
2	CT-470	Major Project	0	0	4	4
3	XX-XXX	Open Elective - IV	3	0	0	3
4	XX-XXX	Open Elective - V	3	0	0	3
Total Credits						14
5	EP-499	Endeavour Project(Beyond the Syllabus)				3
Total Contact hours/week						18

List of Departmental Elective(s) - I

S. No.	Course Code	Course Title	L	T	P	Credit
1	CT-261	Analysis & Design of Algorithms	3	0	0	3
2	CT-262	Theory of Computation	3	0	0	3

List of Departmental Elective(s) - II

S. No.	Course Code	Course Title	L	T	P	Credit
1	CT-357	Network Administration	4	0	0	4
2	CT-358	Network Security Protocols	4	0	0	4

List of Departmental Elective(s) - III

S. No.	Course Code	Course Title	L	T	P	Credit
1	CT-359	Cryptography	4	0	0	4
2	CT-360	Database Security	4	0	0	4

List of Departmental Elective(s) - IV

S. No.	Course Code	Course Title	L	T	P	Credit
1	CT-361	Network Security	4	0	0	4
2	CT-362	Disaster Recovery & Business Continuity Management	4	0	0	4

List of Departmental Elective(s) - V

S. No.	Course Code	Course Title	L	T	P	Credit
1	CT-363	Linux Server Administration	4	0	0	4
2	CT-364	Latest Trends in Cloud Technology	4	0	0	4

List of Departmental Elective(s) - VI

S. No.	Course Code	Course Title	L	T	P	Credit
1	CT-365	COBIT VALIT & Risk IT	4	0	0	4
2	CT-366	ITIL	4	0	0	4

List of Departmental Elective(s) - VII

S. No.	Course Code	Course Title	L	T	P	Credit
1	CT-457	Cloud Web Services	4	0	0	4
2	CT-458	Latest Trends in Information Security	4	0	0	4

List of Open Elective(s) - I

S. No.	Course Code	Course Title	L	T	P	Credit
1	HU-252	Language through Literature & Films	0	2	0	2
2	BM-270	Foundations of Economic Science	2	0	0	2

List of Open Elective(s) - II

S. No.	Course Code	Course Title	L	T	P	Credit
1	HU-351	Fun with Drama	0	2	0	2
2	BM-370	Marketing Management	2	0	0	2

List of Open Elective(s) - III

S. No.	Course Code	Course Title	L	T	P	Credit
1	BT-471	Bioprocess Technology	3	0	0	3
2	CE-462	Air Pollution & Industrial Waste Management	3	0	0	3
3	CS-458	Information Retrieval	3	0	0	3
4	CS-462	Management Information Systems & E-Commerce	3	0	0	3
5	EC-475	Computer Networks	3	0	0	3
6	EE-465	Energy Conversion Process	3	0	0	3
7	ME-465	Solar Energy & Applications	3	0	0	3
8	PH-451	Nanotechnology	3	0	0	3
9	PH-453	Chaos in Engineering Systems	3	0	0	3

List of Open Elective(s) - IV

S. No.	Course Code	Course Title	L	T	P	Credit
1	BT-475	Bioremediation Technology	3	0	0	3
2	CE-464	Environmental Management	3	0	0	3
3	CS-459	Statistical Simulation & Data Analysis	3	0	0	3
4	EC-473	Robotics & Automation	3	0	0	3

List of Open Elective(s) - V

S. No.	Course Code	Course Title	L	T	P	Credit
1	BT-472	Bioelectronics & Biosensors	3	0	0	3
2	CS-461	Soft Computing	3	0	0	3
3	EE-466	Hydro Power Generation	3	0	0	3
4	MA-453	Mathematical Statistics	3	0	0	3
5	ME-467	Total Quality Management	3	0	0	3

**Detailed Syllabus for B. Tech. Degree Programme
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Semester - I

(Departmental Core Subject)

CT-151	L-T-P-C
Problem Solving through Programming	3-0-2-5

Objective: *Identifying the different types of computational problems, discussing the nature of engineering problems, discussing the different methods of problem solving & introducing the basics of computing & the fundamentals of C programming.*

Course Content

Introduction: Stored Program Architecture of Computers, Evolution of Processors (In terms of word length & Speed only), Storage Device- Primary Memory & Secondary Storage, Working Principle of Primary Storage devices- RAM, ROM, PROM, EPROM , EEPROM, Random, Direct, Sequential access methods.

A Tutorial Introduction: Variables & Arithmetic Expressions, The for statement, Symbolic Constants, Character Input & Output, File Copying, Character Counting, Line Counting, Word Counting, Arrays, Functions, Arguments - Call by Value, Character Arrays, External Variables & Scope.

Types, Operators & Expressions: Variable Names, Data Types & Sizes Constants, Declarations Arithmetic Operators, Relational & Logical Operators, Type Conversions, Increment & Decrement Operators, Bitwise Operators, Assignment Operators & Expressions, Conditional Expressions, Precedence & Order of Evaluation.

Control Flow: Statements & Blocks If-Else, Else-If, Switch, Loops - While & For, Loops - Do-While, Break & Continue, Goto & label

Functions & Program Structure : Basics of Functions, Functions Returning Non-integers, External Variables, Scope Rules, Header Files, Static Variables, Register

Variables, Block Structure, Initialization, Recursion, The C Preprocessor, File Inclusion, Macro Substitution, Conditional Inclusion.

Pointers: Pointers & Addresses, Pointers & Function Arguments, Address Arithmetic, Character Pointers & Functions, Pointers to Pointers

Arrays: Multi-dimensional Arrays, Pointers & arrays, Initialization of Pointer Arrays, Pointers vs. Multi-dimensional Arrays, Command-line Arguments, Pointers to Functions, Complicated Declarations.

Structures: Basics of Structures, Structures & Functions, Arrays of Structures, Pointers to Structures, Self-referential Structures, Table Lookup, Typedef, Unions, Bit-fields.

List of Experiments

1. (a) Write a program to find an area of a triangle($\text{Area} = \frac{1}{2} \times b \times h$)
(b) Number Guessing game: Thinking of an integer between X & Y inclusive, & to your guesses Machine will respond 'Higher', 'Lower', or 'Yes!' as might be the case, each question halves the search space (Binary Search). For example, if the number were 11, the following sequence of guesses could be used to find it: 1 (Higher), 2 (Higher), 4 (Higher), 8 (Higher), 16 (Lower), 12 (Lower), 10 (Higher). Now we know that the number must be 11 because it is higher than 10 & lower than 12.
(c) Write a program to swap two numbers with & without using third variable.
2. (a) Write a program to find the Volume & surface area of a sphere. (Surface area = $4 * \text{Pie} * r * r$ Volume = $4/3 * \text{PI} * R * R * R$).
(b) Armstrong numbers are used in cryptography to generate secret keys. An Armstrong number of three digits is an integer such that the sum of the cubes of its digits is equal to the number itself. For example, 371 is an Armstrong number since $3^{**3} + 7^{**3} + 1^{**3} = 371$. Write a program to find all Armstrong number in the range of 0 & 999.
(c) Write a program to find largest number from a set of given n numbers.
3. (a) Write a program to find an area of a circle($\text{area} = 3.14 * r * r$)
(b) A man put a pair of rabbits in a cage. During the first month the rabbits produced no offspring but each month thereafter produced one new pair of

rabbits. If each new pair thus produced reproduces in the same manner, how many new pairs of rabbits will there be at the end of one year? (This problem is a famous one in the history of mathematics & first appeared in Liber Abaci, a book written by the Italian mathematician Leonardo Pisano also known as Fibonacci, in the year 1202) {Hint – Generate 12 term Fibonacci series & sum up}

- (c) Write a recursive/non recursive function to check whether the given number is Fibonacci or not.
4. (a) A vowel is a speech sound made by allowing breath to flow out of the mouth, without closing any part of the mouth or throat (although the lips may move to create the correct sound, as in creating the sound “o”). Letters of the English alphabet that represent vowels: a, e, i, o, u. A consonant is a speech sound made by partially or completely blocking the flow of air through the mouth (using the lips, teeth, tongue, & palate). Letters of the English alphabet that represent consonants include all the letters that are not vowels. Examples: d, k, s. Write a program to find whether the entered character is a vowel or a consonant.
- (b) The luhn algorithm or luhn formula is also known as modulus 10 or mod 10 algorithm, it's a simple checksum formula used to validate a variety of identification numbers such as credit card numbers IMEI numbers, national provider identifier number in US & Canadian social insurance numbers. It was created by IBM scientist Hans Peter Luhn. The algorithm is not intended to be cryptographically secure hash function it was designed to protect against accidental errors not malicious attacks. Most credit cards & many government identification numbers use the algorithm as a simple method of distinguishing valid numbers from the collection of random digits. Write a program to check whether given credit card number is valid or not.
 - (c) Write a function to add two numbers, without using any arithmetic operator. Even the ++ in for statement is not allowed
5. (a) You are given a number n, represent the given number in 32 bits & also display the number of bits that are set.

- (b) A prime number is an integer $p > 1$ with no positive divisors except 1 & p itself. An integer $n > 1$ which is not a prime number is called composite. For example 13 & 17 are primes, but 21 is composite because $21 = 3 \cdot 7$. Write a program to generate prime numbers such that $p_1, p_2, \dots, p_i \leq n$.
- (c) Given a number & the position, write a program to flip the bit of a given number.
6. (a) The least common multiple of two integers is the smallest positive integer which is divisible by both. For example $\text{LCM}(4, 6) = 12$ because 12 is the smallest positive integer with the property $12/4$ & $12/6$. Write a program to find the $\text{LCM}(x,y)$. The greatest common divisor of two integers m & n , not both zero is the largest integer which divides both. This number is denoted by $\text{GCD}(m,n)$. For example $\text{GCD}(18,24)$ is 6. Because 6 is the largest integer with the property $18/6$ & $24/6$. Write a program to compute $\text{GCD}(m,n)$.
- (b) A list contains repeated numbers; all the numbers are repeated odd number of times except one which is repeated even number of times. Write a Program to find out that number, which is repeated even number of times.
- (c) Write a program to mask the entry of the password field with '*' symbol.
7. (a) If n is even, divide by 2. If n is odd, multiply by 3 & add 1. Repeat this process with the new value of n , terminating when $n=1$. For example, the following sequence of numbers will be generated for $n=22$: [22 11 34 17 52 26 13 40 20 10 5 16 8 4 2 1]
- (b) Every composite number n can be expressed as a product of two numbers at least one of which is a prime. But if the other factor is again composite then we break it down further as a product of a prime & another, possibly composite, & so on in this way until we have n written as a product of only prime numbers. This procedure is what we call prime factorization of n or factorization of n into primes. Write a program to find the prime factors of a given integer.
- (d) Write a code to compress a given string, for example aaabbccd compress it to a3b2c2d1aabbcc to a2b2c2.

8. (a) Write a program to demonstrate file read, write and append operations.
(b) Create student structure with the following data members. Name, USN, semester, percentage marks. Write a program to create persistent student information using file operations. {Hint – write/read/display the detail of a student to/from file.}
(c) A man invested Rupees. P in a bank at R% per annum for T months. Write a program to find simple interest ($SI=(P*R*T)/100$).
9. (a) Write a program to sum up the following series: $1+4+27+\dots+n^n$
(b) Sort the given numbers n_1, \dots, n_k in descending/ascending order using any sorting technique.
(c) Write a c program to convert a given character string to uppercase or lower case accordingly for example - MadaM to mADAm
10. (a) Write a recursive/non recursive function to search a number in array of numbers using linear search.
(b) Write a program to search for given substring in a string.
(c) For a given number n, display the sum of odd & even numbers.

Text/Reference Books

1. The C Programming Language. Kernighan B. W. & Ritchie D. M. 2nd Ed. Prentice-Hall India, 2009.
2. C Programming with Problem Solving. Jones J. A. & Harrow K. 1st Ed. Yash Printograph, New Delhi, 2007

**Detailed Syllabus for B. Tech. Degree Programme
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Semester - I

(Departmental Core Subject)

CE-151
Engineering Mechanics

L-T-P-C
3-1-0-4

Objective: *The subject deals with the concepts of static & dynamic systems involving kinematic & dynamic analysis.*

Course Content

Basic principles: Equivalent force system; Equations of equilibrium; Free body diagram; Reaction; Static indeterminacy. Structures: Difference between trusses, frames & beams, Assumptions followed in the analysis of structures; 2D truss; Method of joints; Method of section; Frame; Simple beam; types of loading & supports; Shear Force & bending Moment diagram in beams; Relation among load, shear force & bending moment. Friction: Dry friction; Description & applications of friction in wedges, thrust bearing (disk friction), belt, screw, journal bearing (Axle friction); Rolling resistance. Virtual work & Energy method: Virtual Displacement; Principle of virtual work; Applications of virtual work principle to machines; Mechanical efficiency; Work of a force/couple (springs etc.); Potential energy & equilibrium; stability. Center of Gravity & Moment of Inertia: First & second moment of area; Radius of gyration; Parallel axis theorem; Product of inertia, Rotation of axes & principal moment of inertia; Moment of inertia of simple & composite bodies. Mass moment of inertia. Kinematics of Particles: Rectilinear motion; Curvilinear motion; Use of Cartesian, polar & spherical coordinate system; Relative & constrained motion; Space curvilinear motion. Kinetics of Particles: Force, mass & acceleration; Work & energy; Impulse & momentum; Impact problems; System of particles. Kinematics & Kinetics of Rigid Bodies: Translation; Fixed axis rotational; General plane motion; Coriolis acceleration; Work-energy; Power; Potential

energy; Impulse-momentum & associated conservation principles; Euler equations of motion & its application.

Text/Reference Books

1. Engineering Mechanics: Statics and Dynamics. Shames I. H. 4th Ed. PHI. 2002.
2. Engineering Mechanics. Vol I - Statics, Vol II - Dynamics. Meriam J. L. & Kraige L. G. 5th Ed. John Wiley. 2002.
3. Engineering Mechanics. Vol. I and II. Hibbler R. C. Pearson Press. 2002.

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Semester - I

(Departmental Core Subject)

ME-151 L-T-P-C
Engineering Drawing & Computer Aided Drafting 0-1-1-2

Objective: *Engineering drawing is a visual language of an engineer. It permits students to convert an object into its visual representation.*

Course Content

Importance of engineering drawing; Conventions & standards: ISO; Scales; Curves; Orthographic projections : points, lines, planes & solids; Sections of solids; Isometric projections; Development of surfaces; Intersection of solids.

List of Experiments

1. Introduction to Engineering Graphics, sheet layout, instruments, BIS standards, lines, lettering & dimensioning
2. Scales -types of scales-plain scale, diagonal scale, vernier scale
3. Curves- conic sections, ellipse, parabola, hyperbola, cycloid, epicycloid, hypocycloid
4. Orthographic Projections-introduction, multi-view projection system, orthographic views, methods of multi-view projections, projecting side views, sectional views
5. Projection of Points -introduction, position of points in I, II, III & IV quadrant
6. Projection of Lines & Auxiliary projections-line inclined to one plane & parallel to the other-line inclined to both the planes. Projection on auxiliary planes
7. Projection of Planes- introduction, perpendicular & parallel to the reference planes, projections of planes inclined to one reference plane & perpendicular to the other, plane inclined to both ref. planes

8. Projection of solids with axes inclined to one of the reference plane & parallel to the other
9. AUTOCAD- fundamentals of 2-D, drawing & edit commands. Drawing of 2D & 3D object
10. Section of Solids- sections of prisms, pyramids, cone cylinder
11. Development of Surfaces- methods of development-cube, prisms, pyramids, cone cylinder
12. Intersection of Surfaces- line method-cutting plane method, Intersection of two prisms- Intersection of cylinder & cylinder
13. Isometric Projection- isometric axes lines & planes, isometric scale, isometric views of standard shapes, solids

Text/Reference Books

1. Engineering Drawing. Dhananjay A.J. Tata McGraw-Hill. 2008
2. Engineering Drawing. Bhatt N. D. & Panchal V.M. 43rd Ed. Charator Publishing House. 2001.
3. Engineering Drawing. Shah M. B. & Rana B. C. 2nd Ed. Pearson Education. 2009.
4. Graphic Science and Design. French T. E., Vierck C. J. & Foster R. J. 4th Ed. McGraw-Hill. 1984.
5. Fundamentals of Engineering Drawing. Luzadder W. J. & Duff J. M. 11th Ed. PHI. 1995.
6. Engineering Drawing and Graphics. Venugopal K. 3rd Ed. New Age International. 1998.

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Semester - I

(Humanities & Basic Sciences Subject)

HU-153	L-T-P-C
Professional Communication - I	2-0-0-2

Objective: *To develop communicative competence*

Course Content

Communication: Importance of effective communication skills, Objectives & Process of communication; Types of communication: Verbal & non-verbal; Channels of communication, Media of communication; Barriers to communication: Physical, Psychological, Mechanical, Linguistic & Cultural; Types of listening, Principles of effective listening

Word Power: Words often misspelt, One word substitute, Use of idiomatic expressions & phrases

Time & Stress Management: Planning, Scheduling & Prioritizing, Multitasking, Delegating; Saying no assertively; Stress & its causes, Barriers to stress management & Handling stress

Text/Reference Books

1. Technical Communication. Raman M. & Sharma S. Oxford University Press. 2004.
2. Essentials of Business Communication. Pal R. & Korlahalli J. Sultan Chand & Sons. 2011.
3. Word Power Made Easy. Lewis N. 2nd Ed. Goyal Publisher. 2011.

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Semester - I

(Humanities & Basic Sciences Subject)

CH-154
Chemistry - I

L-T-P-C
3-0-1-4

Objective: *The subject deal with the concepts related to Physical chemistry & develops a scientific attitude by means of distinguishing, analyzing & solving various engineering problems. It also provides in-depth knowledge of thermodynamics, quantum chemistry, chemical kinetic, corrosion & colloids.*

Course Content

Concept of Thermodynamic system: Definition with example of di thermal wall, adiabatic wall, isolated system, closed system, open system, extensive property, intensive property. Introduction to first law of thermodynamics: different statements, mathematical form. Internal energy: Definition, Example, Characteristics, Physical significance, Mathematical expression for change in internal Energy, Expression for change in internal energy for ideal gas. Enthalpy: Definition, Characteristics, Physical significance, Mathematical expression for change in Enthalpy, Expression for change in enthalpy for ideal gas. Heat Capacity: Definition, Classification of Heat Capacity (C_p & C_v): Definition & General expression of $C_p - C_v$. Expression of $C_p - C_v$ for ideal gas. Reversible & Irreversible processes: Definition, Work done in Isothermal Reversible & Isothermal Irreversible process for Ideal gas, Adiabatic changes: Work done in adiabatic process, Interrelation between thermodynamic parameters (P , V & T), slope of P - V curve in adiabatic & isothermal process. Application of first law of thermodynamics to chemical processes: exothermic, endothermic processes, law of Lavoisier & Laplace, Hess's law of constant heat summation, Kirchhoff's law. 2nd law of thermodynamics: Statement, Mathematical form of 2nd law of thermodynamics (Carnot cycle). Joule

Thomson & throttling processes; Joule Thomson coefficient for Ideal gas, Concept of inversion temperature. Evaluation of entropy: characteristics & expression, entropy change in irreversible cyclic process, entropy change for irreversible isothermal expansion of an ideal gas, entropy change of a mixture of gases. Work function & free energy: Definition, characteristics, physical significance, mathematical expression of ΔA & ΔG for ideal gas, Maxwell's Expression (only the derivation of 4 different forms), Gibbs Helmholtz equation. Condition of spontaneity & equilibrium reaction. Chemical potential, Real gas, Real Solution, Cell EMF & its Thermodynamic derivation of the EMF of a Galvanic cell (Nernst equation), single electrode potentials, hydrogen half-cell, quinhydrone half-cell & calomel half-cell (construction, representation, cell reaction, expression of potential, Discussion, Application) Storage cell, fuel cell (construction, representation, cell reaction, expression of potential, Discussion, Application). Application of EMF measurement on a) Ascertain the change in thermodynamic function (ΔG , ΔH , ΔS) b) ascertain the equilibrium constant of a reversible chemical reaction c) ascertain the valency of an ion. Corrosion - basics & impacts, Reaction laws: rate & order; molecularity; zero, first & second order kinetics. Pseudo unimolecular reaction, Arrhenius equation. Mechanism & theories of reaction rates (Transition state theory, Collision theory: Steady state approximation, Rate determining state approximations, Bohr's theory & its limitations, de-Broglie relation, Heisenberg Uncertainty principle, Schrodinger equation, Schrodinger equation for hydrogen atom in Cartesian coordinate & polar coordinates, Significance of four quantum numbers, shape of s, p & d atomic orbitals, discovery of spin, spin quantum number & magnetic quantum number. Rules for filling electrons in orbitals, stability of half & completely filled orbitals, relative energies of atomic orbitals, anomalous electronic configurations, The properties of liquid surface, surfactants, colloidal systems, solid surfaces, physio sorption, & chemisorption.

List of Experiments

1. Determination of water hardness by complexometric titration.
2. Determination of total alkalinity of water sample.
3. Determination of chloride ion in water sample by Argentometric method.

4. Determination of total dissolved oxygen content in water sample by Winkler's method.
5. Copper sulfate estimation by iodometric titration.
6. Potassium dichromate estimation by iodometric titration.
7. Redox titration: Estimation of FAS by internal & external indicators.
8. Gravimetric analysis: Estimation of Ba as BaSO_4
9. Gravimetric analysis: Estimation of Ag as AgCl
10. pH metric measurements: Determination of strength of unknown HCl solution by pH metric titration.

