NEHRU COLLEGE OF ENGINEERING AND RESEARCH CENTRE

(Accredited by NAAC, Approved by AICTE New Delhi, Affiliated to APJKTU)

Pampady, Thiruvilwamala(PO), Thrissur(DT), Kerala 680 588

DEPARTMENT OF COMPUTER SCIENCE AND ENGINEERING

SYLLABUS BOOK FOR STUDENTS

APJ ABDUL KALAM TECHNOLOGICAL UNIVERSITY 2015 SCHEME SYLLABUS FOR CSE

VISION OF THE INSTITUTION

To mould true citizens who are millennium leaders and catalysts of change through excellence in education.

MISSION OF THE INSTITUTION

NCERC is committed to transform itself into a center of excellence in Learning and Research in Engineering and Frontier Technology and to impart quality education to mould technically competent citizens with moral integrity, social commitment and ethical values.

We intend to facilitate our students to assimilate the latest technological know-how and to imbibe discipline, culture and spiritually, and to mould them in to technological giants, dedicated research scientists and intellectual leaders of the country who can spread the beams of light and happiness among the poor and the underprivileged.

ABOUT DEPARTMENT

- Established in: 2002
- Courses offered : B.Tech in Computer Science and Engineering

  M.Tech in Computer Science and Engineering

  M.Tech in Cyber Security
- Approved by AICTE New Delhi and Accredited by NAAC
- Certified by ISO 9001-2015.
- Affiliated to the A P J Abdul Kalam Technological University.

DEPARTMENT VISION

Producing Highly Competent, Innovative and Ethical Computer Science and Engineering Professionals to facilitate continuous technological advancement.

DEPARTMENT MISSION

1. To Impart Quality Education by creative Teaching Learning Process
2. To Promote cutting-edge Research and Development Process to solve real world problems with emerging technologies.
3. To Inculcate Entrepreneurship Skills among Students.
4. To cultivate Moral and Ethical Values in their Profession.

PROGRAMME EDUCATIONAL OBJECTIVES

PEO1: Graduates will be able to Work and Contribute in the domains of Computer Science and Engineering through lifelong learning.

PEO2: Graduates will be able to Analyse, design and development of novel Software Packages, Web Services, System Tools and Components as per needs and specifications.

PEO3: Graduates will be able to demonstrate their ability to adapt to a rapidly changing environment by learning and applying new technologies.

PEO4: Graduates will be able to adopt ethical attitudes, exhibit effective communication skills, Teamworkand leadership qualities.

PROGRAM OUTCOMES (POs)

Engineering Graduates will be able to:

1. Engineering knowledge: Apply the knowledge of mathematics, science, engineering fundamentals, and an engineering specialization to the solution of complex engineering problems.

2. **Problem analysis:** Identify, formulate, review research literature, and analyze complex engineering problems reaching substantiated conclusions using first principles of mathematics, natural sciences, and engineering sciences.

3. **Design/development of solutions:** Design solutions for complex engineering problems and design system components or processes that meet the specified needs with appropriate consideration for the public health and safety, and the cultural, societal, and environmental considerations.

4. **Conduct investigations of complex problems:** Use research-based knowledge and research methods including design of experiments, analysis and interpretation of data, and synthesis of the information to provide valid conclusions.

5. **Modern tool usage:** Create, select, and apply appropriate techniques, resources, and modern engineering and IT tools including prediction and modeling to complex engineering activities with an understanding of the limitations.

6. **The engineer and society:** Apply reasoning informed by the contextual knowledge to assess societal, health, safety, legal and cultural issues and the consequent responsibilities relevant to the professional engineering practice.

7. **Environment and sustainability:** Understand the impact of the professional engineering solutions in societal and environmental contexts, and demonstrate the knowledge of, and need for sustainable development.

8. **Ethics:** Apply ethical principles and commit to professional ethics and responsibilities and norms of the engineering practice.

9. **Individual and team work:** Function effectively as an individual, and as a member or leader in diverse teams, and in multidisciplinary settings.