Text/Reference Books

1. Physical Chemistry. Atkins P. W. 5th Ed. ELBS. 1994.
2. Physical Chemistry. Levine I. A. 4th Ed. McGraw-Hill. 1995.
3. Quantum Chemistry. Levine I. A. 2nd Ed. Prentice Hall. 1995.
4. Introductory Quantum Chemistry. Chandra A.K. 4th Ed. Tata McGraw-Hill. 1994

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Semester - I

(Humanities & Basic Sciences Subject)

MA-151
Mathematics - I

L-T-P-C
3-1-0-4

Objective: *To develop an understanding of the fundamental concepts of the calculus, differential equations & linear algebra to connect them with real world problems from other disciplines along with the development of mathematical reasoning & problem solving abilities.*

Course Content

Differential Calculus (Functions of one variable): Taylor's & Maclaurin's theorems with remainders, concavity & convexity of a curve, points of inflexion, asymptotes & curvature.

Differential Calculus (Functions of several variables): Partial derivatives & their geometrical interpretation, derivatives of composite & implicit functions, Euler's theorem on homogeneous functions, harmonic functions, Taylor's expansion of functions of several variables, maxima & minima - Lagrange's method of multipliers, Sequences & Series : Sequences & their limits, convergence of series, comparison test, Ratio test, Root test, Absolute & conditional convergence, alternating series.

Integral Calculus: Riemann integration, fundamental theorem of calculus, improper integrals; application to length, area, volume & surface area of revolution. Multiple integrals with applications to volume, surface area, moments of inertia.

Ordinary Differential Equations: Solution of $dy/dx = f(x, y)$; linear differential operator L, higher order ordinary differential equations with constant coefficients: Wronskian solution space; Euler's equation; boundary value problem; initial value problem – existence & uniqueness theorem.

Matrix Algebra: Rank & inverse of a matrix, consistency of linear system of equations; Eigen values, Eigen vectors & their applications to system of ordinary differential equations; Cayley-Hamilton theorem; Diagonalization of matrices.

Text/Reference Books

1. Higher Engineering Mathematics. Ramana B. V. 1st Ed. Tata McGraw-Hill Education. 2006.
2. Calculus and Analytic Geometry. Thomas G. B. & Finney R. L. 9th Ed. ISE Reprint. Addison-Wesley. 1998.
3. Advanced Engineering Mathematics. Kreyszig E. 10th Ed. Wiley Eastern 2012.
4. Advanced Engineering Mathematics. Jain R. K. & Iyengar S. R. K. 3rd Ed. Narosa Publishing House. 2010.
5. Calculus - Vol.2. Apostol T. M. 2nd Ed. Wiley India. 2003.
6. Higher Engineering Mathematics. Grewal B.S. 42nd Ed. Khanna Publication. 2012.

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Semester - I

(Humanities & Basic Sciences Subject)

PH-151
Physics - I

L-T-P-C
3-0-1-4

Objective: *Objective of this course is to introduce concepts of electrostatics & magnetostatics leading to the Maxwell's electromagnetic waves & understanding the wave nature of light using various optical phenomena like interference, diffraction & polarization. The particle nature of electromagnetic wave will also be introduced.*

Course Content

Gauss law & its applications in electrostatics in vector form, electric polarization, permittivity, energy density in an electric field, Ampere's law, charged particle motion in E & B fields, magnetization, Faraday's law of electromagnetic induction; Equation of continuity, generalized Ampere's law, Maxwell's equations, wave equation, plane wave solutions, electromagnetic wave propagation in dielectrics & conductors, reflection/refraction, polarization, interference, diffraction of EM waves Origin of quantum hypothesis, de Broglie's hypothesis of matter waves, Uncertainty principle, Wave function & wave mechanics, Schrodinger equation, QM operators, Expectation value, one-dimensional solutions: zero potential, step potential, potential barrier & potential well.

List of Experiments

1. Determination of wavelength of sodium light source using Newton's Ring Method
2. Determination of wavelength of monochromatic light source using Fresnel's Biprism

3. Determination of the wavelength of monochromatic light using Michelson Interferometer
4. Determination of wavelength of laser using single slit diffraction
5. Determination of the wavelength of prominent lines of mercury using plane transmission grating
6. Determination of specific rotation of sugar solution using Polarimeter
7. Determination of Refractive index & dispersive power of prism material using spectrometer
8. Verification of the Biot Savart's law
9. Variation of magnetic field along the axis of a circular coil & determination of the radius of the coil
10. Determination of frequency of AC mains using Sonometer
11. Determination of the characteristic constant or ballistic constant of a ballistic galvanometer

Text/Reference Books

1. Elements of Electromagnetics. Sadiku M. N. O. 6th Ed. Oxford. 2014.
2. Optics. Ghatak A. 5th Ed. Tata McGraw-Hill Publishing Company Ltd. 2005.
3. Electromagnetics. Laud B.B. 2nd Ed. New Age International (P) Ltd. 1987.
4. Classical Electrodynamics. Jackson J.D. 3rd Ed. Wiley. 1998.
5. Foundations of Electromagnetic Theory. Reitz J.R., Milford F.J. & Christy R. W. 4th Ed. Narosa Pub. House. 2008.
6. Fundamentals of Optics. Jenkins F. A. & White H. E. 4th Ed. McGraw-Hill International Editions. 2001.

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Semester - II

(Departmental Core Subject)

CT-152	L-T-P-C
Introduction to Web Technology	2-0-2-4

Objective: *Web Technology has revolutionized mankind & entirely changed the way we look at things. Banking, Education, Retailing, Manufacturing & Research are some of the things that have undergone major transformations due to influence from web development. By adding more features, increasing the scope & reach of industries, making it available to users irrespective of their geography, web has captivated the human minds. Learning web technology is one of the top priorities for every computer enthusiast in order to better understand its working & scope. Students will understand the fundamental working technology behind web development & HTML. They will be taught concepts like JS, HTML5 thus making them capable of web development.*

Course Content

Introduction to Web: What is Web?, What is WWW, Web site - Static & Dynamic web site, Web application - Client-server, Web development Technologies- Html, CSS, Js , XML, Servlet & JSP, PHP & Ajax

Html: Introduction to Html, Html structure, Html Editors, Html element/tag & attributes, Designing simple page - Html tag, Head tag, Body tag; More Html tags - Anchor tag, Image tag, Table tag, List tag, Frame tag, Div tag ; Html forms - Input type, Text area, Select , Button

CSS: Introduction to CSS, Syntax, Selectors, Embedding CSS to Html, Formatting fonts, Text & background colour, Borders & boxing

JavaScript: Introduction to JS, Embedding JS into Html, Variables, Data types, Operators, Conditional statements, Looping statements, Strings, Arrays, Math Object, Date Object, Functions, Objects, Event Handling.

XML: Introduction to XML, Difference b/w Html & XML, XML editors, XML Elements & Attributes XML DTD, XML Schema, XML DOM

List of Experiments

1. Design a simple web page with head, body & footer, with heading tags, image tag
2. Design a web site for book information, home page should contain books list, when particular book is clicked, information of the books should display in the next page.
3. Design a page to display the product information such as name, brand, price etc. with table tag
4. Design a web site for book information using frames, home page should contain two parts, left part should contain books list, & right part should contain book information.
5. Design a web page to capture the user information such as name, gender, mobile number, mail id, city, state, & country using form elements.
6. Design a web page with nice formatting like background image, text colors & border for text using external CSS.
7. Design a web page to perform mathematical calculations such as addition, subtraction, multiplication, & division
8. Design a web page to read data from an XML file & display the data in tabular format, take the data as employee information.
9. Design a web site for online purchase using CSS, JS & XML, web site should contain the following web pages: Home page, Login page, Signup page, Product details page

Text/Reference Books

1. HTML, XHTML & CSS Bible, Pfaffenberger B., Schafer S. M. & White C. Bill Karow. 5th Ed. Wiley Publishing Inc, 2010.

2. HTML Black Book. Holzner S. 1st Ed. Dreamtech Press. 2000.
3. Web Design with HTML, CSS, JavaScript and jQuery Set. Duckett J. Wiley. 2014
4. Beginning Java Script with DOM scripting and Ajax. Heilmann C. 1st Ed. Apress Publisher, 2010.
5. Learning PHP & My SQL. Davis M. & Philips J. 1st Ed. O'Reilly Publisher, 2009
6. PHP Cook Book. Sklar D. & Trachtenberg A. 2nd Ed. O'Reilly Publisher, 2008

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Semester - II

(Departmental Core Subject)

EC-152 L-T-P-C
Basics of Electrical & Electronics Engineering 3-0-1-4

Objective: *The aim of this course is to develop an understanding of the basics of electrical & electronics components, circuits & systems, operation of transformers & other electrical machines.*

Course Content

Circuit Analysis Techniques: Circuit elements, Simple RL & RC Circuits, Ohm's law, Kirchoff's laws, Nodal Analysis, Mesh Analysis, Linearity & Superposition, Source Transformations, Thevenin's & Norton's Theorems, Phasor Relationship for R, L & C, Impedance & Admittance, Phasor Diagrams, Response as a function of ω .

Diodes & Transistors: Semiconductor Diode, Zener Diodes, Rectifier Circuits, Wave Shaping Circuits, Bipolar Junction Transistors, Field-Effect Transistors.

Operational Amplifiers: Op-amp Equivalent Circuit, Practical Op-amp Circuits, DC Offset, Constant Gain Multiplier, Voltage Summing, Voltage Buffer.

Logic Gates: Number Systems & Codes, Logic Gates, Boolean Theorems, De Morgan's Theorems, Sum-of Product Form, Algebraic Simplification, Karnaugh Map Method.

Introduction to Transformers & AC Machines: Ideal Transformer, Circuit Model of Transformer, Efficiency, Three Phase Induction Motor.

Introduction to Fractional-kW Motors & DC Machines: Single Phase Induction Motors, DC Generator & DC Motor.

List of Experiments

1. Study & Verification of Kirchoff's Current Law

2. Study & Verification of Kirchoff's Voltage Law
3. Study & Verification of Thevenin's Theorem for dc network
4. Study & Verification of Norton's Theorem for dc network
5. Study & Verification of R-C series circuit & determination of phase angle
6. Study of the volt-ampere (V-I) characteristics for Silicon P-N Junction diode
7. Study of the volt-ampere (V-I) characteristics for a Zener diode
8. Study of the input & output characteristics for a transistor in common base configuration
9. Verification of Truth Table for basic & universal logic gates
10. Determination of copper loss & core loss for a single phase transformer through O/C-S/C Test

Text/Reference Books

1. Engineering Circuit Analysis. Hayt W.H. & Kemmerly J.E. 2nd Ed. McGraw-Hill. 1993.
2. Circuits, Devices and Systems. Smith R.J. & Dorf R.C. 5th Ed. John Wiley & Sons. 1992.
3. Electronic Devices and Circuit Theory. Boylestad R.L. & Nashelsky L. 6th Ed. Prentice Hall India. 2001.
4. Digital Systems. Tocci R.J. 6th Ed. Prentice Hall India. 2001.
5. Electrical Engineering Fundamentals. Del T. V. 2nd Ed. Prentice Hall India. 1994.
6. Circuit Theory (Analysis and Synthesis). Chakrabarti A. Dhanpat Rai & Co. 2001.

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Semester - II

(Humanities & Basic Sciences Subject)

HU-154	L-T-P-C
Professional Communication - II	1-1-0-2

Objective: *To build interpersonal skills & communicate effectively.*

Course Content

Business Meetings: Notice, Agenda, Minutes of Meeting

Group Discussions: Classification of GD topics; GD as a part of the selection process; GD phases; Non-verbal communication in GD, Do's & don'ts of GD.

Professional Mannerisms & Grooming: Kinesics, Office etiquette; Telephone skills, Netiquette

SWOT, Résumé, Cover letter writing, Job Acceptance Letter.

Goal setting: Significance, Progressive steps to achieve goals; Anticipating career challenges & utilizing opportunities.

Text/Reference Books

1. Foundations of Business Communication: An Integrative Approach. Young, D. McGraw Hill Education. 2005.
2. How to Succeed in Group Discussions and Personal Interviews. Mandal S. Jaico Publishers. 2004.
3. Business Communication: Connecting in a Digital World (SIE). Lesikar, R. & Pande, N. McGraw Hill Education. 2015.

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Semester - II

(Humanities & Basic Sciences Subject)

CH-155
Chemistry - II

L-T-P-C
3-0-1-4

Objective: *This course aims at understanding various concepts of inorganic & organic chemistry, broad spectrum knowledge of chemical bonding, organic reaction mechanism, stereochemistry, spectroscopy, polymer science, green chemistry & environmental pollution studies.*

Course Content

Bonding Models in Inorganic Chemistry- Introduction, Ionic bonding: Introduction to stoichiometric defects (Schottky & Frenkel) & non – stoichiometric defects (Metal excess & metal deficiency). Role of silicon & germanium in the field of semiconductor. Valence shell Electron Repulsion Theory (VSEPR). Discussion of structures of IF_3 , $SnCl_2$, CO_3^{2-} & Valence bond theory, Molecular orbital theory Linear combination of atomic orbitals (LCAO) method. Structures of simple hetero nuclear diatomic molecules such as CO, NO, HF, Coordination numbers, Crystal field theory, Metal ions in Biological systems, Air Pollution Types of pollutants, source effects, sink & control of primary pollutants – CO, NO_x, HC, SO_x & particulates, effects of pollutants on man & environment – photochemical smog & acid rain. Greenhouse effect, ozone layer depletion, Water Pollution: Classification of pollutants, their sources, effects of water pollutions on human & plant life, waste water treatment – domestic & industrial. Pollution due to Oil & grease in water. Thermal pollution: Sources, effects of thermal pollution on plant & animal life, control techniques, radioactive pollution: sources, effects, treatment & disposal, Solid Waste Management, Weapons of mass destruction, biological weapons, chemical weapons, disarmament & peaceful uses of chemistry in

day to day life. Green Chemistry, 12 principles of green chemistry, application of green chemistry in industrial processes, Renewable & Non-renewable energy resources & Primary & Secondary energy resources, Polymers, Organic Reaction Mechanism, Stereochemistry of Carbon Compounds, Basic concepts of spectroscopy, UV-VIS spectroscopy, applications, Fundamentals of Microwave & IR spectroscopy & its applications, determination of molecular structure.

List of Experiments

1. Inorganic qualitative analysis: Detection of acid radicals.
2. Inorganic qualitative analysis: Detection of basic radicals.
3. Estimation of available chlorine in bleaching powder sample.
4. Thin layer chromatography: Separation of given amino acids by TLC method.
5. Determination of rate constant of a first order reaction by titrimetric method.
6. Spectrophotometry: Verification of Beer's law.
7. Conductometric measurements: Determination of strength of unknown HCl solution by conductometric titration.
8. Qualitative analysis of single solid organic compounds: Detection of characteristic elements (N, Cl, Br & I) by chemical tests.
9. Qualitative analysis of single solid organic compounds: Detection of functional groups by systematic chemical tests.
10. Flame photometry: Determination of Na & K in water sample.

Text/Reference Books

1. Environmental Sciences towards sustainable future. Wright R. Prentice Hall of India. 2007.
2. Essentials of Ecology & Environmental sciences. Rana S. V. S. 3rd Ed. Prentice Hall of India. 2007.
3. Ecology. Subrahmanyam S & Sambamurty S. S. 2nd Ed. Narosa Publishing House. 2007.
4. Concepts of Ecology. Kormondy E. J. 4th Ed. Prentice Hall of India Pvt. Ltd. 2007.
5. Textbook of Environmental Studies for Undergraduate Courses. Bharucha E. 2nd Ed. University Grants Commission. New Delhi. 2004.
6. Advanced Inorganic Chemistry. Cotton F. A. & Wilkinson G. 3rd Ed. Wiley Eastern Ltd. 1972.
7. Inorganic Chemistry. Shriver D. J. Atkins P. W. & Langford C. H. 2nd Ed. ELBS.

- 1994.
8. Organic Chemistry. Pine S. H. 5th Ed. McGraw-Hill. 1987.
 9. Fundamentals of Molecular Spectroscopy. Banwell C. N. & McCash E. M. 4th Ed. McGraw-Hill. 1962.
 10. Introduction to Molecular Spectroscopy. Barrow G. M. 5th Ed. McGraw-Hill 1962.
 11. Green Chemistry Engineering. Doble M. & Kruthiventi A.K. Academic press. 2007.

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Semester - II

(Humanities & Basic Sciences Subject)

MA-152
Mathematics - II

L-T-P-C
3-1-0-4

Objective: *The objective of the course is to make the students familiar with certain important mathematical techniques involving complex analysis & transforms which have applications in various disciplines of Engineering & Technology.*

Course Content

Complex Analysis: Complex Variables: Limit, continuity, differentiability & analyticity of functions, Cauchy-Riemann equations, line integrals in complex plane, Cauchy's integral theorem, independence of path, existence of indefinite integral, Cauchy's integral formula, derivatives of analytic functions, Taylor's series, Laurent's series, Zeros & singularities, Residue theorem, evaluation of real integrals.

Transform Calculus: Definition of Laplace Transform, linearity property, conditions for existence of Laplace Transform. First & second shifting properties, Laplace Transform of derivatives & integrals, unit step functions, Dirac delta-function, error function. Differentiation & integration of transforms, convolution theorem, inversion, periodic functions. Evaluation of integrals by Laplace Transform. Solution of initial & boundary value problems. Fourier Transform, Fourier sine & cosine transforms. Linearity, scaling, frequency shifting & time shifting properties. Self-reciprocity of Fourier Transform, convolution theorem. Applications to boundary value problems. Brief Introduction of Z-Transform, Mellin transform & Wavelet Transform.

Fourier Series : Periodic functions, Fourier series representation of a function, half range series, sine & cosine series, Fourier integral formula, Parseval's identity.

Text/Reference Books

1. Higher Engineering Mathematics. Ramana B. V. 1st Ed. Tata McGraw-Hill Education. 2006.
2. Complex Analysis for Mathematics and Engineering. Mathews J. H. & Howell R. W. 3rd Ed. Narosa. 1998.
3. Advanced Engineering Mathematics. Kreyszig E. 10th Ed. Wiley Eastern. 2012.
4. Advanced Engineering Mathematics. Jain R. K. & Iyengar S. R. K. 3rd Ed. Narosa Publishing House. 2009.
5. Complex Variables- Introduction and Applications. Ablowitz M. J. & Fokas A. S. 2nd Ed. Cambridge University Press. 1998.
6. Complex Variables and Applications. Brown J. W. & Churchill R. V. 7th Ed. McGraw-Hill. 2004.

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Semester - II

(Humanities & Basic Sciences Subject)

PH-152
Physics - II

L-T-P-C
3-0-1-4

Objective: *The objective of this course to introduce the notion of quantum physics & its applications in understanding the electrical, thermal & magnetic properties of various materials, band theory of solids, nanostructures, lasers, superconductivity & its applications.*

Course Content

Nature of waves & particles, Wave-packets & uncertainty, Wave particle duality, Wave mechanics & its mathematical tools, Classical & quantum statistics, Statistics of discrete energy levels, Black body spectral density, Bose condensation; Free electrons, density of states, Kronig-Penny model, Effective mass, Band structure, Electrons in various types of solids, Particle in quantum well, Harmonic oscillator & Hydrogen atom problems, Application to semiconductor doping, Nonperiodic materials; Tunneling of particles & examples, Tunneling through multiple barriers & semiconductor junctions; Interaction among quantum wells: materials under electric & magnetic fields, magnetic resonance effects; Nanostructures – Concepts of electrons in low dimensional confinement, Quantum wells & Super-lattices leading to new device concepts; Lasers – Einstein coefficients, Population inversion, Light amplification, Optical resonators, Characteristics of lasers; Superconductors –Vortex, Flux quantization, SQUID, Levitation & its applications.

List of Experiments

1. Determination of Planck's constant using Light Emitting Diode

2. Determination of temperature coefficient, reverse saturation current & energy band gap of a P-N junction
3. Determination of the energy band gap of semiconductor using four-probe method
4. Determination of the charge carrier concentration & Hall coefficient of a given semiconductor using Hall experiment setup
5. Determination of the ratio of e/m for the electron using the helical method
6. Determination of electronic charge by Millikan's oil drop method
7. Determination of velocity of ultrasonic waves using quartz crystal
8. Determination of wavelength of He-Ne laser using millimeter scale as a grating
9. Determination of wavelength of Diode laser using single slit / double slit & obtain diffraction patterns of different apertures
10. Determination of numerical aperture of an optical fibre cable
11. Determination of capacitance of a parallel plate capacitor with & without dielectric material
12. Determination of the height of a distant object/building with the help of sextant

Text/Reference Books

1. Concepts of Modern Physics. Beiser A. 5th Ed. McGraw-Hill. 1995.
2. Modern Physics. Krane K. S. 2nd Ed., John-Wiley. 1995.
3. Quantum Physics of Atoms, Molecules, Solids, Nuclei and Particles. Eisberg R. & Resnick R. 2nd Ed. John-Wiley. 1985.
4. Introduction to Solid State Physics. Kittel C. 7th Ed. John-Wiley India Pvt. Ltd. 1995.
5. Solid State Physics. Pillai S. O. 6th Ed. New Age International Publishers Ltd. 2009.
6. Semiconductor physics and devices. Neamen D. 4th Ed. McGraw-Hill. 2011.

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EP-199/EP-299/EP-399/EP-499

L-T-P-C

Endeavour Project (Beyond the Syllabus)

0-0-0-3

Our University is continuously looking at innovative ways to deliver knowledge to our students, making learning & delivery mechanism innovative, interesting & easy with truly 'out of the box' teaching-learning process. This beyond the syllabus initiative uses all working second Saturdays as class days.

Endeavour is a compulsory interdisciplinary project for all students of the University. Respective Heads of the Department shall select students & form groups. Each project shall be supervised by a faculty member.

The faculty of SPSU will select a contemporary topic, which is preferably industry relevant & associate a company or professional who can provide application-oriented perspective. The topic chosen may be from wide range of subjects. For example: - Biodiversity, Social subjects, Media & advertisement, Environment, Scientific, Technical, Management, Architecture, Tourism or any other subject or their combination.

The project is evaluated in two phases: Internal Evaluation & External Evaluation. This ensures descriptive assessment of the projects performance & challenges faced during the implementation of the project. The project will be spread over two semesters beginning from the odd semester (July to November) & ending in the even semester (December to May) every year. The grade obtained in this course may be used to improve the student's semester grade point average.

The final report should include the reasons for the choice of the title, the concept, the structure, the results with working models/drawings etc. & its practicality. The role & responsibility of every individual of the group should be indicated clearly. The report should be written in the prescribed format/guidelines, certified by the faculty member & presented as a seminar.

The project is evaluated as per the approved procedure & marks obtained are computed in the even semester.

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Semester - III

(Departmental Core Subject)

CT-251	L-T-P-C
Discrete Mathematics & Graph Theory	4-0-0-4

Objective: *The purpose of this course is to understand & use discrete structures that are backbones of computer science. In particular, this class is meant to introduce logic, proofs, sets, relations, functions, counting, & probability, with an emphasis on applications in computer science.*

Course Content

Logic: Proposition, logical connectives, laws of logic, logical equivalence, rules of inference. Predicate & Quantifiers. Negations, logical equivalence with quantifiers.

Basics of Counting: Fundamental principles, Permutation & Combinations, Mathematical Induction, Recursive Definitions.

Relations & Functions: Sets, Relations, Functions, Pigeonhole Principle.

Properties of Relations: Representing Relations, Hasse diagrams, Closure of Relations, Transitive closure- Warshall's Algorithm Equivalence Relations, Partial Ordering.

Group Theory: Definition & Properties of Groups, Sub Groups, Cyclic Groups. Cosets &

Coding Theory: Cosets & Lagrange's Theorem. Coding Theory, Hamming Matrix, Parity Check & Generator Matrices.

Group codes: Group codes, Decoding with coset leaders, Hamming Matrices.

Text/Reference Books

1. Discrete and Combinatorial Mathematics. Grimaldi R.P. Pearson Education 4th Ed. Asia. New Delhi. 2002
2. Discrete Mathematics with Applications. Thomas Koshy. 1st Ed. Academic Press. 2005

3. Discrete Mathematics and its Applications. Rosen K. H. 6th Ed. Tata McGraw- Hill Publishing Company Limited. New Delhi. 2004
4. Elements of Discrete Mathematics. Liu. 4th Ed. TMH. 2004.
5. Essence of Logic. John Kelley. PHI. 2002.

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Semester - III

(Departmental Core Subject)

CT-252	L-T-P-C
Computer Architecture & Organization	4-0-0-4

Objective: *The purpose of this course is to understand how Computer Systems work & its basic principles & analyze the system performance current state of art in memory design.*

Course Content

Introduction to Digital Electronics: Basic Gates (Demorgans theorems, duality theorem, NOR,NAND,XOR,XNOR gates), Boolean expressions & logic diagrams, Types of Boolean expressions

Register Transfer & Micro-operation: Register Transfer Language, Register Transfer, Bus & Memory Transfer: Three state bus buffers, Memory Transfer. Arithmetic Micro-operations: Binary Adder, Binary Adder-Subtrator, Binary Incrementor, Logic Micro-operations: List of Logic micro operations, Shift Micro-operations (excluding H/W implementation), Arithmetic Logic Shift Unit.

Basic Computer Organization: Instruction Codes, Computer Registers: Common bus system, Computer Instructions: Instruction formats, Instruction Cycle: Fetch & Decode, Flowchart for Instruction cycle, Register reference instructions

Micro Programmed Control Unit: Control Memory, Address Sequencing, Conditional branching, Mapping of instruction, Subroutines, Design of Control Unit, Central Processing Unit: Introduction, General Register Organization, Stack Organization: Register stack, Memory stack; Instruction Formats, Addressing Modes

Computer Arithmetic: Introduction, Addition & Subtraction, Multiplication Algorithms (Booth algorithm), Division Algorithms, Input – Output Organization: Peripheral devices,

Input – Output interface, Introduction of Multiprocessors: Characteristics of multiprocessors.

Modes of Data Transfer & Memory Organization: Modes of Data Transfer: Priority Interrupt, Direct Memory Access, Memory Organization: Memory Hierarchy, Main Memory, Auxiliary Memory, Associative Memory, Cache Memory, Virtual Memory

Text/Reference Books

1. Computer System Architecture. Mano M. 3rd Ed. PHI. 2007.
2. Computer Organization and Architecture. Stallings W. 10th Ed. PHI. 2016
3. Digital Computer Electronics: An Introduction to Microcomputers. Malvino. 2nd Ed. TMH. 1984.
4. PC Hardware in a Nutshell. Thompson B. F. & Thompson R. B. O'Reilly, 2nd Ed. 2010.
5. Fundamentals of Computer Organization and Architecture. AB-EL-BARR M. & EL-REWNI H. John Wiley & Sons. 2005.
6. Fundamental Of computer Organization. Zomaya A. 2010.

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Semester - III

(Departmental Core Subject)

CT-253	L-T-P-C
Information Security Fundamentals	4-0-0-4

Objective: *The course primarily covers the Types of Threats, Vulnerabilities, Risks & various terminologies in Information Security. It explains the formation of Security policy at various levels inside the Organization & provides the definition Procedures, Standard & Guidelines. The units emphasizes the need of Performing Asset Classification & Declassification, Retention & Disposal of Information Asset also it identifies the various levels of Authorization for access Viz., Owner, Custodian & User.*

Course Content

Introduction to Information Security: Definition of Information Security, Evolution of Information Security; Basics Principles of Information Security; Critical Concepts of Information Security; Components of the Information System; Balancing Information Security & Access; Implementing IT Security, The system Development Life cycle, Security professional in the organization.

The Need for IT Security: Business Needs-Protecting the functionality, Enabling the safe operations, Protecting the data, safe guarding the technology assets; Threats-compromises to Intellectual property, deliberate software attacks, Espionage & trespass, sabotage & vandalism; Attacks-Malicious Codes, Back Doors, Denial of Service & Distributed Denial of Service, Spoofing, sniffing, Spam, Social Engineering.

Risk Management: Definition of risk management, risk identification, & risk control, Identifying & Accessing Risk, Assessing risk based on probability of occurrence & likely impact, the fundamental aspects of documenting risk via the process of risk

assessment, the various risk mitigation strategy options, the categories that can be used to classify controls.

Network Infrastructure Security & Connectivity: Understanding Infrastructure Security- Device Based Security, Media-Based Security, Monitoring & Diagnosing; Monitoring Network- Firewall, Intrusion Detection System, Intrusion Prevention system; OS & Network Hardening, Application Hardening; Physical & Network Security- Policies, Standards & Guidelines.

Text/Reference Books

1. Information Security Risk Analysis. Peltier T. R. 3rd Ed. Auerbach, 2012.
2. Operating System Concepts. Silberschatz A., Galvin P. B. & Gagne G. 8th Ed. John Wiley & Sons. 2009.
3. Information security: Principles and Practice. Stamp M. 2nd Ed. John Wiley & Sons. 2011.

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Semester - III

(Departmental Core Subject)

CT-254	L-T-P-C
Object Oriented Programming in Java	3-0-2-5

Objective: *Object oriented programming is the most proven technique for developing reliable programs. It helps in increased productivity, reusability of code, decrease in the development time, & reduces cost of production to an extent. The cost of maintaining such systems have also considerably decreased. There are many languages which used the object oriented concepts & techniques. Some of them are C++, Java, Smalltalk, Objective-C, etc. Java is a purely object oriented language. Systems/applications created using java programming language reduces the need for developing & maintain complex & space consuming applications.*

Course Content

Introduction: History, Overview of Java, Object Oriented Programming, A simple Programme, Two control statements - if statement, for loop, using Blocks of codes, Lexical issues - White space, identifiers, Literals, comments, separators, Java Key words. Data types: Integers, Floating point, characters, Boolean, A closer look at Literals, Variables, Type conversion & casting, Automatic type promotion in Expressions Arrays. Operators : Arithmetic operators, The Bit wise operators, Relational Operators, Boolean Logical operators, Assignment Operator, Operator Precedence. Control Statements: Selection Statements - if, Switch: Iteration Statements - While, Do-while, for Nested loops, Jump statements.

Classes: Class Fundamentals, Declaring objects, Assigning object reference variables, Methods, constructors, "this" keyword, finalize () method A stack class, Over loading methods, using objects as parameters, Argument passing, Returning objects,

Recursion, Access control, Introducing final, understanding static, Introducing Nested & Inner classes, Using command line arguments. Inheritance: Inheritance basics, Using super, method overriding, Dynamic method Dispatch, using abstract classes, using final with Inheritance

Packages: Definition, Access protection importing packages, Interfaces: Definition implementing interfaces. Exception Handling: Fundamental, Exception types, Using try & catch, Multiple catch clauses, Nested try Statements, throw, throws, finally, Java's Built - in exception, using Exceptions.

Multithreaded Programming: The Java thread model, The main thread, Creating a thread, Creating multiple thread, Creating a thread, Creating multiple threads, Using isalive() & Join(), Thread - Priorities, Synchronization, Inter thread communication, suspending, resuming & stopping threads, using multithreading. I/O basics, Reading control input, writing control output, Reading & Writing files, Applet Fundamentals, the AWT package, AWT Event handling concepts The transient & volatile modifiers, using instance of using assert.

JAVA Database Connectivity (JDBC): Database connectivity: JDBC architecture, JDBC Drivers, the JDBC API: loading a driver, connecting to a database, Creating & executing JDBC statements, Handling SQL exceptions, Accessing result sets: Types of result sets, Methods of result set interface. An example JDBC application to query a database.

List of Experiments

1. Write a program to check whether two strings are equal or not.
2. Write a program to display reverse string.
3. Write a program to find the sum of digits of a given number.
4. Write a program to display a multiplication table.
5. Write a program to display all prime numbers between 1 to 1000.
6. Write a program to insert element in existing array.
7. Write a program to sort existing array.
8. Write a program to create object for Tree Set & Stack & use all methods.
9. Write a program to check all math class functions.

10. Write a program to execute any Windows 95 application (Like notepad, calculator etc.)
11. Write a program to find out total memory, free memory & free memory after executing garbage Collector (gc).
12. Write a program to copy a file to another file using Java to package classes. Get the file names at run time & if the target file is existed then ask confirmation to overwrite & take necessary actions.
13. Write a program to get file name at runtime & display number of lines & words in that file.
14. Write a program to list files in the current working directory depending upon a given pattern.
15. Create a textfield that allows only numeric value & in specified length.
16. Create a Frame with 2 labels, at runtime display x & y coordinate of mouse pointer in the labels.

Text/Reference Books

1. The complete reference Java -2. Schildt H. 5th Ed. Tata McGraw Hill.
2. SAMS teach yourself Java – 2. Cedenhead R. & Lemay L. 3rd Ed. Pearson Education. 2002.

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Semester - III

(Departmental Core Subject)

CT-255	L-T-P-C
Data Structures & Algorithms	3-0-2-5

Objective: *A data structure is a particular way of storing & organizing data in a computer so that it can be used efficiently. Different kinds of data structures are suited to different kinds of applications & some are highly specialized to specific tasks. This course covers the basic concepts of different data structures which are the basic building blocks of Programming & problem solving.*

Course Content

Introduction to Data structures: Definition, Classification of data structures: primitive & non-primitive, Elementary data organization, Time & space complexity of an algorithm (Examples), String processing. Dynamic memory allocation & pointers: Definition of dynamic memory allocation, Accessing the address of a variable, Declaring & initializing pointers, Accessing a variable through its pointer, Meaning of static & dynamic memory allocation, Memory allocation functions: malloc(), calloc(), free() & realloc(). Recursion: Definition, Recursion in C (advantages), Writing Recursive programs – Binomial coefficient, Fibonacci, GCD.

Searching & Sorting: Basic Search Techniques: Sequential search: Iterative & Recursive methods, Binary search: Iterative & Recursive methods, Comparison between sequential & binary search. Sort: General background & definition, Bubble sort, Selection sort, Insertion sort, Merge sort, Quick sort

Stack & Queue: Stack – Definition, Array representation of stack, Operations on stack: Infix, prefix & postfix notations, Conversion of an arithmetic expression from Infix to postfix, Applications of stacks. Queue: Definition, Array representation of queue, Types

of queue: Simple queue, Circular queue, Double ended queue (deque) , Priority queue ,
Operations on all types of Queues

Linked List: Definition, Components of linked list, Representation of linked list,
Advantages & Disadvantages of linked list. Types of linked list: Singly linked list, doubly
linked list, Circular linked list, Operations on singly linked list: creation, insertion,
deletion, search & display.

Tree Graphs & their Applications: Definition : Tree, Binary tree, Complete binary tree,
Binary search tree, Heap Tree terminology: Root, Node, Degree of a node & tree,
Terminal nodes, Non-terminal nodes, Siblings, Level, Edge, Path, depth, Parent node,
ancestors of a node. Binary tree: Array representation of tree, Creation of binary tree.
Traversal of Binary Tree: Preorder, Inorder & postorder. Graphs, Application of Graphs,
Depth First search, Breadth First search.

List of Experiments

1. Use a recursive function to find GCD of two numbers.
2. Use a recursive function to find the Fibonacci series.
3. Use pointers to find the length of a string & to concatenate two strings.
4. Use pointers to copy a string & to extract a substring from a given a string.
5. Use a recursive function for the towers of Hanoi with three discs.
6. Insert an integer into a given position in an array.
7. Deleting an integer from an array.
8. Write a program to create a linked list & to display it.
9. Write a program to sort N numbers using insertion sort.
10. Write a program to sort N numbers using selection sort.
11. Inserting a node into a singly linked list.
12. Deleting a node from a singly linked list.
13. Pointer implementation of stacks.
14. Pointer implementation of queues.
15. Creating a binary search tree & traversing it using in order, preorder & post order.
16. Sort N numbers using merge sort.

Text/Reference Books

1. Data Structures and Algorithm Analysis in C. Weiss. 2nd Ed. Pearson Education. .2001
2. Schaum's outline series Data structures. Lipschutz. Tata McGraw-Hill.
3. Data Structures and program designing using C. Kruse. 2nd Ed. Pearson Education. 2006
4. An Introduction to Data Structures with Applications. Trembley J. P. & Sorenson P. 2nd Ed. McGraw Hill Education. 2017.
5. Programming in ANSI C. Balaguruswamy E. 6th Ed. McGraw Hill Education. 2012
6. Data Structures Using C. Bandyopadhyay. Pearson Education. 1999.
7. Data Structures Using C. Tenenbaum. 2nd Ed. Pearson Education. 1998.
8. Introduction to Data Structures in C. Kamthane. 1st Ed. Pearson Education 2005.
9. Practical approach to Data Structures. Hanumanthappa M. Laxmi Publications. Fire Wall media. 2006.
10. Data Structures using C and C++. Maoshe L. A. & Aaron M. T. Pearson Education.

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Semester - III

(Departmental Core Subject)

CT-256	L-T-P-C
Software Engineering	3-0-1-4

Objective: *Software engineering incorporates various accepted methodologies to design software. This course gives a detailed description of the entire process of developing a software project & also the issues associated after development. This course covers the introductory concepts of software engineering & its design, development & maintenance.*

Course Content

Software Product & Process: Introduction – S/W Engineering Paradigm – Verification – Validation – Life Cycle Models – System Engineering – Computer Based System – Business Process Engineering, Overview – Product Engineering Overview.

Software Requirements: Functional & Non-Functional – Software Document – Requirement Engineering Process – Feasibility Studies – Software Prototyping – Prototyping in the Software Process – Data – Functional & Behavioral Models – Structured Analysis & Data Dictionary.

Analysis, Design Concepts & Principles: Systems Engineering - Analysis Concepts - Design Process & Concepts – Modular Design – Design Heuristic – Architectural Design – Data Design – User Interface Design – Real Time Software Design – System Design – Real Time Executives – Data Acquisition System – Monitoring & Control System.

Testing: Taxonomy of Software Testing – Types Of S/W Test – Black Box Testing – Testing Boundary Conditions – Structural Testing – Test Coverage Criteria Based On Data Flow Mechanisms – Regression Testing – Unit Testing – Integration Testing –

Validation Testing – System Testing & Debugging – Software Implementation Techniques

Software Project Management: Measures & Measurements – ZIPF's Law – Software Cost Estimation – Function Point Models – COCOMO Model – Delphi Method – Scheduling – Earned Value Analysis – Error Tracking – Software Configuration Management – Program Evolution Dynamics – Software Maintenance – Project Planning – Project Scheduling– Risk Management – CASE Tools

List of Experiments

1. Study and compute different SDLC Models. Apply any model on Software (new system) Development and prepare plan for that as per applied model.
2. Prepare the Functional and Non-Functional requirements chart for online banking system / Railway reservation System / Hospital Management System.
3. Prepare Data dictionary for Employee Management System / Student Admission System /Hotel Management System with proper structure. Also create same database table practically using different RDBMS (MS Access/SQL / Oracle etc) tools.
4. Design Input Form design layout: Tabular format, Design using different input form control with proper diagram and format for Employee Management System / Student Admission System /Library Management System.
5. Design Output Form design layout: Tabular format, Graphical format, Detailed Reports and Summary Reports with proper diagram and format.
6. Prepare the Testing Plan for Software/System and write the test cases for validation of forms for any computerized system.
7. Calculate the Software Project estimation cost using COCOMO Model for any kind of system.

Text/Reference Books

1. Software engineering. Sommerville I. 7th Ed. Pearson Education Asia, 2007.
2. Software Engineering – A practitioner's Approach. Pressman R. S. 6th Ed. McGraw-Hill International Edition. 2005.

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Semester - IV

(Departmental Core Subject)

CT-257	L-T-P-C
Operating System	3-0-2-5

Objective: *The operating system is the most important program that runs on a computer. Every general-purpose computer must have an operating system to run other programs. Operating systems perform basic tasks, such as recognizing input from the keyboard, sending output to the display screen, keeping track of files & directories on the disk, & controlling peripheral devices such as disk drives & printers. This course covers the concept of operating system & its applications.*

Course Content

Introduction to Operating System: Objectives & Functions of OS, Evolution of OS, OS Structures, OS Components, OS Services, System calls, System programs, Virtual Machines. History of UNIX, Features & Benefits, Versions of UNIX, Features of UNIX File System, Commonly Used Commands & getting Started (Login/Logout) . Creating & viewing files using cat, file comparisons, View files, disk related commands, checking disk free spaces.

Process Management – Processes & Threads: Processes: Process concept, Process scheduling, Co-operating processes, Inter process Communication. Threads: Introduction to Threads, Single & Multi-threaded processes CPU Scheduling: Basic concepts, Scheduling criteria, Scheduling Algorithms, Multiple Processor Scheduling, Real-time Scheduling, Unix Process Management: The Structure of Processes: Process States & Transitions - Layout of system memory - Context of a process. Process Control: Process Creation – Signals – Process Termination – Invoking other programs – PID & PPID – Shell on a Shell.

Process Management – Synchronization & Deadlocks: Process Synchronization: Mutual Exclusion, Critical – section problem, Synchronization hardware, Semaphores, Classic problems of synchronization, Critical Regions, Monitors, OS Synchronization, Atomic Transactions. Deadlocks: System Model, Deadlock characterization, Methods for handling Deadlocks, Deadlock prevention, Deadlock Avoidance, Deadlock Detection, Recovery from Deadlock.

Storage Management: Memory Management: Logical & physical Address Space, Swapping, Contiguous Memory Allocation, Paging, Segmentation with Paging. Virtual Memory Management: Demand paging, Process creation, Page Replacement Algorithms, Allocation of Frames, Thrashing, File-System Interface: File concept, Access Methods, Directory structure, File- system Mounting, File sharing, Protection & consistency semantics. File-System Implementation: File-System structure. Directory Implementation, Allocation Methods, Free-space Management, Efficiency & Performance, Recovery. Disk Management: Disk Structure, Disk Scheduling, Disk Management, Swap-Space Management, Disk Attachment, stable-storage Implementation. The Unix File System: Inodes - Structure of a regular file – Directories - Conversion of a path name to an inode - Super block - Inode assignment to a new file - Allocation of disk blocks. System calls for the file System: Open – Read - Write - Lseek – Close - File creation - Creation of special files - Changing directory & root - changing owner & mode – stat & fstat - pipes - Dup - Mounting & Un mounting file systems - Link & Un link.

Protection & Security: Protection: Goals of Protection, Domain of Protection, Security: Security Problem, User Authentication, One – Time Password, Program Threats, System Threats,

Unix system administration: Common administrative tasks, identifying administrative files configuration & log files, Role of system administrator, Managing user accounts- adding & deleting users, changing permissions & ownerships, Creating & managing groups, modifying group attributes, Temporary disabling of user's accounts, creating & mounting file system, checking & monitoring system performance - file security & Permissions, becoming super user using su. Getting system information with uname,

host name, disk partitions & sizes, users, kernel, installing & removing packages with rpm command

List of Experiments

1. Execute 25 basic commands of UNIX.
2. Basics of functionality & modes of VI Editor.
3. WAP that accepts user name & reports if user is logged in.
4. WAP which displays the following menu & executes the option selected by user:
(a) ls (b) Pwd (c) ls -l (d) ps -fe
5. WAP to print 10 9 8 7 6 5 4 3 2 1 .
6. WAP that replaces all "*.txt" file names with "*.txt.old" in the current.
7. WAP that echoes itself to stdout, but backwards.
8. WAP that takes a filename as input & checks if it is executable, if not make it executable.
9. WAP to take string as command line argument & reverse it.
10. Create a data file called employee in the format given below:
EmpCode(Character), EmpName(Character), Grade(Character), Years of experience(Numeric), Basic Pay(Numeric).

```
$vi employee
```

```
A001      ARJUN      E1    01    12000.00
A006      Anand        E1    01    12450.00
A010      Rajesh        E2    03    14500.00
A002      Mohan         E2    02    13000.00
A005      John          E2    01    14500.00
A009      Denial Smith  E2    04    17500.00
A004      Williams     E1    01    12000.00
```

Perform the following functions on the file: Sort the file on EmpCode, Sort the file on (i) Decreasing order of basic pay (ii) Increasing order of years of experience, Display the number of employees whose details are included in the file, Display all records with 'smith' a part of employee name, Display all records with EmpName starting with 'B', Display the records on Employees whose grade is E2 & have

work experience of 2 to 5 years, Store in 'file 1' the names of all employees whose basic pay is between 10000 & 15000, Display records of all employees who are not in grade E2

Text/Reference Books

1. Operating System Concepts and design. Milonkovic M. 2nd Ed. McGraw Hill 1992.
2. Operation System Concepts. Tanenbaum. 2nd Ed. Pearson Education. 1992
3. Operating System. Silberschatz, Galvin & Gagne. 6th Ed. WSE (WILEY Publication). 2008.
4. Operating System. Stallings W. 4th Ed. Pearson Education. 2001.
5. Operating System. Deitel H. M. 2nd Ed. Pearson Education. 2002.
6. Operating System. Silberschatz A. & Galvin P. B. 8th Ed. Pearson Education 1989 (Chapter 1,3.1,3.2,3.3,3.4,3.6,4,5,6 (Except 6.8,6.9), 7, 8,9,10,11,13, (Except 13.6) 19 (Except 19.6),20(Except 20.8, 20.9), 22,23).
7. Operating Systems. Nutt 3rd Ed. Pearson Education. 2004.