10. **Communication:** Communicate effectively on complex engineering activities with the engineering community and with society at large, such as, being able to comprehend and write

effective reports and design documentation, make effective presentations, and give and receive clear instructions.

11. **Project management and finance:** Demonstrate knowledge and understanding of the engineering and management principles and apply these to one‟s own work, as a member and leader in a team, to manage projects and in multidisciplinary environments.

12. **Life-long learning:** Recognize the need for, and have the preparation and ability to engage in independent and life-long learning in the broadest context of technological change.

PROGRAM SPECIFIC OUTCOMES (PSO)

PSO1: Ability to Formulate and Simulate Innovative Ideas to provide software solutions for Real-time Problems and to investigate for its future scope.

PSO2: Ability to learn and apply various methodologies for facilitating development of high quality System Software Tools and Efficient Web Design Models with a focus on performance optimization.

PSO3: Ability to inculcate the Knowledge for developing Codes and integrating hardware/software products in the domains of Big Data Analytics, Web Applications and Mobile Apps to create innovative career path and for the socially relevant issues.

APJ ABDUL KALAM TECHNOLOGICAL UNIVERSITY

Curriculum

for

B.Tech Degree

Semesters III to VIII

2016

Computer Science and Engineering

APJ ABDUL KALAM TECHNOLOGICAL UNIVERSITY

CET CAMPUS, THIRUVANANTHAPURAM – 695016

KERALA, INDIA

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Sl No	Semester	Page No	University Link
1	III	7	S3S4-CS201; CS202; CS205; CS208; CS231 https://ktu.edu.in/eu/att/attachments.htm?download=file&id=ils5HPKtTLu6C6nq3WFmyjGJ2orplz%2BJGI3Ye4Z3Lb8%3D
2	IV	24	S3S4-CS203; CS207; CS204; CS206; CS232 to CS234 https://ktu.edu.in/eu/att/attachments.htm?download=file&id=W4zSJSNIBAAOl4KkntBD5aZJX6yfPypdJ9OdI6kRnc8%3D
3	V	40	S5S6-CS301 to CS303; CS306 to CS309; CS331; CS332; CS334; CS361 to CS369; CS372 https://ktu.edu.in/eu/att/attachments.htm?download=file&id=ZtP3Rdpxm5tYJzMcgQhlHhVlVq8zgyY1vx7rcJEOxqM%3D
4	VI	61	S5S6-CS304; CS305; CS333 https://ktu.edu.in/eu/att/attachments.htm?download=file&id=1baflCMVWIocEeOuqANSimZHzSltELmhaQhfvnt%2BnkM%3D
5	VII	79	S7S8 - CS401 to CS405; CS407; CS409; CS431; CS461 to CS466; CS469; CS472 https://ktu.edu.in/eu/att/attachments.htm?download=file&id=ch5aWjjnN2Fsz%2FPO1emiK7PzbsXJFAsQAfmqJQza53k%3D
6	VIII	97	S7S8 - CS467 Machine Learning; CS468 Cloud Computing https://ktu.edu.in/eu/att/attachments.htm?download=file&id=KfwFfYVMCTn7VtJPp%2BuWJrV3NIu80n%2Fnn6lpEJjUPa0%3D
7	General Subjects	108	S3 - MA201 Linear Algebra & Complex Analysis https://ktu.edu.in/eu/att/attachments.htm?download=file&id=YqPBooalLjlpnJxSH9JjP5fAcUwvpK2vjTfp4%2FFwyaY%3D S4- MA202 Probability Distributions, Transforms and Numerical Methods https://ktu.edu.in/eu/att/attachments.htm?download=file&id=im1S3yn%2FpJh7qiRRngAvkFv%2B2Kf2R%2FPyPfVezr6h4XU%3D HS200 Business Economics; HS210 Life Skills; HS300 POM https://ktu.edu.in/eu/att/attachments.htm?download=file&id=7UHd2xbmifnEQ6AHYYrb6v0BSXMaPh3xD6QczsN%2Ba9U%3D Design Project, Comprehensive Exam, Seminar, Project https://ktu.edu.in/eu/att/attachments.htm?download=file&id=x6NbZIRqogY%2Fej7jAf1gfQN8Ew2qVGx%2Br5n8oANyO80%3D