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Semester - IV

(Departmental Core Subject)

CT-258
Computer Networks

L-T-P-C
4-0-0-4

Objective: *It is important for networking professionals to have a sound grounding in the basics of networking & with the networking technology being developed thick & fast, the professionals need to be updated of them at all times. The focus of this unit is providing a background to the basics of networking & its underlying principles. The learners taking this unit will explore the fundamentals of networking, the principle & purpose behind layered models.*

Course Content

Overview of the Internet: Protocol, Layering Scenario, TCP/IP Protocol Suite: The OSI Model, Internet history standards & administration; Comparison of the OSI & TCP/IP reference model.

Physical Layer: Guided transmission media, wireless transmission media.

Data Link Layer - design issues, CRC codes, Elementary Data Link Layer Protocols, sliding window protocol

Multi Access Protocols - ALOHA, CSMA, Collision free protocols, Ethernet- Physical Layer, Ethernet Mac Sub layer, data link layer switching & use of bridges, learning bridges, spanning tree bridges, repeaters, hubs, bridges, switches, routers & gateways.

Network Layer: Network Layer Design issues, store & forward packet switching connection less & connection oriented networks-routing algorithms-optimality principle, shortest path, flooding, Distance Vector Routing, Control to Infinity Problem, Hierarchical Routing, Congestion control algorithms, admission control.

Internetworking: Tunneling, Internetwork Routing, Packet fragmentation, IPv4, IPv6 Protocol, IP addresses, CIDR, ICMP, ARP, RARP, DHCP.

Transport Layer: Services provided to the upper layers elements of transport protocol-addressing connection establishment, connection release, Connection Release, Crash Recovery.

The Internet Transport Protocols: UDP-RPC, Real Time Transport Protocols, The Internet Transport Protocols- Introduction to TCP, The TCP Service Model, The TCP Segment Header, The Connection Establishment, The TCP Connection Release, The TCP Connection Management Modeling, The TCP Sliding Window, The TCP Congestion Control, The future of TCP.

Application Layer- Introduction, providing services, Applications layer paradigms, Client server model, Standard client-server application-HTTP, FTP, electronic mail, TELNET, DNS, SSH.

Text/Reference Books

1. Data Communications and Networking. Forouzan B. A. 5th Ed. TMH, 2013.
2. Computer Networks. Tanenbaum A. S. 4th Ed. Pearson Education.
3. An Engineering Approach to Computer Networks. Keshav S. 2nd Ed. Pearson Education.
4. Understanding communications and Networks. Shay W. A. 3rd Ed. Cengage Learning.
5. Introduction to Computer Networks and Cyber Security. Wu C. H. & Irwin J. D. CRC Press.
6. Computer Networks. Peterson L. L. & Davie B. S. 4th Ed. Elsevier.
7. Computer Networking: A Top-Down Approach Featuring the Internet. Kurose J. F. & Ross K. W. 3rd Ed. Pearson Education.

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Semester - IV

(Departmental Core Subject)

CT-259
RDBMS

L-T-P-C
3-0-2-5

Objective: *The following are the main topics to be covered in this course: Evolving Role of Software, Software Characteristics, Components & Applications, Process, Methods, & Tools, Generic View of Software Engineering, Software Process Models & Evolutionary Software Models. System Engineering, Analysis Concepts & Principles, Analysis Modeling, Design Concepts & Principles, Design Methods, Software Testing. The Management Spectrum, People, Problem, Process & the Project; Software Process & Project Metrics, Software Measurement, Metrics For Software Quality, Software Project Planning, Risk Management, Project Scheduling & Tracking, Software Quality Assurance & Software Configuration Management. Software Reuse & Reengineering.*

Course Content

Introduction: Purpose of Database System -- Views of data – Data Models – Database Languages — Database System Architecture – Database users & Administrator – Entity– Relationship model (E-R model) – E-R Diagrams -- Introduction to relational databases.

Relational Model: The relational Model – The catalog- Types– Keys - Relational Algebra – Domain Relational Calculus – Tuple Relational Calculus - Fundamental operations – Additional Operations- SQL fundamentals. Oracle data types, Data Constraints, Column level & table Level Constraints, working with Tables. Defining different constraints on the table, Defining Integrity Constraints in the ALTER TABLE Command, Select Command, Logical Operator, Range Searching, Pattern Matching, Oracle Function, Grouping data

from Tables in SQL, Manipulation Data in SQL. Joining Multiple Tables (Equi Joins), Joining a Table to itself (self Joins), Sub queries Union, intersect & Minus Clause, Creating view, Renaming the Column of a view, Granting Permissions, - Updating, Selection, Destroying view Creating Indexes, Creating & managing User Integrity – Triggers - Security – Advanced SQL features –Embedded SQL– Dynamic SQL- Missing Information– Views – Introduction to Distributed Databases & Client/Server Databases Database Design: Functional Dependencies – Non-loss Decomposition – Functional Dependencies – First, Second, Third Normal Forms, Dependency Preservation – Boyce/Codd Normal Form-Multi-valued Dependencies & Fourth Normal Form – Join Dependencies & Fifth Normal Form Transactions: Transaction Concepts - Transaction Recovery – ACID Properties – System Recovery – Media Recovery – Two Phase Commit - Save Points – SQL Facilities for recovery –Concurrency – Need for Concurrency – Locking Protocols – Two Phase Locking – Intent Locking – Deadlock- Serializability – Recovery Isolation Levels – SQL Facilities for Concurrency.

List of Experiments

1. Create User in Oracle Database & grant & revoke the privileges & use of commit savepoint rollback command
2. Create the following: Synonym sequences & Index, Create alter & update views
3. Create PL/SQL program using cursors, control structure, exception handling
4. Create following: Simple Triggers, Package using procedures & functions.
5. Create the table for
 - OMPANY database
 - STUDENT database & Insert five records for each attribute.
6. Illustrate the use of SELECT statement
7. Conditional retrieval - WHERE clause
8. Query sorted - ORDER BY clause

9. Perform following: UNION, INTERSECTION & MINUS operations on tables & UPDATE, ALTER, DELETE, DROP operations on tables
10. Query multiple tables using JOIN operation.
11. Grouping the result of query - GROUP BY clause & HAVING clause
12. Query multiple tables using NATURAL & OUTER JOIN operation.

Text/Reference Books

1. Database System Concepts. Silberschatz A. Korth H. F. & Sudharshan S. 5th Ed. Tata McGraw Hill. 2006.
2. Fundamentals of Database Systems. RamezElmasri & Navathe S. B. 4th Ed. Pearson/Addision Wesley. 2007.
3. Database Management Systems. Ramakrishnan R. 3rd Ed. McGraw Hill. 2003.

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Semester - IV

(Departmental Core Subject)

CT-260	L-T-P-C
Hardware Architecture & Programming Concepts	4-0-0-4

Objective: *Hardware architecture is the representation of an engineered electronic or electromechanical hardware system, & the process & discipline for effectively implementing the design for such a system. It is generally part of a larger integrated system encompassing information software & device.*

Course Content

Introduction to Hardware architecture & programming concepts: PC Components. Microprocessor – history of microprocessors, transistor, IC, evolution of microprocessors. Microcontrollers – history. System software & machine architecture, simplified instructional computer (SIC), assembler, loader, linker, macro processor, compilers

Microprocessor: Moore's law, Microprocessor architecture, 8085, 8-bit, 12-bit, 16-bit, 32-bit, & 64-bit microprocessor, 8085, 8086, RISC microprocessor, multi-core processors, register sets, addressing modes

Microcontrollers: Embedded systems, embedded design, Types of microcontrollers, memory technologies, 8051 – architecture, serial communication, interrupts. 8096 – Instruction sets & programming, hardware features.

Assemblers: Basic assembler function, SIC assembler, Machine dependent assembler features, machine independent assembler features, one pass assembler, multi-pass assembler, MASM assembler

Loaders, Linkers & Compilers: Basic loader function, Bootstrap loader, Machine dependent loader, machine independent loader, program linking, linkage editor,

dynamic linkage. Compilers – function, machine dependent & machine independent compilers.

Text/Reference Books

1. Microprocessors and interfacing. Hall D. V. 2nd Ed.(Rev.) TMH 2006.
2. The 8051 Microcontroller and Embedded Systems, Using assembly and C. Mazidi M. A., Mazidi J. G. & McKinlay R. D. 2nd Ed. Pearson. 2007.
3. The 8051 Microcontroller architecture, programming & Applications. Ayala K. J. 3rd Ed. Thomson Learning. 2004.
4. System Software. Beck L. L. 3rd Ed. Pearson Education. 1997.
5. Lex and Yacc. Levine J. R., Mason T. & Brown D. 2nd ed. O'Reilly SPD 2012.
6. System Programming and Operating Systems. Dhamdhare D. M. 2nd Ed. Tata McGraw Hill. 1999.

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Semester - V

(Departmental Core Subject)

CT-351	L-T-P-C
Cloud Technology	3-0-2-5

Objective: *Cloud computing is a colloquial expression used to describe a variety of different computing concepts that involve a large number of computers involves a large number of computers that are connected through a real-time communication network. In science, cloud computing is a synonym for distributed computing over a network & means the ability to run a program on many connected computers at the same time. This course covers basic concepts of cloud types, services & security etc*

Course Content

Introduction: Introduction to Cloud Computing, History & Evolution of Cloud Computing, Types of clouds, Private Public & hybrid clouds, Cloud Computing architecture, Cloud computing infrastructure, Merits of Cloud computing, , Cloud computing delivery models & services (IaaS, PaaS, SaaS), obstacles for cloud technology, Cloud vulnerabilities, Cloud challenges, Practical applications of cloud computing.

Cloud Computing Companies & Migrating to Cloud : Web-based business services, Delivering Business Processes from the Cloud: Business process examples, Broad Approaches to Migrating into the Cloud, The Seven-Step Model of Migration into a Cloud, Efficient Steps for migrating to cloud., Risks: Measuring & assessment of risks, Company concerns Risk Mitigation methodology for Cloud computing, Case Studies

Cloud Cost Management & Selection of Cloud Provider: Assessing the Cloud: software Evaluation, System Testing, Seasonal or peak loading, Cost cutting & cost-benefit analysis, Selecting the right scalable application. Considerations for selecting cloud solution. Understanding Best Practices used in selection of Cloud service & providers,

Clouding the Standards & Best Practices Issue: Interoperability, Portability, Integration, Security, Standards Organizations & Groups associated with Cloud Computing, Commercial & Business Consideration

Governance in the Cloud: Industry Standards Organizations & Groups associated with Cloud Computing, Need for IT governance in cloud computing, Cloud Governance Solution: Access Controls, Financial Controls, Key Management & Encryption, Logging & Auditing, API integration. Legal Issues: Data Privacy & Security Issues, Cloud Contracting models, Jurisdictional Issues Raised by Virtualization & Data Location, Legal issues in Commercial & Business Considerations

Ten cloud do's & do not's.: Don't be reactive, do consider the cloud a financial issue, don't go alone, do think about your architecture, don't neglect governance, don't forget about business purpose, do make security the centerpiece of your strategy, don't apply the cloud to everything, don't forget about Service Management, do start with a pilot project.

Text/Reference Books

1. Cloud Computing: Principles and Paradigms. Buyya R. K., Broberg J. & Goscinski A. M. John Wiley & Sons Publications. 2011.
2. Brief Guide to Cloud Computing. Barnett C. Constable & Robinson Limited, 2010.
3. Handbook on Cloud Computing. Furht B. & Escalante A. Springer. 2010.

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Semester - V

(Departmental Core Subject)

CT-352
Principles of Virtualization

L-T-P-C
3-0-2-5

Objective: *Virtualization is the single most effective way to reduce IT expenses while boosting efficiency & agility in organizations. This unit explores the implementation & usage of VMWare Virtualization, its installation process & the working of Windows Server hyper V.*

Course Content

Basics of Virtualization

Understanding Virtualization, Need of Virtualization & Virtualization Technologies: Server Virtualization, Storage Virtualization, I/O Virtualization, Network Virtualization, Client Virtualization, Application virtualization, Desktop virtualization, Understanding Virtualization Uses: Studying Server Consolidation, Development & Test Environments , Helping with Disaster Recovery

Deploying & Managing an Enterprise Desktop Virtualization Environment

configure the BIOS to support hardware virtualization; Install & configure Windows Virtual PC: installing Windows Virtual PC on various platforms (32-bit, 64-bit), creating & managing virtual hard disks, configuring virtual machine resources including network resources, preparing host machines; create, deploy, & maintain images

Deploying & Managing a Presentation Virtualization Environment

Prepare & manage remote applications: configuring application sharing, package applications for deployment by using RemoteApp, installing & configuring the RD Session Host Role Service on the server.

Accessing Published Applications

Access published applications: configuring Remote Desktop Web Access, configuring role-based application provisioning, configuring Remote Desktop client connections. Configure client settings to access virtualized desktops: configuring client settings

Understanding Virtualization Software

List of virtualization Software available. Vmware- introduction to Vsphere, ESXi, VCenter Server & Vsphere client. Creating Virtual Machine.. Introduction to HYPER-V role. Create Virtual Machines. Create Hyper-v virtual networking, Use virtual Machine Snapshots. Monitor the performance of a Hyper-v server, Citrix XENDesktop fundamentals

List of Experiments

1. Installing VMware ESXi server.
2. Accessing ESXi through vSphere Client & Uploading ISO Images of OS into the Datastore of ESXi Server.
3. Creating Virtual machines in the ESXi Server
4. Monitoring the performance of ESXi Server.
5. Preparing Domain for vCenter Server as prerequisite.
6. Installing vCenter Server
7. Creating Datacenter & adding ESXi Server as Host to vCenter Server.
8. Cloning a Virtual Machine & Creating a Virtual Machine from cloned VM Template.
9. Configuring vNetwork Distributed Switch using vCenter Server.
10. Assigning permissions to users on Datacenter

Text/Reference Books

1. Virtualization with Microsoft Virtual Server 2005. Grotenhuis T. et al. Syngress Publications. 2006.
2. Virtualization--the complete cornerstone guide to virtualization best practices. Menken I. & Blokdijk G. Lightning Source Incorporated. 2008.
3. Virtualization: From the Desktop to the Enterprise. Wolf C. & Halter E. M. EBook. 2005.

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Semester - VI

(Departmental Core Subject)

CT-353
Storage Technology

L-T-P-C
3-0-0-3

Objective: *Data is all around us, in different forms & amounts. As we are stepping into the revolutionizing world of advanced computing, data storage also has to undergo many transformations in terms of techniques & hardware used for the same. This makes it significant for a computer student to learn different aspects of data storage. In this course, students will learn fundamentals of data storage, covering topics like demands on data, how storage techniques have evolved over a period of time & vital information about storage topologies like DAS, NAS & SAN, along with their comparison features.*

Course Content

Introduction to Information storage & Management:
Information Storage: Data – Types of Data –Information - Storage , Evolution of Storage Technology & Architecture, Data Center Infrastructure - Core elements- Key Requirements for Data Center Elements -Managing Storage Infrastructure, Key Challenges in Managing Information, Information Lifecycle - Information Lifecycle Management - ILM Implementation -ILM Benefits ,Summary

Storage System Environment: Components of a Storage System Environment – Host – Connectivity – Storage, Disk Drive Components –Platter – Spindle - Read/Write Head - Actuator Arm Assembly - Controller - Physical Disk Structure - Zoned Bit Recording - Logical Block Addressing , Disk Drive Performance -1 Disk Service Time , Fundamental Laws Governing Disk Performance , Logical Components of the Host -

Operating System - Device Driver -Volume Manager - File System – Application ,
Application Requirements & Disk Performance, Summary .

Backup & Recovery:

Backup Purpose -Disaster Recovery - Operational Backup –Archival, Backup
Considerations, Backup Granularity, Recovery Considerations, Backup Methods ,
Backup Process, Backup & Restore Operations, Backup Topologies - Serverless
Backup , Backup Technologies -Backup to Tape - Physical Tape Library - Backup to
Disk - Virtual Tape Library

Local Replication: Source & Target -Uses of Local Replicas, Data Consistency -
Consistency of a Replicated File System - Consistency of a Replicated Database ,
Local Replication Technologies - Host-Based Local Replication - Storage Array-Based
Replication , Res tore & Restart Considerations - Tracking Changes to Source &
Target , Creating Multiple Replicas, Management Interface

Managing the storage Infrastructure:

Monitoring the Storage Infrastructure -Parameters Monitored - Components Monitored -
Monitoring Examples - Alerts, Storage Management Activities - Availability
management - Capacity management - Performance management - Security
Management - Reporting- Storage Management Examples, Storage Infrastructure
Management Challenges

Text/Reference Books

1. Storage Networks: The Complete Reference. Spalding R. Tata McGraw Hill
Publication. 2003.
2. Information Storage and Management: Storing, Managing, and Protecting Digital
Information. 1st Ed. EMC Education Services, Wiley. 2009.

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Semester - VI

(Departmental Core Subject)

CT-354	L-T-P-C
Installation & Configuration of Server	3-0-2-5

Objective: *Windows Server 2012 R2 Foundation is an operating system that enables core IT resources, such as file & print sharing, remote access, & security. It provides a network foundation from which you can centrally manage settings on your computers that are based on the Windows® operating system, & upon which you can run the most popular business applications. This course explores the method to install, upgrade, & deploy the Windows Server. Also, the learners will have the functional knowledge of configuring core network services & the active directory of Windows Server. This course provides the knowledge & skills necessary to plan & implement a Windows Server 2012 & Windows Server 2012 R2 environment. It incorporates both the planning of the server infrastructure & key aspects of the implementation, management & maintenance of Active Directory & Network Infrastructure. It covers the most important job tasks for Server Administrators who are responsible for the planning, operations, & day-to-day maintenance of Windows Server 2012 & Windows Server 2012 R2 servers in the enterprise.*

Course Content

Installing & Configuring Servers

Selecting a Windows Server 2012

Edition, Supporting Server Role, Supporting Server Virtualization, Server Licensing.

Installing Windows Server 2012: System Requirement, Performing a Clean Installation,

Installing Third-Party Drivers, Working with Installation Partitions, Using Server Core,

Server Core Defaults, Server Core Capabilities, Using the Minimal Server Interface,

Upgrade paths, Preparing to Upgrade Installation, Installing Windows Server Migration Tools.

Configuring Servers: Completing Post-Installation Tasks & GUI Tools, Converting Between GUI & Server, Configuring NIC Teaming, Using Roles, Features, & Services, Using Roles Manager, Adding Roles & Features, Deploying Roles to VHDs, Configuring Services.

Configuring Local Storage: Planning Server Storage, Determining the Number of Servers Needed, Estimating Storage Requirements, Selecting a Storage Technology, Selecting a Physical Disk Technology, Using External Drive Arrays, Planning for Storage Fault Tolerance, Using Disk Mirroring, Using RAID, Using Storage Spaces, Understanding Windows Disk setting, selecting a Partition style, understanding disk & Volume Types, Choosing a Volume Size, Understanding File System, Working with Disks, Adding a New Physical Disk, Creating & Mounting VHDs, Storage Pool, Virtual Disks, Simple Volume, Creating a Striped, Spanned, Mirrored, or RAID-5 Volume, Extending & Shrinking Volumes & Disks.

Configuring File & Share Access: Designing a File-Sharing Strategy, Arranging Shares, Controlling Access, Mapping Drives, Creating Folder Shares, Assigning Permissions, Understanding the windows Permission Architecture & Basic, Advanced Permissions, Allowing & Denying Permissions, Inheriting Permissions, Understanding Effective Access, Setting Share Permissions, Understanding NTFS Authorization, Assigning Basic NTFS Permissions, Understanding Resource Ownership, Combining Share & NTFS Permissions.

Configuring Print, Document Services, Servers for Remote Management.

Understanding the Windows Print Architecture & Printing, Server Printing Flexibility, sharing a Printer Drivers & Managing Printer Drivers, Using Remote Access Easy Print, Configuring Printer Security, Adding Printer Servers, Deploying Printers with Group Policy, Adding Server & Workgroup Servers, Calibrating Server Manager Performance, Configuring WinRM & Windows Firewall, Creating Server Groups, Using Remote Server Administration Tools, Using Windows PowerShell Web Access, Installing Windows PowerShell Web Access, Configuring the Windows PowerShell Web Access

Gateway, Configuring a Test Installation, Customizing a Gateway Installation, Creating Authorization Rules, Working with Remote Servers.