Syllabus (2015 Scheme)

Semester III

Course Code	*Course Name*	*L-T-P*	*Credits*	*Exam Slot*
MA201	Linear Algebra & Complex Analysis	3-1-0	4	A
CS201	Discrete Computational Structures	3-1-0	4	B
CS203	Switching Theory and Logic Design	3-1-0	4	C
CS205	Data Structures	3-1-0	4	D
CS207	Electronics Devices & Circuits	3-0-0	3	E
HS210/ HS200	Life Skills/Business Economics	3-0-0/ 2-0-2	3	F
CS231	Data Structures Lab	0-0-3	1	S
CS233	Electronics Circuits Lab	0-0-3	1	T

Total Credits = 24 **Hours: 28/29** **Cumulative Credits= 71**

Course code	Course Name	L-T-P Credits	Year of Introduction
CS201	DISCRETE COMPUTATIONAL STRUCTURES	3-1-0-4	2016

Pre-requisite: NIL

Course Objectives

1. To introduce mathematical notations and concepts in discrete mathematics that is essential for computing.
2. To train on mathematical reasoning and proof strategies.
3. To cultivate analytical thinking and creative problem solving skills.

Syllabus

Review of Set theory, Countable and uncountable Sets, Review of Permutations and combinations, Pigeon Hole Principle, Recurrence Relations and Solutions, Algebraic systems (semigroups, monoids, groups, rings, fields), Posets and Lattices, Prepositional and Predicate Calculus, Proof Techniques.

Expected Outcome:

Students will be able to

1. identify and apply operations on discrete structures such as sets, relations and functions in different areas of computing.
2. verify the validity of an argument using propositional and predicate logic.
3. construct proofs using direct proof, proof by contraposition, proof by contradiction and proof by cases, and by mathematical induction.
4. solve problems using algebraic structures.
5. solve problems using counting techniques and combinatorics.
6. apply recurrence relations to solve problems in different domains.

Text Books

1. Trembly J.P and Manohar R, "Discrete Mathematical Structures with Applications to Computer Science", Tata McGraw–Hill Pub.Co.Ltd, New Delhi, 2003.
2. Ralph. P. Grimaldi, "Discrete and Combinatorial Mathematics: An Applied Introduction", 4/e, Pearson Education Asia, Delhi, 2002.

References:

1. Liu C. L., "Elements of Discrete Mathematics", 2/e, McGraw–Hill Int. editions, 1988.
2. Bernard Kolman, Robert C. Busby, Sharan Cutler Ross, "Discrete Mathematical Structures", Pearson Education Pvt Ltd., New Delhi, 2003
3. Kenneth H.Rosen, "Discrete Mathematics and its Applications", 5/e, Tata McGraw – Hill Pub. Co. Ltd., New Delhi, 2003.
4. Richard Johnsonbaugh, "Discrete Mathematics", 5/e, Pearson Education Asia, New Delhi, 2002.
5. Joe L Mott, Abraham Kandel, Theodore P Baker, "Discrete Mathematics for Computer Scientists and Mathematicians", 2/e, Prentice-Hall India, 2009.