Creating & Configuring Virtual Machine Settings & Storage

Virtualization Architectures, Hyper-V Implementations & Licensing, Hyper-V Hardware Limitations & Server, Installing Hyper-V, Using Hyper-V Manager, Creating a VM, Installing an Operating System, Configuring Guest Integration Services, Allocating Memory, Using Dynamic Memory, working with Virtual Disks, Understanding Virtual Disk Formats, Creating Virtual Disks, Creating a New Virtual Disk, Adding Virtual Disks to Virtual Machines, Creating Differencing Disks, Configuring Pass-Through Disks, Modifying Virtual Disks, Creating Snapshots, Connecting to a SAN, Connecting Virtual Machines to a SAN.

List of Experiments

1. Installation windows Server 2012.
2. Configuration for Windows Server.
3. Configuration Local Storage for Windows Server.
4. Configuration File & Share Access for Windows Server.
5. Configuration Print & Document Services for Windows Server.
6. Configuration windows server for Remote Management.
7. Creating Virtual Machine in Windows Server.
8. Configuration & Setting Virtual Machine.

Text/Reference Books

1. Windows Server 2012: A Handbook for Professionals. Raj A. CreateSpace Independent Publishing Platform. 2015.
2. MCSA 70-410 Cert Guide R2: Installing and Configuring Windows Server 2012 (Certification Guide) Hardcover – Import, 12 Sep 2014. Poulton D. & Camardella D.
3. Installing and Configuring Windows Server 2012. Zacker C. 1st Ed. Microsoft Press US. 2013.
4. Mastering Windows Server 2012 R2. Minasi M., Greene K., Booth C. & Butler R. Sybex. 2013.

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Semester - VI

(Departmental Core Subject)

CT-355
Cyber Forensics

L-T-P-C
3-0-2-5

Objective: *Cyber Forensics deals with the development of tools & software to gather evidences from computers, without corrupting the information contained. A relatively new field, it is quickly gaining momentum as the complexities in the crimes are on the rise & it has become imperative to treat each cybercrime with diligence. Students are taught about different forms of cybercrime & its implications & duties of professionals employed at different levels towards analyzing & controlling cybercrime. Methods to recover data from storage devices are covered in following chapters. Different forensic techniques & cyber laws are also dealt in detail.*

Course Content

Computer Forensics: Introduction to Computer Forensics, Forms of Cyber Crime, First Responder Procedure- Non-technical staff, Technical Staff, Forensics Expert & Computer Investigation procedure

Storage Devices & Data Recover Methods

Storage Devices- Magnetic Medium, Non-magnetic medium & Optical Medium. Working of Storage devices-Platter, Head assembly, spindle motor. Data Acquisition, Data deletion & data recovery method & techniques

Forensics Techniques

Windows forensic, Linux Forensics, Mobile Forensics, Steganography, Application Password cracking-Brute force, Dictionary attack, Rainbow attack. Email Tacking – Header option of SMTP, POP3, IMAP

Cyber Law

Corporate espionage, Evidence handling procedure, Chain of custody, Main features of Indian IT Act 2008 (Amendment)

Forensic Analysis of Web Server

Developing, administering & managing a remotely hosted web site, Use of HTML browsers on ports other than 80, Control Panel – Forensics traces left on web site admin machine, traces left on hosting servers. Anti-Forensics Techniques – Methods used to thwart subsequent forensics analysis, Forensics traces left, Approaches that may be used to reduce the effectiveness of these methods. Internet & Web attack forensics

List of Experiments

1. Physical Collection of electronic evidence using forensic standards
2. Dismantling & re-building PCs in order to access the storage media safely
3. Boot sequence & Power On Self-Test mode analysis
4. Examination of File systems of Windows
5. Examination of File systems of Linux
6. Examination of File systems of Mac
7. Analyzing Word processing & Graphic file format
8. Network data sniffing & analyzing
9. Password & encryption techniques
10. Internet forensic & Malware analysis
11. Data recovery techniques for hard drive
12. Data recovery techniques for Pen drive & CD

Text/Reference Book

1. Guide to Computer Forensics and Investigations. Nelson B., Steuart C. & Phillips A. 4th Ed. Cengage Learning. 2009.

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Semester - VI

(Departmental Core Subject)

CT-356	L-T-P-C
Mobile Wireless & VOIP Security	3-0-0-3

Objective: *Basic understanding of security in wireless world is very important for any IT Security Professional. As organizations are increasingly adapting VoIP for converged messaging, call centres & interactive multimedia collaboration, implementing security principles is vital for maintaining confidentiality & privacy. This course covers the basics of mobile communication, security in wireless communication, VoIP security & mobile forensics.*

Course Content

Introduction to Mobile communication: Mobile & Telecommunication protocols & their vulnerabilities, Gain knowledge of managerial, technical & procedural controls to address Mobile & Telecommunication vulnerabilities

Wireless Security: Wireless protocols & their vulnerabilities, Gain knowledge of managerial, technical & procedural controls to address Wireless vulnerabilities

Voice over Internet Protocol (VOIP) Security

VOIP concepts, protocols & vulnerabilities, Gain knowledge of managerial, technical & procedural controls to address VOIP vulnerabilities

Mobile Forensics & Data Extraction: Mobile forensics process including seizure, data acquisition types like Physical, Logical, Manual, External & Internal memory, storage, analysis using tools & techniques

Text/Reference Books

1. Information Systems Security: Security Management, Metrics, Frameworks and Best Practices. Godbole N. Wiley. 2009.
2. Network Security Bible. Cole E. 2nd Ed. Wiley. 2009.

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Semester - VII

(Departmental Core Subject)

CT-451

Data Center

L-T-P-C

3-0-0-3

Objective: *This course covers the significance, setting-up & Services provided by data centers. Data center fundamentals helps students to understand the basic concepts of Data center architecture, network infrastructure in a Data center, server frames fault tolerance, Data center availability, network implementation & disaster recovery.*

Course Content

Overview of Data Centers: Data Centers Defined, Data Center Goals, Data Center Facilities, Roles of Data Centers in the Enterprise, Roles of Data Centers in the Service Provider Environment, , Application Architecture Models. The Client/Server Model & Its Evolution, The n-Tier Model, Multitier Architecture Application Environment, Data Center Architecture

Data Center Requirements: Data Center Prerequisites, Required Physical Area for Equipment & Unoccupied Space, Required Power to Run All the Devices, Required Cooling & HVAC, Required Weight, Required Network Bandwidth, Budget Constraints, Selecting a Geographic Location, Safe from Natural Hazards, Safe from Man-Made Disasters, Availability of Local Technical Talent, Abundant & Inexpensive Utilities Such as Power & Water, Selecting an Existing Building (Retrofitting), tier standard

Data Center Design: Characteristics of an Outstanding Design, Guidelines for Planning a Data Center, Data Center Structures, No-Raised or Raised Floor, Aisles, Ramp, Compulsory Local Building Codes, Raised Floor Design & Deployment, Plenum, Floor Tiles, Equipment Weight & Tile Strength, Electrical Wireways, Cable Trays, Design & Plan against Vandalism

Introduction to Server Farms: Types of server farms & data centre, internet server farm, intranet server farm, extranet server farm , internet data center, corporate data center, software defined data center, data center topologies, Aggregation Layer, Access Layer, Front-End Segment, Application Segment, Back-End Segment, Storage Layer, Data Center Transport Layer, Data Center Services, IP Infrastructure Services, Application Services, Security Services, Storage Services

Business Continuity & Disaster Recovery fundamentals: Business continuance infrastructure services, the need for redundancy, Information availability , BC terminology , BC planning life cycle , BC technology solutions , backup & recovery considerations , backup technologies , Uses of local replicas , Local replication technologies , Restore & restart considerations , Modes of remote replications , remote replication technologies

Text/Reference Books

1. IP Storage Networking. Oreinstein G. Addison Wesley Professional. 2006.
2. Information Storage and Management. Somasundaram G. & Srivastava A. 1st Ed. Wiley. 2009.
3. Administering Data-Centers. Jayswal K. 1st Ed. Wiley. 2005.

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Semester - VII

(Departmental Core Subject)

CT-452	L-T-P-C
Cloud Computing Solutions	3-0-2-5

Objective: *Windows Azure is a Cloud computing solution. It is a cloud computing platform & infrastructure, for building, deploying & managing applications & services through a global network of Microsoft-managed data centers. This course introduces the students to Windows Azure, help them to create websites in Azure, query using SQL, etc.*

Course Content

Introduction: Introduction to MS. Azure, Virtual Machines: Creating Virtual Machines, Difference Between Basic & Standard VMs, Logging in to a VM & Working, Attaching an empty Hard Disk to VM, Hosting a Website in VM , Configuring End Points, Scaling up & Down, Creating a custom Image from VM, Creating a VM from a custom Image, Shut down VM without Getting Billed, VM Pricing

Managing Infrastructure in Azure: Azure Virtual Networks, Highly Available Azure Virtual Machines, Virtual Machine Configuration Management, Customizing Azure Virtual Machine Networking. Load Balancing: Creating Cloud Services, Adding Virtual Machines to a Cluster, Configuring Load Balancer.

Windows Azure

Azure Storage: What is a Storage Account, Advantages, Tables, blobs, queues & drives, Azure Appfabric: Connectivity & Access control Automation: Introduction Windows Power Shell ,Creation of Runbooks, Uploading a Shell Script, Authoring a Shell Script.

SQL Azure: Creating a SQL Server, Creating a SQL DB, Creating Tables, Adding Data to the Tables, View Connection Strings, Security Configurations, Migrating on premise DB to SQL Azure.

Websites: Creating a Website, Setting deployment credentials, Choosing a platform, Setting up Default page for website, Scaling ,Auto Scaling by Time, Auto Scaling by Metric, Difference between Free, Shared, Basic & Standard websites, Creating a website using Visual studio

List of Experiments

1. Create & document the process of creating a windows azure account
2. Create a virtual machine from the gallery of windows server 2008 R2
3. Create a virtual machine using the option “quick Create”
4. Create a custom VM & Capture the image
5. Create a vm from a captured image
6. Add a VMs to a cluster & deploy load balancer on the same
7. Create & publish / host a webpage in windows azure
8. Create a website using Visual studio
9. Create a SQL server DB , Create tables & add data to the table
10. Test basic sql commands on the table created in the previous step.
11. Migrate an on premise DB to Azure
12. Create a storage account in Azure

Text/Reference Books

1. Cloud Computing Bible. Sosinsky B. Wiley-India. 2010.
2. Cloud Computing: Principles and Paradigms. Buyya R., Broberg J. & Goscinski A. M. Wiley. 2011.
3. Windows Azure Step By step. Brunetti R. 1st Ed. Microsoft Press US. 2011.

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Semester - VII

(Departmental Core Subject)

CT-453
Cloud Security

L-T-P-C
3-0-0-3

Objective: *As cloud computing security to escalate in importance and evolve, it is important that enterprises understand how to best handle the paradigm change in business operations that the cloud presents. This level of understanding will enable enterprises to maximize the benefits that cloud platforms offer, while simultaneously addressing the cloud's unique and emerging threats and vulnerabilities.*

Course Content

Introduction to Cloud Security: Cloud Services, Cloud Services Implementation, Biggest cloud vendors and their location, The effects on security of the cloud distributed across various locations on the globe, Current state of cloud security, Security policies to be implemented while dealing with security on the cloud

Tackling Cloud Security: Benefits of implementing cloud security in private cloud ,Evidence detection feasibility in case of cyber crime on the cloud, Issues of e – Discovery in the cloud, Conducting forensics on the cloud, Open source security issues and tackling mechanism.

Security Levels & Issues: Infrastructure Security, Network level security, Host level security, Application level security, Data security and Storage, Data privacy and security Issues

Access Management: Jurisdictional issues raised by Data location, Identity & Access Management, Access Control, Trust, Reputation, Risk, Authentication in cloud computing, Client access in cloud, Cloud contracting Model, Commercial and business considerations

Commercial Clouds: Open Source & Commercial Clouds: Eucalyptus, Microsoft Azure, Amazon EC2

Text/Reference Books

1. Cloud Security: A Comprehensive Guide to Secure Cloud Computing. Krutz R. L. & Vines R. D. Wiley-India. 2010.
2. Cloud Computing. Miller M. Pearson Education. New Delhi. 2009.

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Semester - VII

(Departmental Core Subject)

CT-454
Ethical Hacking

L-T-P-C
3-0-2-5

Objective: *The course primarily covers the Ethical hacking methodology & its different stages which include the Foot printing, Scanning, Enumeration & System hacking techniques & a broad knowledge about white box & black box testing. The Unit describes a wide range of attacks that can cause adverse negative effects on IT systems that include Denial of service, Session hijacking & severe vulnerabilities that can be seen in Web Applications.*

Course Content

Introduction to Ethical Hacking: Hacking Methodology, Process of Malicious hacking. Footprinting & Scanning: Footprinting, Scanning. Enumeration: Enumeration. System hacking & Trojans: System hacking, Trojans & Black Box Vs White Box Techniques.

Attacking Methodology

Denial of Service, Sniffers. Session hijacking & hacking Web Servers: Session hijacking, hacking Web Servers. Web Application Vulnerabilities & Web Techniques Based Password Cracking: Web Application Vulnerabilities, Web Based Password Cracking Techniques.

Web & Network Hacking: SQL Injection, hacking Wireless Networking. Viruses, Worms & Physical Security: Viruses & Worms, Physical Security. Linux hacking: Linux hacking. Evading IDS & Firewalls: Evading IDS & Firewalls.

Report writing & Mitigation: Introduction to Report Writing & Mitigation, requirements for low level reporting & high level reporting of Penetration testing results, Demonstration of vulnerabilities & Mitigation of issues identified including tracking

List of Experiments

1. Passive Reconnaissance using “Who is” & Online tools
2. Active Reconnaissance using “Sampad” & web site details
3. Full Scan, half Open Scan & Stealth scan using “nmap”
4. UDP & Ping Scanning using “Advance Lan Scanner” & “Superscan”
5. Packet crafting using “Packet creator” tools
6. Exploiting NetBIOS vulnerability
7. Password Revelation from browsers & social networking application
8. Creating & Analyzing spoofed emails
9. Creating & Analyzing Trojans
10. OS password cracking

Text/Reference Books

1. Hacking Exposed. McClure S., Scambray J. & Kurtz G. 7th Ed. McGraw Hill. 2010.
2. Basic of hacking and Penetration Testing. Engerbrestson P. Elsevier. 2010.
3. Certified Ethical Hacker All-in-One. Walker M. McGraw-Hill. 2011.

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Semester - VII

(Departmental Core Subject)

CT-456	L-T-P-C
Application, Web Security & SDLC	4-0-0-4

Objective: *Its deals with information security principles & implementation rite from start of Software development life cycle & application Security software life cycle.*

Course Content

Phases in Software Development Life Cycle: System Development & Management of Development, Life-Cycle Phases including Project Initiation, Functional Design analysis & Planning, System Design specifications, Software development, Installation & Implementation, Operational Maintenance & Disposal, Separation of duties in the application development lifecycle in the development, testing & Production environments.

Introduction to Web Security & its Application : Different environments demand different security, Environment versus Application controls, Complexity of Functionality, Data Types, formats & Length, Implementation & Default Issues, Failure states, common web security vulnerabilities, OWASP top 10 threats & counter measures

Features of Java & its Security: Enterprise Java Beans, Expert Systems & Knowledge-Based Systems, Artificial Neural Networks, Object code versus Machine code, Features of Java, Java Security, Active X & Component Object Model (COM), Security issues resulting from Logic Bombs, Malware & Trojan Horses & their impact on Applications

Web attacks & trends: Introduction to Web Attacks & Trends, URL Interpretation attacks, Input Validation attacks, SQL Injection attacks, Impersonation attacks & Buffer Overflow attacks, their effects & the technical & managerial controls to be put in place to address such attacks

Web commerce Security: Overview of e-commerce & m-commerce; important concepts; attacks; countermeasures

Text/Reference Book

1. Information Systems Security: Security Management, Metrics, Frameworks and Best Practices. Godbole N.

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Semester - VII

(Departmental Core Subject)

CT-450	L-T-P-C
Summer Internship/Industry Project	0-0-0-3

Summer Internships offer students personal & real world spirits & exposes to an actual working life, an experiential foundation to their career choices & the chance to build valuable business networks. Under this programme each student undergoes training in an Industry for a minimum period of six weeks during the summer vacation after VI Semester. Through the internship students are exposed with the various processes involved at any typical industrial unit such as, operating procedure, construction processes, management procedures etc. & have the opportunity to relate with the knowledge they acquired in the classroom. Students execute a small project based on any of the above mentioned aspects under the supervision of competent personnel in the industry & a faculty member of the university.

After completion of the Internship, students are required to prepare a report, based on the activities performed during the internship, as per the prescribed format/ guidelines. The report should be certified by the Supervisors, & presented in the form of a seminar in the VII Semester.

Evaluation of the Summer Internship will be done as per the approved procedure.

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Semester - VII

(Departmental Core Subject)

CT-455	L-T-P-C
Comprehensive Viva Voce	0-0-0-2

The knowledge gained by the students during their B.Tech. programme will be evaluated through a Comprehensive Viva Voce Test in the VII Semester. The test will cover the entire syllabi of the B.Tech. degree programme. Preparation for the Comprehensive Viva Voce Test will also help the students in their placement activities. The evaluation will be done as per the approved procedure.

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Semester - VII

(Departmental Core Subject)

CT-460
Minor Project

L-T-P-C
0-0-3-3

Students undertake project work to develop the skill & aptitude of problem-solving. The project work is divided into two parts: Minor & Major. The Minor project is to be undertaken in the VII Semester.

Students will choose an area of their interest in consultation with a faculty member of the department, who will act as the Supervisor. The area of interest could be confined to his/her discipline or may be interdisciplinary.

The project work will involve all or some of the following processes: identification of problem, study of related literature, data collection & analysis, theoretical formulation, fabrication, experimentation & result analysis.

The preliminary work such as problem identification through literature survey, field survey etc. & preparation of plan of execution should be compiled in the form of a report, in the prescribed format/ guidelines. The report, duly certified by the Supervisor, should be submitted to the Head of the Department.

Progress made by students will be continuously monitored & evaluated as per the approved procedure.

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Semester - VII

(Management Subject)

BM-451	L-T-P-C
Ethics & IPR	2-0-0-2

Objective: *The aim of this course is to sensitize students towards professional ethics, values & associated aspects. It initially addresses concerns relating to product & service quality & then moves on to ethical aspects of organizational functioning. The course throws light on ethical issues & crimes that are likely to remain at the core of corporate concerns & discusses intellectual property related issues that are the need of modern industrial & business enterprises.*

Course Content

Role of Corporations: Some big changes in the world in last 60 years (WW II, GATT, WTO) & impact on business, Need for strategic planning & process management, Business strategies & challenges in leading global organizations.

Quality Management: Quality as a strategic imperative, Evolution of quality management, Distinction between quality control, quality assurance & quality management, International standards (ISO family of standards) & International models for quality management, quality in services, enhanced focus on accreditation, the accreditation process, standards for key services (food processing: HACCP & education: NAAC).

Ethics & Human Values: Ethics & morals values, Ethical theories, Common features of unethical companies & leaders, Professional ethics, Professional Codes of Ethics, Benefits & limitations of code of ethics, Corporate social responsibility & its business implications.

Intellectual Property Issues: Protecting the intangible, Evolution of knowledge as property, What are Intellectual property rights, Classification of intellectual property, Role of WTO & WIPO, The patenting process, Patent infringement, Copyrights, Requirements for registration of a copyright, Copyright infringement. Fair use of copyrighted material, Trade secrets, Reverse engineering, Protecting software.

Environmental & Health Concerns: Introduction, Manufacturing in the 21st century, Resource conservation, the social costs of environmental destruction (land, water & air pollution), ISO 14000 standards & approaches to environmentally friendly technology, carbon trading, international treaties & their limitations.

Text/Reference Books

1. Managing intellectual Capital: Organizational, Strategic and Policy Dimensions. Teece D.J. Oxford University Press. 2000.
2. Profiting from Intellectual Capital: Extracting Value from Innovation. Sullivan P.H. John Wiley. 1998.
3. Intellectual property law in India. Narang P.S. Georgia Law Agency. 2001.
4. ISO 9000 Quality systems Handbook. Hoyle D. 6th Ed. A Butterworth-Heinemann Title. 2009.
5. Implementing ISO 9000: 2015. Purushothama B. Edited. WPI Publishing. 2014.

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Semester - VIII

(Departmental Core Subject)

CT-470
Major Project

L-T-P-C
0-0-4-4

After completion of the Minor Project, students shall undertake the Major Project in the VIII Semester. The idea conceived in the Minor Project shall be executed in this semester under the supervision of the faculty member. Students shall complete the practical aspect of the project. Thereafter they will prepare a report, as per the prescribed format/ guidelines, incorporating the results, their analysis & interpretation. The report, duly certified by the Supervisor, should be submitted to the Head of the Department.

Progress made by the student will be continuously monitored & evaluated as per the approved procedure.

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Semester - IV

(Departmental Elective - I)

CT-261	L-T-P-C
Analysis & Design of Algorithms	3-0-0-3

Objective: An algorithm is a set of rules for carrying out calculation either by hand or on a machine. To write an application, an algorithm should be defined first. This course provides an introduction to fundamental techniques for designing & analyzing algorithms, including asymptotic analysis; divide-and-conquer algorithms & recurrences; greedy algorithms; data structures; dynamic programming; graph algorithms; & randomized algorithms.

Course Content

Role of Algorithms in Computing

Introduction: What is an Algorithm? Notion of Algorithm, Fundamentals of Algorithmic Problem Solving, Role of algorithms in computing, Algorithms as a technology.

Fundamentals of algorithm analysis

Fundamentals of the Analysis of Algorithm Efficiency, Asymptotic notation & Basic Efficiency Classes, Algorithm design. Brute Force Approaches: The method, Exhaustive search – Traveling salesman problem, Assignment problem, Selection Sort & Bubble Sort, Sequential Search

Sorting, Sets & Selection

Merge sort, The Set Abstract Data Type, Quick sort, Bucket sort, Radix sort, Comparison of sorting algorithms.

Graphs & Dynamic Programming

Graphs: Graph abstract data type, Data structures for graphs, Graph traversals-BFS, DFS, Directed graphs, weighted graphs. Dynamic Programming: The method,

Computing of Binomial Coefficient & Fibonacci Series, All pairs shortest path-Floyd's algorithm, Assembly line scheduling.

Greedy Algorithms, Text Processing & Cryptography

The greedy strategy, Greedy methods & optimization, Topological sort, Bipartite cover, Minimum cost spanning trees, Huffman codes, Single source shortest paths-Dijkstra's algorithm. Text Processing & Cryptography: Strings & Pattern matching algorithms, Introduction to cryptography concepts.

Text/Reference Books

1. Introduction to Algorithms. Cormen T. H. Leiserson C. E., Rivest R. L. & Stein C. 2nd Ed. Prentice Hall of India Pvt. Ltd. 2004.
2. Data Structures, Algorithms and Applications in C++. Sahni S. 2nd Ed. University Press. 2005.
3. Introduction to the Design and Analysis of Algorithms. Levitin L. 2nd Ed. Pearson Education. 2007.

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Semester - IV

(Departmental Elective - I)

CT-262
Theory of Computation

L-T-P-C
3-0-0-3

Objective: *Theory of computation is the branch that deals with how efficiently problems can be solved using an algorithm, on a model of computation – which is a mathematical abstraction of computers. One such model is the Turing machine. It is believed that if a problem can be solved by a Turing machine, then it can be solved by a computer that has a set amount of memory. Theory of computation comprises of automata theory, finite language theory, computability theory & computational complexity theory. In this course, the students will be learning about automata theory, finite languages & Turing machine.*

Course Content

Introduction to Finite Automata & Regular Expressions

Introduction to Finite Automata: Introduction to finite automata, the central concepts of automata theory, Deterministic finite automata – definition, how a DFA processes strings, notations for DFA's Non-deterministic finite automata – definition, extended transition function, the language of an NFA. Regular Expressions : An application – Text search, finding strings in a Text, NFA for text search, a DFA to recognize a set of keywords, Finite automata with Epsilon transitions, exercise problems, Finite automata & regular expressions - from DFA's to regular expressions, converting DFA's to regular expressions by eliminating states, Applications of regular expressions

Regular Languages & Context-Free Grammar

Regular languages, Properties of Regular Languages: Regular Languages, Applications of regular expressions, properties of regular languages- proving languages

not to be regular, the pumping lemma for regular languages , Closure properties of regular languages – closure of regular languages under Boolean operations-union, complementation, intersection & difference , Equivalence & minimization of automata. Context free grammars & languages: Definition of context-free grammars, derivations using a grammar, leftmost & rightmost derivations, the language of a grammar & sentential forms, exercise problems, Parse trees – constructing a parse tree, the yield of a parse tree, inference, derivations & parse trees, Applications of context free grammars – Markup languages, XML & document-type definitions, Ambiguity in grammars & languages – ambiguous grammars.

Push Down Automata

Pushdown automat : The languages of a PDA – acceptance by final state, acceptance by empty stack Informal introduction, formal definition of PDA, a graphical notation for PDA's, The languages of a PDA – from empty stack to final state, from final state to empty stack, Equivalence of PDA's & CFG's – from grammars to PDA, from PDA's to grammars

Properties of Context Free Grammar

Properties of context free languages: Normal forms for context free grammars – eliminating useless symbols, computing the generating & reachable symbols, Eliminating ϵ -productions, eliminating unit productions, Chomsky normal form (CNF), exercise problems, The pumping lemma for context free languages, Closure properties of context free languages.

Introduction to Turing Machine

Introduction to Turing machines: Problems that computers cannot solve, The Turing machine – the quest to decide all mathematical questions, notation for the Turing machine, instantaneous descriptions for Turing machines, Programming techniques for Turing machines – storage in the state, multiple subroutines, exercises tracks. Undecidable: A language that is not recursively enumerable, an undecidable problem that is RE, Post's correspondence problem, other undecidable problems, Exercises

Text/Reference Books

1. Introduction to Automata theory, Languages and Computation. Hopcroft J. E., Motwani R. & Ullman J. D. 3rd Ed. Pearson education. 2007.

2. Fundamentals of the Theory of computation, Principles and Practice. Greenlaw R., Hoover H. J. & Kaufmann M. 1998.
3. Introduction to languages and theory of computation. Martin J. 3rd Ed. Tata McGraw Hill. 2007.
4. Introduction to Computer theory. Cohen D. I. N. 2nd Ed. John Wiley & Sons. 2004.

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Semester - V

(Departmental Elective - II)

CT-357
Network Administration

L-T-P-C
4-0-0-4

Objective: *This course describes the architecture, components, & operations of routers in larger & more complex networks. Topics include how to configure routers for advanced functionality, to configure & troubleshoot routers & resolve common issues with OSPF in both IPv4 & IPv6 networks. Other topics include the implementation & configuration of common data link protocols & how to apply WAN security concepts, principles of traffic, access control & addressing services. Students will learn methods to properly configure manage & troubleshoot from fundamentals to advanced routing technologies*

Course Content

Networking Fundamentals: The TCP/IP & OSI Networking Models, Fundamentals of Ethernet LANs, Fundamentals of WANs, Fundamentals of IPv4 Addressing & Routing, Fundamentals of TCP/IP Transport & Applications

Ethernet LANs & Switches: Building Ethernet LANs with Switches, Cisco LAN Switches, Configuring Ethernet Switching.

IP Version 4 Addressing & Subnetting: Perspectives on IPv4 Subnetting, Analyzing Classfull IPv4 Networks, Analyzing Subnet Masks, Analyzing Existing Subnets, Implementing IP Version 4: Operating Cisco Routers, Configuring IPv4 Addresses & Routes, Implementing Ethernet Virtual LANs, Troubleshooting Ethernet LANs, Spanning Tree Protocol Concepts, Troubleshooting LAN Switching

LAN Routing: Configure IPv4 Routing, Configure & Verify Host Connectivity, Advanced IPv4 Addressing Concepts, Describe the boot process of Cisco IOS routers; Operation

status of a serial interface; Manage Cisco IOS files; Routing & Routing Protocols; OSPF (multi-area); EIGRP (single AS); Passive Interface
IPv4 Services & IP Version 6: Basic IPv4 Access Control Lists, Advanced IPv4 ACLs & Device Security, Network Address Translation, Recognize high availability (FHRP); Describe SNMP v2 & v3, IPV6 addressing

Text/Reference Books

1. CCNA Cisco Certified Network Associate: Study Guide (With CD). 7th Ed. (Paperback). Wiley India. 2011.
2. CCENT/CCNA ICND1 640-822 Official Cert Guide 3rd Ed. (Paperback). Pearson. 2013.
3. Routing Protocols and Concepts CCNA Exploration Companion Guide (With CD) (Paperback). Pearson. 2008.
4. CCNA Exploration Course Booklet : Routing Protocols and Concepts Version 4.0 (Paperback). Pearson. 2010.

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Semester - V

(Departmental Elective - II)

CT-358
Network Security Protocols

L-T-P-C
4-0-0-4

Objective: *The power of computers can be witnessed when multiple computers are connected to form a network & start sharing information amongst them. But when this happens, the entire network becomes an open source & exposed to threats due to many users who log into these networks & their environments. Therefore it becomes important to learn about Network Security, in order to safeguard our networks from hackers & damages. Learning network concepts therefore becomes significant & no study of computers is complete without them.*

Course Content

Open Systems Interconnection (OSI) Model: Introduction to the 7 layers of the OSI model, concept of the OSI model, the Application Layer, the Presentation Layer, the Session Layer, the Transport Layer, the Network Layer, the Data Link Layer & the Physical layer

Security Protocols - Application Layer

Introduction to Protocol concepts, Important Protocols, File Transfer Protocol, Socket Secure (SOCKS), Secure Shell (SSH), Remote Terminal Control Protocol (Telnet), Transport Layer Security/Secure Sockets Layer (TLS/SSL), Extensible Messaging & Presence Protocol (XMPP), Wireless Application Protocol (WAP) & Internet Relay Chat (IRC)

Transport Layer: Introduction to Transport Layer, TCP/IP, User Datagram Protocol (UDP), Real-time Transport Protocol (RTP), Datagram Congestion Control Protocol

(DCCP), Stream Control Transmission Protocol (SCTP), Resource reservation Protocol (RSVP)&Explicit Congestion Notification (ECN)

Network Layer: Introduction to Network Layer, Internet Protocol Version 4 (IP4), Internet Protocol Version 6 (IP6), Internet Protocol Security (IPSEC), Internet Control Message Protocol (ICMP) & Internet Group Management Protocol (IGMP).

Data Link Layer: Introduction to Data Link Layer, the Address Resolution Protocol (ARP), the Open Shortest Path First (OSPF), the Neighbor Discovery Protocol (NDP),the Tunneling Protocol (Tunnels) &the Point to Point Protocol (PPP)

Text/Reference Books

1. Information Systems Security: Security Management, Metrics, Frameworks and Best Practices. Godbole N. wiley. 2009.
2. Network Security Bible. Cole E. 2nd Ed. Wiley. 2009.

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Semester - V

(Departmental Elective - III)

CT-359
Cryptography

L-T-P-C
4-0-0-4

Objective: *Security is ubiquitous. With the advent of e-commerce & electronic transactions, the need for development of secured systems has grown tremendously. Cryptography is the study of building ciphers to ensure the confidentiality & integrity of information. Along with it is the activity of analysing the strength of a cipher by subjecting it to several forms attack. This course covers the basic concepts of Cryptography, certain cryptographic algorithms & its applications.*

Course Content

Introduction to Cryptography: The Confidentiality, Integrity & Availability (CIA) Triad, Cryptographic concepts, methodologies & practices, Symmetric & Asymmetric cryptography, public & private keys, Cryptographic algorithms & uses, Construction & use of Digital signatures

Types of Algorithms: The basic functionality of hash/crypto algorithms (DES, RSA, SHA, MD5, HMAC, DSA) & effects on key length concepts in Elliptical Curve Cryptography & Quantum Cryptography

Key Management: The basic functions involved in key management including creation, distribution, verification, revocation & destruction, storage, recovery & life span & how these functions affect cryptographic integrity

Application of Cryptography: Major key distribution methods & algorithms including Kerberos, ISAKMP etc., Vulnerabilities to cryptographic functions, the Use & functions of Certifying Authorities (CAs), Public Key Infrastructure (PKI) & System architecture requirements for implementing cryptographic functions.

Text/Reference Books

1. Information Systems Security: Security Management, Metrics, Frameworks and Best Practices. Godbole N. Wiley. 2009.
2. Cryptography and Security. Shyamala C. K. Hiarini N. & Padmanabhan T. R. 1st Ed. Wiley Publications. 2011.

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Semester - V

(Departmental Elective - III)

CT-360	L-T-P-C
Database Security	4-0-0-4

Objective: *Every program & every application that we use, connect with data or information in some way or the other & this data is stored in a systematic manner in a database, which is chosen depending on the requirements of the software & the users. As data forms a very crucial part of IT & is prone to security threats & attacks, it becomes important to protect the data using technology. This course will teach students, methods to protect databases.*

Course Content

The Database & DBMS Architecture: Introduction to Database & DBMS Architecture, Hierarchical Database Management Systems, Network Database Management Systems, Relational Database Management Systems, Object-Oriented Database Management Systems, End-User Database Management Systems, Spreadsheets

Concepts of Database Security: Concept of Least Privilege in User ID for databases. Concept of NoSQL databases Differences from classical DBMS concepts with NoSQL, Advantages of NoSQL like Elastic Scaling, Big Data, Goodbye DBAs', Economics/Cost, Flexible Data models.

Concepts of NoSQL: Non/ partial applicability of ACID (Atomicity, Consistency, Isolation, Durability) guarantees in NoSQL databases as compared to traditional RDBMS databases. Horizontal scalability benefits of NoSQL Databases compared to traditional Databases, Protecting Database - Understanding permissions, Creating & using database roles, using schemas for security, configuring cross-database security

Concepts of Key Value & Tuple Store Databases: Concept of UnSQL or Unstructured Query Language, Concept of Key Value & Tuple Store Databases, Concept of Graph Databases, Concept of Multi-model Databases, Code & Data Encryption- Using service & database master keys, creating & using symmetric & asymmetric keys, creating & storing hash values, Authenticating stored procedure by signature

SQL Server & Concepts: Concept of Object Databases, Concept of Grid & Cloud Databases, Concept of XML databases, Concept of Multidimensional & Multi-value Databases

SQL Server Auditing: Auditing – Using the profiler to audit SQL server access, using DML trigger for auditing data modification, Using DDL triggers for auditing structure modification, configuring SQL server auditing.

Text/Reference Books

1. Database security. Castano S. 2nd Ed. Addison-Wesley Professional. 2008.
2. Microsoft SQL server 2012 Security Cookbook. Bruchez R. PACKIT publishing. 2012.
3. Handbook of database security: Applications and Trends. Gertz M. & Jajodia S. Springer. Lib. of congress. 2008.
4. Implementing database security and auditing: a guide for DBAs Ben-Natan R. Elsevier. 2005.

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Semester - V

(Departmental Elective - IV)

CT-361
Network Security

L-T-P-C
4-0-0-4

Objective: *The power of computers can be witnessed when multiple computers are connected to form a network & start sharing information amongst them. But when this happens, the entire network becomes an open source & exposed to threats due to many users who log into these networks & their environments. Therefore it becomes important to learn about Network Security, in order to safeguard our networks from hackers & damages. Learning network concepts therefore becomes significant & no study of computers is complete without them.*

Course Content

Introduction to Network Security: Perimeter Security – Overview of Network Security, Access Control, Device Security, Security features on Switches, Firewall, Types of firewall, Access Management, Multifactor Authentication, Wireless LAN (WLAN) Security & Network Admission Control (NAC)

Threats, Vulnerabilities & Attacks: Threat; Vulnerabilities; Attacks – Application Attack, Network Attack & Mitigating & Deterring Attacks; Network Security – Security through network devices, Security through Network Technologies & Security through Network Design Elements, Administering a Secure Network

Network Security Management

Secure Socket Layer (SSL) – Introduction to SSL, Open SSL basics, Problems with SSL, Cryptography, Message Digests Algorithms, Digital Signature & Public Key Infrastructure (PKI); Data Privacy – IPsec VPN, Dynamic Multipoint VPN (DMVPN),

Group Encrypted Transport VPN (GET VPN), Secure Sockets Layer VPN (SSL VPN) & Multiprotocol Label Switching VPN (MPLS VPN).

Network Security Controls

Network Intrusion Prevention – Overview of Intrusion Prevention System (IPS), Intrusion Detection System (IDS), Deploying IPS & IPS high Availability; host Intrusion Prevention; Anomaly Detection & Mitigation

Network Management

Security Monitoring & correlation; Security Management - Security & Policy Management & Security Framework & Regulatory Compliance; Best Practices Framework, Case Studies.

Text/Reference Books

1. Information Systems Security: Security Management, Metrics, Frameworks and Best Practices. Godbole N. Wiley. 2009.
2. Network Security Bible. Cole E. 2nd Ed. Wiley. 2009.

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Semester - V

(Departmental Elective - IV)

CT-362	L-T-P-C
Disaster Recovery & Business Continuity Management	4-0-0-4

Objective: *Primarily the unit covers the importance of having a Business Continuity Planning, Disaster recovery planning for Organization & emphasizes the Standard practices proposed by the NIST SP 800-34 Emergency Action Plan for recovery.*

The Unit gives a broad coverage on the different phases of BCP that consist of Project Management & Initiation, Business Impact Analysis, Recovery Strategies, Planning Development & Implementation. The Unit emphasizes the various methods of Technical Data Recovery procedures that can be immediately taken on the event of a Service Disruption & also allocating the roles & responsibilities for Various Key personnel. The Unit also gives importance to the Testing, Maintenance & Training process. A wide variety of testing process that involves full interruption, walk through, Check listing, Simulation & Parallel are explained in detail.

Course Content

Business Continuity Management (BCP): Introduction to Business Continuity Planning (BCP), Business Resumption Plan (BRP) or Disaster Recovery Plan (DRP), Common terminologies used in BCP & DRP, NIST SP800-34 Emergency Action plan which includes the phases of Recover/Resume, Protect & Sustain, Causes of Disasters.

Stages in BCP: BCP objectives. Information Protection Environment. Security Technology & Tools. Steps involved in creating a BCP, Phase 1: Project Management & Initiation. Phase 2: Business Impact Analysis. Phase 3: Recovery Strategies, Phase 4: Plan Development & Implementation.

Business Recovery strategies: Facility & Supply Recovery strategies. User Recovery strategies. Technical Recovery strategies, Data Recovery strategies, Activation Phase- Major Disaster or Disruption, Intermediate Disaster or Disruption, Minor Disaster, Activating BC/DR Teams, Developing Triggers, Transition Trigger. Defining BC/DR Team & Key Personnel, Defining Tasks, Assigning Resources, Communication Plan.

Testing, Maintenance, Awareness & Training Mechanisms: Different types of tests including structured walk-through, checklist test, simulation, parallel test & full interruption test. Steps required to maintain a BCP.

Preparation of BCP: Requirements for BCP awareness & training Visit a business organization of your choice & prepare a Business Continuity Plan for the same using the learning from this course.

Text/Reference Books

1. Business Continuity and Disaster Recovery Planning. Snedaker S. Syngress. 2007.
2. Crisis Management Mastering Skills. Harvard Business School. 2004.
3. Disaster Recovery Planning: Preparing. Toigo J. W. 3rd Ed. 2012.

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Semester - VI

(Departmental Elective - V)

CT-363	L-T-P-C
Linux Server Administration	4-0-0-4

Objective: *RHEL is a high performing operating system. RHEL 6 is the sixth generation of the long term & predictable operating platform. With the flexibility to deploy on physical hardware, as a virtual host, as a virtual guest or in the cloud, Red hat Enterprise Linux 6 is the ideal foundation for next-generation datacenters. The fresh system administrators need to have a strong functional knowledge of RHEL 6 in any current IT work environment. The course explores the security & network access controls in Linux, organizing network system & Mail Services, Securing Data & Account Management.*

Course Content

Fundamentals of Linux: Development of Linux, Linux Distributions. Structure of Linux Operating System, Logging In & General Orientation, The X Window System, KDE, GNOME. Navigating the File Systems, Managing Files, File Permission & Access, Shell Basics, Shell Advanced Features, File Name Generation. Common Unix commands
Administration of LinuxO: Installing Linux, Configuring Disk Devices, Creating & Managing File Systems, File System Backup, Kickstart Installation, Linux Boot Loaders, Linux Kernel Management, Managing User Accounts, Understanding File Listing, Ownership & Permission, Managing Software using RPM, Connecting to Network, Linux Network Services, Setting up a Printer
Input & Output Redirection: Input Redirection, Output Redirection, Error Redirection, Filter, Pipes. Networking in Linux: Network Connectivity, IP address, Accessing Remote system, Transferring files, & Internet configuration. Process Control: Identifying

Process, Managing Process, Background Processing, Putting jobs in Background.
Offline File Storage: Storing files to Media Booting process & User

Linux Basic networking & naming service: Introduction to Networking, Networking,
Internet Network Services, Dynamic DNS, Electronic Messaging, Apache , NIS &
Network File Sharing: NIS, Network File Sharing, SAMBA. Security: Defining System
Security Policies, System Authentication Services & Security, Securing Services,
Securing Data & Communication

The UnixFileSystem: Inodes - Structure of a regular file – Directories - Conversion of a
path name to an inode - Super block - Inode assignment to a new file - Allocation of disk
blocks. System calls for the file System: Open – Read - Write - Lseek – Close - File
creation - Creation of special files - Changing directory & root - changing owner & mode
– stat & fstat - pipes - Dup - Mounting & Un mounting file systems - Link & Un link.

Text/Reference Books

1. Red hat Linux Administration. Turner M. & Shah S. McGraw-Hill. 2010.
2. Redhat Fedora linux for Dummies. Barkakati N. Wiley Publishing Inc. 2011.
3. RHCSA/RHCE Red Hat Linux Certification Study Guide (Exams EX200 & EX300). Jang M. 6th Ed. (Certification Press) [Paperback]. McGraw-Hill Osborne Media. 2011.

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Semester - VI

(Departmental Elective - V)

CT-364
Latest Trends in Cloud Technology

L-T-P-C
4-0-0-4

Objective: *This course will help to understand the current trends in Cloud Technologies and how to build large scale distributed systems and cloud applications. It also comprehend the importance of cloud security with an understanding of ubiquitous computing and applications.*

Course Content

Cloud implementation and applications: Cloud Platforms- Amazon EC2 and S3, Cloudstack, Intercloud, Google App Engine, Open Source Cloud computing standards, Forums and Platforms ,Open Source cloud Eucalyptus, Open stack, Open Nebula, etc., Applications.

Operations, Management and Orchestration in Cloud: Orchestration in the Enterprise(SOA and workflows), Identity and Access Management, Network and Operations Management(Framework, Model and Policy based Management), Elasticity Management in cloud

Cloud security: Cloud Security risks, Security, Privacy, Trust, Operating system security, Security of virtualization, Security risks posed by shared images, Security risk posed by a management OS, Trusted virtual machine monitor, Business case for cloud security and the levels and models available, including infrastructure-, application-, and data-level security , identity and risk management, encryption and multifactor authentication. Compliance issues that affect specific industries. Identifying Security requirement and security tools, services and software.

Server, Storage and Networking in Cloud Technology: Cloud Storage and structure of modern Data datacenter, Networking appliances and Load balancers, SDN, Quality of Data and services in Networks.

Ubiquitous computing: Basics and Vision, Applications and Requirements, Smart Devices and Services, Human Computer Interaction, Tagging, Sensing and controlling, Context-Aware Systems, Ubiquitous Communication, Management of Smart Devices, Ubiquitous System Challenge and outlook.