Course Plan			
Module	**Contents**	**Hours (54)**	**End Sem Exam Marks**
I	**Review of elementary set theory** : Algebra of sets – Ordered pairs and Cartesian products – Countable and Uncountable sets **Relations** :- Relations on sets –Types of relations and their properties – Relational matrix and the graph of a relation – Partitions – Equivalence relations - Partial ordering- Posets – Hasse diagrams - Meet and Join – Infimum and Supremum ***Functions** :-* *Injective, Surjective and Bijective functions - Inverse of a function- Composition*	3 6 1	15 %
II	Review of Permutations and combinations, Principle of inclusion exclusion, Pigeon Hole Principle, **Recurrence Relations**: Introduction- Linear recurrence relations with constant coefficients– Homogeneous solutions – Particular solutions – Total solutions **Algebraic systems**:- Semigroups and monoids - Homomorphism, Subsemigroups and submonoids	3 4 2	15 %
FIRST INTERNAL EXAM			
III	**Algebraic systems (contd…)**:- Groups, definition and elementary properties, subgroups, Homomorphism and Isomorphism, Generators - Cyclic Groups, Cosets and Lagrange's Theorem Algebraic systems with two binary operations- rings, fields-sub rings, ring homomorphism	6 2	15 %
IV	**Lattices and Boolean algebra** :- Lattices –Sublattices – Complete lattices – Bounded Lattices - Complemented Lattices – Distributive Lattices – Lattice Homomorphisms. Boolean algebra – sub algebra, direct product and homomorphisms	7 3	15 %
SECOND INTERNAL EXAM			
V	**Propositional Logic**:- Propositions – Logical connectives – Truth tables Tautologies and contradictions – Contra positive – Logical	2 3	20 %

	equivalences and implications Rules of inference: Validity of arguments.	 3	
VI	**Predicate Logic**:- Predicates – Variables – Free and bound variables – Universal and Existential Quantifiers – Universe of discourse. Logical equivalences and implications for quantified statements – Theory of inference : Validity of arguments. **Proof techniques:** Mathematical induction and its variants – Proof by Contradiction – Proof by Counter Example – Proof by Contra positive.	3 3 3	20 %
END SEMESTER EXAM			

Question Paper Pattern:

1. There will be *five* parts in the question paper – A, B, C, D, E
2. Part A
    a. Total marks : 12
    b. *Four* questions each having 3 marks, uniformly covering module I and II; All *four* questions have to be answered.
3. Part B
    a. Total marks : 18
    b. *Three* questions each having 9 marks, uniformly covering module I and II; T*wo* questions have to be answered. Each question can have a maximum of three subparts
4. Part C
    a. Total marks : 12
    b. *Four* questions each having 3 marks, uniformly covering module III and IV; All *four* questions have to be answered.
5. Part D
    a. Total marks : 18
    b. *Three* questions each having 9 marks, uniformly covering module III and IV; T*wo* questions have to be answered. Each question can have a maximum of three subparts
6. Part E
    a. Total Marks: 40
    b. *Six* questions each carrying 10 marks, uniformly covering modules V and VI; *four* questions have to be answered.
    c. A question can have a maximum of three sub-parts.

7. There should be at least 60% analytical/numerical questions.

Course No.	Course Name	L-T-P-Credits	Year of Introduction
CS203	Switching Theory and Logic Design	3-1-0-4	2016

Pre-requisite: Nil

Course Objectives

1. To impart an understanding of the basic concepts of Boolean algebra and digital systems.
2. To impart familiarity with the design and implementation of different types of practically used sequential circuits.
3. To provide an introduction to use Hardware Description Language

Syllabus

Introduction to Number Systems, Boolean Algebra, Canonical Forms, Logic Gates, Digital Circuit Design, Combination Logic Circuit Design, Sequential Circuit Design, Registers, Counter, Memory modules, Programmable Logical Arrays, Hardware Description Language for Circuit Design, Arithmetic algorithms

Expected Outcome:

Students will be able to:-

1. apply the basic concepts of Boolean algebra for the simplification and implementation of logic functions using suitable gates namely NAND, NOR etc.
2. design simple Combinational Circuits such as Adders, Subtractors, Code Convertors, Decoders, Multiplexers, Magnitude Comparators etc.
3. design Sequential Circuits such as different types of Counters, Shift Registers, Serial Adders, Sequence Generators.
4. use Hardware Description Language for describing simple logic circuits.
5. apply algorithms for addition/subtraction operations on Binary, BCD and Floating Point Numbers.