Text/Reference Books

1. Cloud Computing Bible. Sosinsky B. Wiley.
2. Enterprise Cloud Computing. Shroff G. Cambridge.
3. Ubiquitous Computing: Smart Devices, Environments and Interactions. Poslad S. John Wiley & Sons, 2011.
4. Cloud Computing: A practical approach for learning and implementation. Shrinivasan A & Suresh J. Pearson.
5. Cloud Computing Principles and Paradigms. Buyya R., Broberg J. & Goscinski A. Wiley.
6. Cloud Security: Comprehensive guide to Secure Cloud Computing. Krutz R. Wiley Publishing.
7. Cloud Computing: Practical Approach. Velte A. T. McGraw Hill.
8. Cloud Security and Privacy. Mather T. O'REILLY.

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Semester - VI

(Departmental Elective - VI)

CT-365	L-T-P-C
COBIT VALIT & Risk IT	4-0-0-4

Objective: *COBIT is a framework created for supporting toolset by which managers could bridge the gap between control requirements, technical issues & business risks.*

Val IT is a governance framework used to create business value from IT investments. At the root of Val IT is a set of guiding principles, processes & best practices to support & help executive management & boards at an enterprise level.

The objective of RiskIT is to provide an end-to-end, comprehensive perspective of all risks pertaining to use of IT & deals with thorough treatment of risk management. Its principles can be customized to suit the environment in your organization & is definitely an encouraging aspect for individuals to contribute their skills to the growth of the organization

Course Content

Introduction to COBIT: COBIT 5 – Its importance & relevance - 5 Principles of COBIT: Meeting Stakeholders needs, Covering the Enterprise End-to-End, Applying a Single Integrated Framework, Enabling a Holistic approach & Separating the Governance from the Management

Enablers of COBIT: Processes, Organizational Structures, Culture, Ethics & Behaviour, Principles, Policies & Frameworks, Information, Services Infrastructure Applications, People, Skills & Competencies.

Risk IT – its Importance & Relevance

Interlinkages between Risk IT with COBIT & Val IT

Three domains of Risk IT with their sub processes

Risk Governance: Establish & Maintain a Common Risk view, Integrate with Enterprise Risk Management (ERM), Make Risk-aware Business Decisions.

Risk Evaluation: Collect data, Analyze Risk, Maintain Risk Profile, Risk Response, Articulate Risk, Manage Risk, React to Events

VAL IT & its importance: Val IT, its importance & relevance, Key Val IT terms, Principles & Domains

Introduction to Information Security Governance (ISG): Importance of ISG, Benefits of ISG, monitoring ISG through metrics, Applying COBIT 5 principles & Risk IT IN Information Security Governance, Overview of COBIT 5, Principles & Processes for ISG, applying Risk IT in ISG, separating Governance & management in ISG

Text/Reference Books

1. ISACA Publications on COBIT. ISACA Knowledge Centre.
2. ISACA Publications on ValIT and Risk IT. ISACA Knowledge Centre.

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Semester - VI

(Departmental Elective - VI)

CT-366
ITIL

L-T-P-C
4-0-0-4

Objective: *ITIL-compatible tools offer better integration, interaction & compatibility with your global partners, & in addition, sticking to strict ITIL standards from a single vendor can help process integrations go seamlessly & ensure all parties are speaking the same technical language.*

It is always an advantage to understand what types of ITIL tools your global partners are working with & how they rate them. ITIL frameworks provide a homogenous IT environment & eases interactions with other global companies using similar preapproved tools. Managing staff, providing services to customers & creating efficiencies for less money can be daunting tasks for any IT organization.

Course Content

ITIL Overview & Service Strategy: ITIL History, Components of the ITIL Library, IT Service Management, Organizing for IT Service Management, Technology & Architecture, Overview of HPSM & OTRS as service management tool, Service Strategy: Service Strategy Lifecycle Stage, Service Portfolio Management, the Demand Management Process, the IT Financial Management Process, Introduction to ISO 20000 Standards

Service Design: Service Design Lifecycle Stage, The Service Catalog Management Process, The Service Level Management Process, The Availability Management Process, The Capacity Management Process, The Information Security, Management Process, The IT Service Continuity, Management Process, The Supplier Management Process

Service Transition: Service Transition Lifecycle Stage, the Change Management Process, the Release & Deployment Management Process, the Service Asset & Configuration Management Process, Knowledge Management

Service Operation: Service Operation Functions : Service Operation Lifecycle Stage, The Service Desk Function, The Technical Management Function, The Application Management Function, The IT Operations Management Function Service Operation Processes :The Event Management Process, The Incident Management Process, The Request Fulfilment Process, The Access Management Process, The Problem Management Process

Continual Service Improvement: Continual Service Improvement principles - CSI & organizational change, Ownership, Role definitions , External & internal drivers , Service Level Management , The Deming Cycle, Service measurement ,Knowledge Management, Benchmarks , Governance ,Frameworks, models, standards & quality systems Continual Service Improvement processes : 7 step improvement process, Service reporting, Service management, return on investment for CSI, business questions for CSI, Service level management

Text/Reference Books

1. Introduction to ITIL. Bon J. V. Stationery Office Books. The Stationery Office. 2010.
2. HP operation Manual. HP. 2010.
3. A Guide to Service Desk Concepts. Knapp D. Cengage Learning. 2010.
4. The Shortcut Guide to Virtualization and Service Automation. Shield G. Real-time Publishers. 2008.
5. Service automation and dynamic provisioning techniques in IP/MPLS environments. Jacquenet C., Bourdon G. & Boucadair M. John Wiley & Sons. 2008.

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Semester - VIII

(Departmental Elective - VII)

CT-457
Cloud Web Services

L-T-P-C
4-0-0-4

Objective: *Amazon Web Services (AWS) provides trusted, cloud-based solutions to help you meet your business needs. Running your solutions in the AWS Cloud can help you get your applications up & running faster while providing the same level of security that organizations AWS also provides resources around the world, so you can deploy your solutions where your customers .*

Course Content

Introduction to Cloud Computing & Amazon Web Services: Introduction to Cloud Computing, Cloud Service Delivery Models (IAAS, PAAS, SAAS), Cloud Deployment Models (Private, Public, Hybrid & Community), Cloud Computing Security, Case Study.

Introduction to Amazon Web Services, Why Amazon? Use Cases, AWS Storage Options, AWS Compute Options, AWS Database Options, AWS Workflow Automation & Orchestration Options, AWS Systems Management & Monitoring Options, AWS Virtual Private Cloud Introduction, Pricing Concepts

Introduction to EC2: Introduction To EC2, Instance Types & Uses, Auto scaling Instances, Amazon Machine Images (AMIS), Modifying Existing Images, Creating New Images Off Of Running Instances, Converting An Instance Store AMI To An EBS AMI, Instances Backed By Storage Types, Creating A Web Server Using Ec2, Elastics Block Storage (EBS), Elastic IPS, Route 53 DNS System, Cloudfront SNS Pricing

S3, cloudwatch, elastic beanstalk & security: Introduction To S3, Buckets & Objects, Security, Creating A Web Server Using S3 Endpoints, Introduction To Cloudwatch, Creating Alarm Notifications, Autoscaling Instances, Deploying Scalable Application On

AWS, Selecting & Launching An Application Environment, Provisioning Application Resources with Cloud formation: Describe Amazon Dynamo, Understand key aspects of Amazon RDS, Launch an Amazon RDS instance, Identify what is Cloud Formation, Describe Amazon Cloud Watch metrics & alarms, Describe Amazon Identity & Access Management (IAM), Security In AWS, IAM (Identity & Access Management), Access Control Lists (ACLs), Securing Data at Rest & In Motion, Security Groups

AWS Storage, Elasticity & AWS Networking: Amazon Storage, S3 Storage Basics, Managing Voluminous Information with EBS, Glacier Storage Service, AWS Networking: Networking Basics, VLAN Basics, Basics of AWS VLANs, AWS Network IP Addressing & Mapping

VIRTUAL PRIVATE CLOUD (VPC): Load Balancers & Availability Zones, Elastic Network Interfaces (ENI), Setting Up VPC & Internet Gateway, Setting Up a Security Group, Launching & EC2 Instance & Assigning An ENI, Setting Up A VPN, Setting Up A Customer Gateway For VPN, Setting Up Dedicated Hardware For VPC, Scenario 1:VPC With A Public Subnet Only (Standalone Web), Scenario 2: VPC with Public & Private Subnets (3 Tier App), Scenario 3:VPC With Public & Private Subnets & Hardware VPN Access (Web On The Cloud, Database & App On Prem) Scenario 4: VPC With A Private Subnet Only & Hardware VPN Access. (Extension Of Your Corporate Network), Case Study

Text/Reference Books

1. Cloud Computing: Principles and Paradigms, Buyya R. K., Broberg J. & Goscinski A. M. John Wiley & Sons Publications, 2011
2. Brief Guide to Cloud Computing. Barnett C. Constable & Robinson Limited. 2010.
3. Amazon Web Services for Dummies. Golden B. John Wiley & Sons. 2013.

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Semester - VIII

(Departmental Elective - VII)

CT-458	L-T-P-C
Latest Trends in Information Security	4-0-0-4
Pre-requisite	CT-253/CT-355/CT-454

Objective: *This course explains about the different threats that are currently prevalent in the world as well as different countermeasures to protect from the everchanging threats landscape. The course also explains about the current trends in information security threats and their countermeasures and helps the students to be more knowledgeable about ways to secure the data. Students will be able to use various techniques and tools to recognize and defend the security threats.*

Course Content

Emerging trends in Security: Importance of Security, protecting ever-growing information in e-commerce and m-commerce society, Internet of Everything, End Point Protection, techniques and tools, Security and its economic consequences, case studies, cyber security risk management, emergence of security for Cloud and Big Data, challenges and opportunities, introduction to latest innovations on Security – Microservices and containers unlocking security automation and scalability, data instrumentation delivering better security context, advanced analytics and machine learning enhancing detection capabilities

Security Threat Intelligence: Emerging security threat landscape, importance of security threat intelligence, common indicators of compromise, Advanced Persistent Threats (APT), criteria, lifecycle, anatomy of APT, symptoms of APT and countermeasures, network centric warfare, cyber bullying, cyber terrorism, hactivists, process automation

Security Incident Response and Malware Analysis: Security incident response management, process, plan, current trends in malware attacks, malware analysis process, techniques and tools, types of malware analysis and stages involved, case study discussions

Adaptive Security: Introduction to Adaptive Security, its importance and implications, key considerations for adaptive security architecture, its role in managing emerging security threats and attacks, averting ripple effect caused by attacks, Security Information and Event Management (SIEM), Digital Right Management (DRM), Digital Loss Prevention (DLP)

Cyber Security Framework – Indian Context: Understanding National Cyber Security Policy, DSCI (Data Security Council of India) Security Framework, Overview of RBI Guidelines on Cyber Security Framework, case study on latest data breaches in India and lessons learnt

Text/Reference Books

1. Information Systems Security. Godbole N.
2. Cyber Security Paperback. Godbole N. & Belapure S.
3. Cybersecurity: Issues of Today, a Path for Tomorrow. Reis D.
4. Windows Malware Analysis Essentials. Marak V
5. Defensive Security Handbook: Best Practices for Securing Infrastructure. Brotherston L. & Berlin A.
6. Malware Analyst's Cookbook and DVD: Tools and Techniques for Fighting Malicious Code. Ligh M., Adair S., Hartstein B. & Richard M.
7. Cuckoo Malware Analysis. Oktavianto D. & Muhandianto I.

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Semester - IV

(Open Elective - I)

HU-252	L-T-P-C
Language through Literature & Films	0-2-0-2

Objective: *To introduce the nuances of English Literature & develop reflective, creative & literary abilities.*

Course Content

The Eyes Have It - Ruskin Bond

Appro JRD - Sudha Murthy

Bacon - Of Study; Of Youth and Age

Douglas Malloch - Be the best of whatever you are

Rabindranath Tagore - Where the mind is without fear

Enhancement of emotional, creative & social quotient through viewing & discussions on selected films

Text/Reference Book

1. Literature and Language Teaching: A Guide for Teachers and Trainers. Lazar G. Cambridge University Press. 2008.

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Semester - IV

(Open Elective - I)

BM-270	L-T-P-C
Foundations of Economic Science	2-0-0-2

Objective: *The objective of this course is to teach basic principles of consumption production, exchange, distribution of remuneration to factors, pricing & public finance. Further, students are provided knowledge on completion of projects by optimizing production with limited resources & also to know infrastructure & development needs of a country to perform tasks accordingly.*

Course Content

Engineers & Economics: Meaning of economics, why engineers should know economics, important basics: consumption, production, exchange, distribution & public finance, cost of production & revenue through sales.

Consumption & Pricing: Cardinal & Ordinal approach to Utility, Laws of Diminishing Marginal Utility & Equi-marginal Utility, Demand: Meaning, Law, Types, Elasticity of Demand: Meaning & Degrees. Laws of Supply, Pricing of all products: Theory & practice.

Factors of Production & Markets: Land, Labour, Capital, Organization & Enterprise, Laws of Returns, Classification of Markets: Perfect & Imperfect competition including Monopoly, Discriminative Monopoly & Oligopoly.

Financial Aspects of Engineering: Money & Finance, An overview of Banking, Money Market, Capital Market, Public Finance & Private Finance, Direct & Indirect Taxes, Canons of Taxation, National Income.

Developmental Aspects of Engineering: Underdevelopment, Stages of economic development, Economic Growth, Growth Theories Economic Reforms: LPG. Application of financial accounting techniques for engineering projects.

Text/Reference Books

1. Textbook of Economic Theory. Stonier A.W. & Hague D.C. 5th Ed. Longman Higher Education. 1980.
2. Introduction to Positive Economics. Lipsey R.G. & Chrystal K.A. 8th Ed. Oxford University Press. 1995.
3. Business Economics (Micro). Shankar G. Nirali Prakashan. 2014.
4. Micro Economic Theory. Jhingan M. L. 7th Ed. Vrinda Publications Pvt. Limited. 2014.
5. Managerial Economics. Theory and Application. Mithani D.M. 7th Ed. Himalaya Publishing House Pvt. Ltd. 2013.
6. Micro economics. Pindyck R.S., Rubinfeld D.L. & Mehta P.L. 7th Ed. Pearson Education India. 2009.

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Semester - V

(Open Elective - II)

HU-351
Fun with Drama

L-T-P-C
0-2-0-2

Objective: *To stimulate imagination, cultural enrichment & explore multidimensional use of language through drama.*

Course Content

Script writing: Story, structure, character development, dialogue, visuals & language with emphasis on critical & analytical thinking, problem-solving & communication skills

Direction: Techniques & art of play direction with emphasis on methods of actor coaching, rehearsal procedures & presentation of several scenes of varying dramatic styles

Enactment: Controlled use of body & voice, analysis & interpretation of roles, characterization & emotional projection

Analysis: Insightful analysis of various aspects of translating a play from script to stage, director's concepts, visual composition, attention to character development & narrative structure & power of the unspoken word

Text/Reference Books

1. Drama Techniques in Language Learning. Maley A. & Duff A. 3rd Ed. Cambridge University Press. 2005.
2. Drama (Resource Book for Teachers). Wessels C. Oxford University Press. 1987.

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Semester - V

(Open Elective - II)

BM-370
Marketing Management

L-T-P-C
2-0-0-2

Objective: *Marketing is no longer a department charged with a limited number of tasks- it is a companywide undertaking. Marketing succeeds only when all departments work together to achieve goals. The syllabus is designed to serve as an introduction to the theory & practice of marketing to the engineering students. It will help them develop competencies in the use of the modern marketing techniques & their applications in design, development & commercialization of new products & services in the rapidly changing markets.*

Course Content

Introduction: Nature & scope of marketing; Importance of marketing as a business function; Marketing concepts – traditional & modern; Selling vs. marketing; Marketing mix & environment, Marketing Myopia.

Consumer Behaviour & Market Segmentation: Significance of consumer behavior; Market segmentation; concepts & importance; Bases for market segmentation.

Product: Concept of product, consumer & industrial goods; Product planning & development: Product life cycle concept, New Product Development, Product Differentiation & Positioning.

Branding: Role of brand & its Significance, Types of Brands, Challenges for Brands, Brand Equity.

Price: Importance of price in the marketing mix; Factors affecting price of a product/ service.

Distributions: Distribution channels; concept & role; Types of distribution channels; Factors affecting choice of a distribution channel.

Communications: Techniques of promotion; Integrated Marketing Communications; Advertising: Role & Significance. Media & their relative merits & limitations, Public Relations & Personal Selling.

E-marketing management: Overview of e-commerce, E-marketing: Role of IT in marketing, E-Marketing-mix, Emerging technology trends & their implications for marketing, Social media & marketing, E-CRM & building relationship.

Text/Reference Books

1. Marketing Management- A south Asian Perspective. Kotler P., Keller K., Koshy A. & Jha M. 12th Ed. Pearson Education. 2007.
2. Marketing Management. Kotler P. & Keller K. Prentice Hall. 2003.
3. Fundamentals of Marketing. Stanton W.J., Michael E.J. & Walker B.J. McGraw-Hill International. 1997.
4. Principles of Marketing. Kotler P. & Armstrong G. Pearson Education. 2007.
5. Fundamentals of Marketing. Stanton W.J. 5th Ed. McGraw-Hill, New York. 1978.
6. Marketing Environment: Planning, Implementation and Control, the Indian context. Ramaswamy V.S. & Namakumari S. Mcmillan. 1990.

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Semester - VII

(Open Elective - III)

BT-471
Bioprocess Technology

L-T-P-C
3-0-0-3

Objective: *A bioprocess is a specific process that uses complete living cells or their components to obtain desired products which is an importance part of biotechnology industry. This course is designed to make a learner efficient in bioprocess calculations & to impart knowledge of different technology used in bioprocess.*

Course Content

Bioprocessing v/s chemical processing, Substrates for bioconversion processes Inoculum development. Process technology for production of primary metabolites: such as baker's yeast, ethanol, citric acid, amino acids, polysaccharides & plastics, Microbial production of industrial enzymes such as glucose isomerase, cellulase, amylase, protease etc., Production of secondary metabolites: penicillin & cephalosporin etc.

Text/Reference Books

1. Encyclopedia of Bioprocess Technology. Flickinger Michael & Drew Stephen. John Wiley & Sons.1999.
2. Principles of Fermentation Technology. Stanbury P.F., Whitaker A. & Hall S. J. 2nd Ed. Elsevier.1995.
3. Microbial biotechnology: Fundamentals of Applied Microbiology. Glazer A.N. & Nikaido H. 2nd Ed. W.H. Freeman & Company. 1995.

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Semester - VII

(Open Elective - III)

CE-462 L-T-P-C
Air Pollution & Industrial Waste Management 3-0-0-3

Objective: *To give understanding of air pollution & its impact, modeling of dispersion of pollutant, control measures, types of waste from different industries & their management.*

Course Content

Air Pollutants, their sources & harmful effects on the environment; Meteorology as applied to air pollution & dispersion of air pollutants, Air quality & emission standards, Removal of gaseous & particulate matter. Sources & types of wastes; solid, liquid & gaseous wastes; Water use in industry, industrial water quality requirements; Control & removal of specific pollutants in industrial wastewaters from dairy, fertilizer, distillery, tannery, sugar, pulp & paper, iron & steel, metal plating etc.

Text/Reference Books

1. Air Pollution-Its Origin and Control. Wark K. & Warner C. F. 2nd Ed. Harper & Row New York. 1981.
2. Air Pollution Control Engineering. Nevers N. D. 2nd Ed. McGraw-Hill International Ed. 1985.
3. Zero Pollution for Industry: Waste Minimization through Industrial Complexes. Nemerow N. L. John Wiley & Sons.1995.
4. Liquid Waste of Industry: Theory, Practices and Treatment. Nemerow N L. 1st Ed. Addison-Wesley. 1971.
5. Wastewater Treatment for Pollution Control. Arceivala S. J. Tata McGraw-Hill. 1999.
6. Industrial Water Pollution Control. Eckenfelder W. W. McGraw-Hill. 2000.

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Semester - VII

(Open Elective - III)

CS-458	L-T-P-C
Information Retrieval	3-0-0-3

Objective: *This course deals with the basic information retrieval approaches to perform the various types of searching, indexing & retrieval from structured or unstructured data & their applications.*

Course Content

Introduction: concepts & terminology of information retrieval systems, Information Retrieval vs. Information Extraction; Indexing: inverted files, encoding, Zipf's Law, compression, boolean queries; Fundamental IR models: Boolean, Vector Space, probabilistic, TFIDF, Okapi, language modeling, latent semantic indexing, query processing & refinement techniques; Performance Evaluation: precision, recall, F-measure; Classification: Rocchio, Naive Bayes, k-nearest neighbors, support vector machine; Clustering: partitioning methods, k-means clustering, hierarchical; Introduction to advanced topics: search, relevance feedback, ranking, query expansion.

Text/Reference Books

1. An Introduction to Information Retrieval. Manning C.D., Raghavan P. & Schtze H. Cambridge University Press. 2009.
2. Modern Information Retrieval. Ricardo B.Y. & Berthier R.N. 1st Ed. Addison-Wesley Publishing Co. 1999.
3. Information Retrieval: Algorithms and Heuristics. Grossman D. A. & Frieder O. Springer – The Information Retrieval Series. 2004.

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Semester - VII

(Open Elective - III)

CS-462	L-T-P-C
Management Information Systems & E-Commerce	3-0-0-3

Objective: *The course aims at acquainting students with the fundamentals of information systems & their application in the various areas of business. It also provides an overview of the emerging domain of e-commerce, its concepts, issues & technologies.*

Course Content

Management Information Systems: Need, Purpose & Objectives- Contemporary Approaches to MIS: Business processes & Information Systems –Information systems function in Business-Use of Information Systems for competitive advantage - MIS as an instrument for the organizational change: Management issues – Types of Business Information Systems.

Enhancing Decision Making: Information, Management & Decision Making - Models of Decision Making - Classical, Administrative & Herbert Simon's Models - Attributes of information & its relevance to Decision Making - Types of information, Decision Support Systems - Group Decision Support Systems – Executive Support Systems

E-commerce: Introduction, Definition of e-commerce, emergence of Internet, commercial use of Internet, history of e-commerce, advantages & disadvantages of e-commerce.

Business models for e-commerce: B2C, B2B, C2C, C2B, brokerage model, aggregator model, info-mediaries, communities, value-chain model, manufacturer model, advertising model, subscription & affiliate model.

Enabling technologies: Internet Client server applications, networks, Uniform Resource Locator (URL), search engines, software agents, Internet Service Providers(ISP), broadband technologies, Electronic Data Interchange(EDI).

E-marketing: characteristics, methods, e-marketing value-chain, site adhesion, browsing behavior model, e-advertising, e-branding, e-marketing strategies.

E-security: Security risks, risk management issues, legal & ethical issues, security mechanisms, encryption, digital signature, digital certificates.

E-payment systems: token-based system, card-based system, e-cash. E-cheque, e-banking, risks, data protection.

Text/Reference Books

1. Management Information Systems. Laudon & Laudon, 13th Ed. Pearson Education Asia. 2014.
2. E-commerce: An Indian Perspective. Joseph P. T. 2nd Ed. Prentice Hall India. 2007.
3. Management Information Systems. Bagchi N. 1st Ed. Vikas Publishing. 2010.

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Semester - VII

(Open Elective - III)

EC-475
Computer Networks

L-T-P-C
3-0-0-3

Objective: *To discuss the principles of data communication, the functions of different layers, IEEE standards employed in computer networking & the different protocols & network components.*

Course Content

Fundamentals of Communications & Networking: Network Topology, LAN, Network node components- Hubs, Bridges, Routers, Gateways, Switches, WAN, ISDN Transmission Technology, Communications protocols. Basic Concept of layering & connection oriented & connection less services, Network structure & architecture, the OSI reference model, TCP/IP Architecture, Networks topology.

OSI Network Management: OSI Network management model – Organizational model – Information model, communication model, OSI & TCP/IP Model design issues, Layers of OSI & TCP/IP Model.

Data Link Layer & Data link layer protocols: Elementary data link protocols, Sliding windows protocols, Error handling, Parity Bit Check, CRC, Checksum, Hamming Code, Hamming Distance, Overview of High Level Data Link Control (HDLC) & Ethernet.

Network Layer: IP Header (IPv4 & IPv6), IP addresses – Calculating IP address & design, TCP/IP packet, ICMP, ARP, RARP, IGMP.

Interior Gateway routing Protocol: OSPF, Exterior Gateway Protocols: BGP.

Point-to-Point networks, Routing algorithms, congestion control algorithms, internetworking.

Transport Layer: Design issues, connection management, User Datagram Protocol: UDP protocol & Header, Transmission Control Protocol: TCP protocol, TCP segment Header Format, TCP window Management, TCP Timer Management.

Application Layer (services & protocols): WWW, Hyper Text Transfer Protocol, Domain Name System (DNS), Electronic mail (SMTP, POP, IMAP), File Transfer Protocol (FTP, TFTP).

Text/Reference Books

1. Computer Networks. Tanenbaum A. S. 3rd Ed. PHI/PE. 2011.
2. Data Communication & Networking. Forouzan B. A. 4th Ed. Tata McGraw-Hill. 2007.

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Semester - VII

(Open Elective - III)

EE-465	L-T-P-C
Energy Conversion Process	3-0-0-3

Objective: *To get acquainted the students with various energy conversion processes used in non-conventional energy sources.*

Course Content

Physics of photovoltaic energy conversion in P-N junctions. Effect of physical properties of photovoltaic converters; Performance characteristics of different types of photovoltaic devices; Design considerations & manufacturing processes; Regulations & efficiency of conversion. Charge carriers & thermoelectric phenomena; Thomson, Peltier, Seebeck effect; Kelvin's relations; Thermoelectric energy conversion; Materials, size & capacity; Performance analysis & optimized design of thermoelectric devices. Physics of thermionic emission; Operation of high level vacuum & low pressure thermionic converters; Vacuum & gas-filled converters; Thermionic nuclear reactors; Heat pipes. Basic principles of Magneto hydrodynamic power generation; Hall effect; Ionization & seeding; Faraday, Segmented electrode, Hall & Cross-connected generators, Open & closed cycles; Liquid metal MHD. Fuel cells, Thermodynamics of Fuel Cells. Performance Analysis. Low, medium, high temperature Fuel Cells.

Text/Reference Books

1. Energy Conversion Systems. Begamudre R. D. 1st Ed. New Age Pub. 2000.
2. Solar PV and Wind Energy Conversion Systems: An Introduction to Theory, Modeling with MATLAB/SIMULINK & the Role of Soft Computing Techniques (Green Energy and Technology) Sumathi S., L. Kumar Ashok & Surekha P. Springer. 2015.

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Semester - VII

(Open Elective - III)

ME-465	L-T-P-C
Solar Energy & Applications	3-0-0-3

Objective: *This course discusses solar energy as an important alternative to conventional sources of energy-its generation & utilization.*

Course Content

The energy crisis- causes & options, renewable & non-renewable forms of energy & their characteristics, solar energy option availability & land area requirements. Solar radiation outside the earth atmosphere & at the earth`s surface, instruments for measuring solar radiation, solar radiation geometry, basic earth-sun angles, flux on tilted surfaces. Liquid flat-plate collectors design & performance parameters, solar air heaters, concentrating collectors, solar ponds & energy storage. Solar thermal power generation: low, medium & high temperature cycles, solar cooling, drying & desalination, solar air & water heating, solar passive architecture. Solar photovoltaic power generation: monocrystalline, polycrystalline & amorphous cells, Fabrication & performance of SPV modules. Indirect methods of solar energy utilization: biomass, wind, wave & ocean thermal energy conversion technologies. Economic considerations.

Text/Reference Books

1. Solar Energy principles of thermal collection and storage. Sukhatme. 2nd Ed. Tata McGraw-Hill. 1996.
2. Solar Energy fundamentals and applications. Garg & Prakash. 8th Ed. Tata McGraw-Hill. 2007.

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Semester - VII

(Open Elective - III)

PH-451
Nanotechnology

L-T-P-C
3-0-0-3

Objective: *The objective of this course is to discuss why & how changes occur in the properties of bulk materials when their size approaches a billionth of a meter & to understand the basics of nanostructures, nanotubes, nano-electronic devices, nanobiotechnology, nanomachines etc.*

Course Content

Basics of low dimensional (0D, 1D, 2D) structures, Quantum dots wires & wells, Nanoparticles-free & dispersed, Nanocrystalline & nanostructured films, Self-organized structures; Nanostructures for optical & electronic applications, Quantum dot diodes, lasers & detectors, Single electron devices & logic applications, Optical computing & Information processing; Carbon based nanostructures, Electrical, mechanical & chemical properties of carbon nanotubes, Sensors & drug delivery vehicles, Data processing; Bulk nanostructured material & Photonic crystals; Nanostructures for Magnetic applications, Giant & Colossal Magnetoresistance. Nanostructured ferromagnetism, Random Access Memories; Nanostructures for catalysis & hydrogen storage, Nanoclays, colloids & hydrogen storage nano materials. Organic & Biological nanostructures. Nanomachines & supra molecular devices.

Text/Reference Books

1. Introduction to Nanotechnology. Poole Jr. C. P. & Owens F. J. 1st Ed. Wiley-India Edition. 2007.
2. Nanotechnology: Principles & Practices. Kulkarni S. K. 3rd Ed. Springer. 2014.
3. Introduction to nanoelectronics. Mitin V. V., Kochelap V. A. & Stroscio M. A. 1st Ed. Cambridge University Press. 2007.

4. Nanoelectronics & Nanosystems. Goser K., Glosekotter P. & Dienstuhl J. 2nd Ed. Springer. 2009.

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Semester - VII

(Open Elective - III)

PH-453 L-T-P-C
Chaos in Engineering Systems 3-0-0-3

Objective: *The objective of this course is to introduce the importance of nonlinearity & its ubiquity in engineering systems. The various techniques/tools used to understand the dynamics of nonlinear systems with examples from various engineering disciplines shall be discussed.*

Course Content

Introduction to chaos. Various examples of chaos in engineering systems, electrical systems (Van Der Pol oscillator); Fluid mechanical systems (Lorenz equations, Aeroelastic flutter), Vibration (Duffing equation), Chemical reactions (Belousov-Zhabotinski reaction) etc. Basic concepts in the mathematical treatment of non linear systems. Note: The emphasis in this course will be on developing a physical understanding of chaotic systems. There will be computer simulation demonstration.

Text/Reference Books

1. Chaos and Non-linear dynamics. Hilborn R. 2nd Ed. Oxford University Press. 2001.
2. Non-linear dynamics and chaos. Strogatz S. H. 1st Ed. Perseus books. 2001.
3. Non-linear dynamics. Lakshmanan M. & Rajsekar S. 1st Ed. Springer. 2003.

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Semester - VIII

(Open Elective - IV)

BT-475
Bioremediation Technology

L-T-P-C
3-0-0-3

Objective: *This course is designed to learn advance technology which use microorganisms & plants to remediate polluted & contaminated sites e.g. Industrial waste water, sewage etc. as well as to make students learn about emerging technologies in this area.*

Course Content

General Introduction, toxic chemicals in the environment, Xenobiotic compounds, Properties, toxicity & types of toxicity, classification of toxicants in environment; atmospheric toxicants; Conventional remediation, thermal, chemical & physical processes, role of microorganisms in pollutant degradation, Bioremediation: process, classification: *In situ* & *Ex situ* bioremediation; constrains & priorities of bioremediation; evaluation of bioremediation; factors affecting process of bioremediation, methods in determining biodegradability; contaminant availability for biodegradation. Microbial remediation & phytoremediation, Impact of biotechnology on bioremediation & global application of bioremediation technologies & case studies, Emerging Environmental Biotechnologies: Bioleaching, Biosorption Biotransformation, Biomonitoring, Microbial fuel cells.

Text/Reference Books

1. Cell biology, Genetics, Molecular Biology Evolution & Ecology. Verma P. S. & Agarwal V. K. S. Chand publication. 2005.
2. Environmental Biotechnology. Shrinivas T. New Age International (P) Limited. 2008.

3. General Microbiology. Stanier R.Y., Michael D. & Edward A. 2nd Ed. McMillan Publications. 1989.
4. Environmental Biotechnology. Foster C. F. & John W. D. A. Ellis Horwood Ltd. 1987.
5. Biotechnology & Biodegradation: Advances in Applied Biotechnology Series. Karrely D. Vol -4. Gulf Publications Co. 1989.
6. Bioremediation engineering; design & application. John C.1st Ed. McGraw-Hill. 1995.
7. Introduction to Environmental Biotechnology. Chatterjee A. K. 3rd Ed. PHI Learning Pvt. Ltd. 2011.
8. Environmental Biotechnology. Joganand S. N. 4th Ed. Himalaya Publishing. 2015.

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Semester - VIII

(Open Elective - IV)

CE-464	L-T-P-C
Environmental Management	3-0-0-3

Objective: *To develop the understanding of various environmental management techniques, legal procedure in India, development of environmental friendly industries, environmental audits & concept of green buildings.*

Course Content

The need for environmental awareness & protection in both natural & man-made systems – effects on atmosphere, water, ecological systems & quality of life. Environmental Impact Assessment & Integrated Environmental Management, Practical applications – cradle to grave concept, life cycle analysis & clean technologies. Environmental Audit, Compliance Audit; Concept of ISO & ISO 14000. Needs of developing countries. Governmental standards for Environmental Protection. Emerging Global Environmental Issues. Environmental Legislation.

Text/Reference Books

1. Environmental Impact Analysis Handbook. John R. G. & David W. C. McGraw-Hill. 1980.
2. Environmental Management in South Africa. Fuggle R. F. & Rabie M. A. Juta & Co. Ltd., Johannesburg. 1991.
3. Pollution – Causes, Effects and Control. Harrison R. M. Whitstable Lithop Ltd. 1990.
4. Environmental Impact Assessment. Canter L. W. McGraw-Hill. 1996.

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Semester - VIII

(Open Elective - IV)

CS-459	L-T-P-C
Statistical Simulation & Data Analysis	3-0-0-3

Objective: *The course is designed to discuss the methods to simulate the statistical inferences obtained from the various datasets. The course discusses the various data analysis methods available & their usage in generating inference from the datasets.*

Course Content

Introduction to probability distributions. Basics of estimation & testing of hypothesis (frequentist approach, Bayesian approach).

Different censoring schemes: Type-I, Type-II, hybrid, progressive. Different models & EM algorithm: mixture model; bivariate distributions; cure rate model; competing risk model.

Generating random sample: discrete & continuous multivariate distributions (multinomial, multivariate normal, multivariate exponential); acceptance rejection principle; Monte Carlo markov chain (metropolis Hastings algorithm, Gibbs sampler); Convergence of MCMC : Harris irreducibility, recurrence, minorization, limit theory for Harris recurrent markov chains.

Resampling techniques: jackknife; bootstrap. Hidden Markov Model (forward-backward algorithm, Viterbi algorithm, Baum-welch algorithm). Artificial Neural Network: framework, topology (feed forward neural network, recurrent neural network), training of ANN (supervised, unsupervised, reinforced learning), robustness. Genetic Algorithm: single objective GA, multi-objective NSGA.

Text/Reference Books

1. Simulation. Ross S.M. 4th Ed. Academic Press. 2006.
2. Data Analysis and Decision Making. Albright S.C., Winston W.L., Zappe C.J., Hinrichs C. & Rogove J. 4th Ed. South-Western Publisher. 2002.
3. Data Analysis, Optimization and Simulation Modeling. Albright B. 4th Ed. Cengage. 2012.

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Semester - VIII

(Open Elective - IV)

EC-473
Robotics & Automation

L-T-P-C
3-0-0-3

Objective: *To introduce the basic concepts, parts of robots & types of robots & to make the student familiar with the various drive systems for robot & various applications of robots, justification & implementation of robot.*

Course Content

Introductory Concepts: Introduction to robotics, robotics history & development, classification of robotics, robotics applications & current research trends in robotics.

Basic Components of Robotics Systems: Robotics manipulators & mechanisms actuators-pneumatics, hydraulics & electrics, sensors classifications, internal & external sensors.

Kinematics: Introduction to robotic manipulators, position & orientation of object space, robots coordinate transforms, Forward position analysis, Denavit-Hartenberg representation & parameter calculation, inverse position analysis & parameter calculation.

Euler angles & computation of parameters for different robot configurations.

Statics: Force & moment balance, recursive calculation, equivalent joint torque.

Dynamics: Inertia properties, Euler-Lagrange formulation, Newton-Euler formulation, recursive Newton-Euler algorithm, dynamic algorithm, recursive robot dynamics.

Control: control techniques, second order linear system, feedback control system & performance of feedback control system, robotic joints & joint controller, non-linear trajectory control.

Motion planning: General consideration in path description & generation, Joint space planning, Cartesian space planning, position & orientation trajectory, point to point planning, continuous path generation.

Introduction to robotic vision, image representation & analysis, template matching edge detection, space analysis, prospective transformation, camera calibration, image compression techniques.

Text/Reference Books

1. Introduction to Robotics. Saha S. K. 2nd Ed. Tata McGraw-Hill. 2014.
2. Introduction to robotics: Mechanics and control. Craig J. J. Addition 2nd Ed. Wesley Longman Publishing Co. 1989.
3. Introduction to Robotics (Analysis, Control, Applications). Niku S. B. 2nd Ed. Wiley India. 2011.
4. Robot Dynamics & Control. Spong M. W. & Vidyasagar M. 1st Ed. Wiley. 1989.
5. Industrial Robotics & Manufacturing Automation. Groover M. P. Tata McGraw-Hill. 1998.

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Semester - VIII

(Open Elective - V)

BT-472	L-T-P-C
Bioelectronics & Biosensors	3-0-0-3

Objective: *This course imparts the knowledge of Biosensors, types of biosensors & their applications in online monitoring of bioprocesses.*

Course Content

Biosensors: components of biosensors, advantages & limitations; types of biosensors; biocatalysis based biosensors, bioaffinity based biosensors & microorganisms based biosensors, biologically active material & analyte. Types of membranes used in biosensor constructions. Design of enzyme electrodes & their applications as biosensors in industry such as health care & environment. Transducers in biosensors: piezoelectric, semiconductor, impedimetric, mechanical & molecular electronics based transducers. chemiluminiscene - based biosensors principles & applications; calorimetric, optical, potentiometric / amperometricconductrometric / resistormetric transducers; biosensors in clinical chemistry, medicine & health care, biosensors for veterinary, agriculture & food. Low cost- biosensor for online & environmental monitoring, Molecular electronics, assembly of photonic biomolecular memory store, information processing; commercial prospects for biomolecular computing systems.

Text/Reference Books

1. Biosensors for Environmental Monitoring. Bilitewski U. & Turner. A.P.F. Harwood. 2000
2. Biotechnology the Science & Business. Harwood, Moses V. & Cape. R.E. Academic Publisher London.1991
3. Biosensors for Analytical Monitoring. Rogers K. R. & Mascini M. EPA Biosensors Group. 2001.

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Semester - VIII

(Open Elective - V)

CS-461	L-T-P-C
Soft Computing	3-0-0-3

Objective: *This course deals with soft computing concepts, neural networks, fuzzy logic, use of heuristics based on human experience, genetic algorithm & its applications to soft computing , optimization problems to text analytics.*

Course Content

Introduction to Soft Computing: Rationale & Basics of Learning: Neural Networks: Multi-layer Feed-forward Networks, Recurrent Networks, Self-organizing Networks; Fuzzy Logic: Basics, inference scheme, Neuro-Fuzzy systems; Evolutionary Algorithms: GA & Optimization, Evolutionary Systems, Genetic Programming; Introduction to Rough Sets, Rough-Fuzzy representations, Belief Networks; Principles of SVM; Research based applications.

Text/Reference Books

1. Soft Computing: Fundamentals and Applications. Pratihari D.K. Revised edition. Narosa. 2015.
2. Neuro Fuzzy and Soft Computing. Jang J.S.R., Sun C.T. & Mizutani E. 1st Ed. PHI. 2004.
3. Principles of Soft Computing. Sivanandam S.N. & Deepa S.N. , 2nd Ed. Wiley. 2007.

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Semester - VIII

(Open Elective - V)

EE-466
Hydro Power Generation

L-T-P-C
3-0-0-3

Objective: *To get acquainted the students with various factors & control of hydro power plants.*

Course Content

Types of Hydro plants subsystems of hydro plant, turbines, hydro alternates hydro plant. Auxiliaries, control of hydro power, micro hydel systems & special problems in hydro plants.

Text/Reference Books

1. Hydro Plant Electrical Systems. David C. M. 1st Ed. HCI Publications. 1999.
2. Hydro-electric and Pumped Storage Plants. Jog M G. 1st Ed. New Age Pub. 1989.

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Semester - VIII

(Open Elective - V)

MA-453	L-T-P-C
Mathematical Statistics	3-0-0-3
Pre-requisite	MA-254 / MA-451

Objective: *To introduce the fundamental techniques of Sampling, Estimation & Hypothesis testing & illustrate these techniques with applications.*

Course Content

Review of Random variables. Order Statistics. Random sampling. The Central Limit Theorem. Sampling Distribution related to normal distribution. Point estimation. Bias & mean square errors of point estimators. Properties of point estimation & Methods of estimation. Confidence intervals. Large sample & small sample confidence intervals. Hypothesis testing. Common large sample tests p values. Small sample hypothesis tests. Power of tests & Neyman-Pearson Lemma.

Text/Reference Books

1. Statistical methods (Vol. II). Das N.G. 1st Ed. McGraw-Hill. 2009.
2. Probability statistics and random processes. Veerarajan T. 3rd Ed. Tata McGraw-Hill Education. 2008.
3. Higher Engineering Mathematics. Ramana B. V. 1st Ed. Tata McGraw-Hill Education. 2006.
4. Fundamentals of mathematical statistics. Gupta S.C. & Kapoor V. K. 11th Ed. S. Chand & Sons. 2002.

**Detailed Syllabus for B. Tech. Degree Programme
in
Cloud Technology & Information Security**

Semester - VIII

(Open Elective - V)

ME-467	L-T-P-C
Total Quality Management	3-0-0-3

Objective: *This course discusses total quality is a description of the culture, attitude & organization of a company that aims to provide & continue to provide its customers with products & services that satisfy the needs.*

Course Content

Quality Concepts: Evolution of Quality control, concept change, TQM Modern concept, Quality concept in design, Review off design, Evolution of proto type. Control on Purchased Product: Procurement of various products, evaluation of supplies, capacity verification, Development of sources, procurement procedure. Manufacturing Quality: Methods & Techniques for manufacture, Inspection & control of product, Quality in sales & services, Guarantee, analysis of claims.

Quality Management: Organization structure & design, Quality function, decentralization, Designing & fitting organization for different types products & company, Economics of quality value & contribution, Quality cost, optimizing quality cost, seduction programme. Human Factor in Quality: Attitude of top management, co-operation, of groups, operators attitude, responsibility, causes of operators error & corrective methods. Control Charts: Theory of control charts, measurement range, construction & analysis of R charts, process capability study & use of control charts.

Attributes of Control Charts: Defects, construction & analysis off-chart, improvement by control chart, variable sample size, construction & analysis of C-chart. Defects Diagnosis & Prevention : Defect study, identification & analysis of defects, corrective measure, factors affecting reliability, MTTF, calculation of reliability, Building reliability in

the product, evaluation of reliability, interpretation of test results, reliability control, maintainability, zero defects, quality circle. ISO-9000 & its concept of Quality Management: ISO 9000 series, Taguchi method, JIT in some details

Text/Reference Books

1. Total Quality management. Lal H. Wiley Eastern Limited. 1990.
2. Beyond Total Quality Management. Bounds G. 1st Ed. McGraw-Hill. 1994.
3. TQM in New Product manufacturing. Menon H.G. 1st Ed. McGraw-Hill. 1992.