Text Books:

1. Mano M. M., *Digital Logic & Computer Design*, 4/e, Pearson Education, 2013. [Chapters: 1, 2, 3, 4, 5, 6, 7].
2. Floyd T. L., *Digital Fundamentals*, 10/e, Pearson Education, 2009. [Chapters: 5, 6].
3. M. Morris Mano, *Computer System Architecture*, 3/e, Pearson Education, 2007. [Chapter 10.1, 10.2, 10.5, 10.6, 10.7].
4. Harris D. M. and, S. L. Harris, Digital *Design and Computer Architecture*, 2/e, Morgan Kaufmann Publishers, 2013 [Chapter 4.1, 4.2]

References:

1. Tokheim R. L., *Digital Electronics Principles and Applications*, 7/e, Tata McGraw Hill, 2007.
2. Mano M. M. and M. D Ciletti, *Digital Design*, 4/e, Pearson Education, 2008.
3. Rajaraman V. and T. Radhakrishnan, *An Introduction to Digital Computer Design*, 5/e, Prentice Hall India Private Limited, 2012.
4. Leach D, Malvino A P, Saha G, *Digital Principles and Applications, 8/e, McGraw Hill Education, 2015.*

COURSE PLAN

Module	Contents	Contact Hours (52)	Sem. Exam Marks;%

I	Number systems – Decimal, Binary, Octal and Hexadecimal – conversion from one system to another – representation of negative numbers – representation of BCD numbers – character representation – character coding schemes – ASCII – EBCDIC etc. Addition, subtraction, multiplication and division of binary numbers (no algorithms). Addition and subtraction of BCD, Octal and Hexadecimal numbers. Representation of floating point numbers – precision – addition, subtraction, multiplication and division of floating point numbers	**10**	**15%**
II	Introduction — Postulates of Boolean algebra – Canonical and Standard Forms — logic functions and gates methods of minimization of logic functions — Karnaugh map method and QuinMcClusky method Product-of-Sums Simplification — Don't-Care Conditions.	**09**	**15%**
III	Combinational Logic: combinational Circuits and design Procedure — binary adder and subtractor — multi—level NAND and NOR circuits — Exclusive-OR and Equivalence Functions. Implementation of combination logic: parallel adder, carry look ahead adder, BCD adder, code converter, magnitude comparator, decoder, multiplexer, de-multiplexer, parity generator.	**10**	**15%**
IV	Sequential logic circuits: latches and flip-flops – edge-triggering and level-triggering — RS, JK, D and T flip-flops — race condition — master-slave flip-flop. Clocked sequential circuits: state diagram — state reduction and assignment — design with state equations	**08**	**15%**
V	Registers: registers with parallel load - shift registers universal shift registers – application: serial adder. Counters: asynchronous counters — binary and BCD ripple counters — timing sequences — synchronous counters — up-down counter, BCD counter, Johnson counter — timing sequences and state diagrams.	**08**	**20%**

VI	Memory and Programmable Logic: Random-Access Memory (RAM)—Memory Decoding—Error Detection and Correction — Read only Memory (ROM), Programmable Logic Array (PLA). *HDL: fundamentals, combinational logic, adder, multiplexer.* Arithmetic algorithms: Algorithms for addition and subtraction of binary and BCD numbers, algorithms for floating point addition and subtraction.	**08**	**20%**

Question Paper Pattern:

1. There will be *five* parts in the question paper – A, B, C, D, E
2. Part A
   a. Total marks : 12
   b. *Four* questions each having *3* marks, uniformly covering module I and II; All *four* questions have to be answered.
3. Part B
   a. Total marks : 18
   b. *Three* questions each having *9* marks, uniformly covering module I and II; T*wo* questions have to be answered. Each question can have a maximum of three subparts
4. Part C
   a. Total marks : 12
   b. *Four* questions each having *3* marks, uniformly covering module III and IV; All *four* questions have to be answered.
5. Part D
   a. Total marks : 18
   b. *Three* questions each having *9* marks, uniformly covering module III and IV; T*wo* questions have to be answered. Each question can have a maximum of three subparts
6. Part E
   a. Total Marks: 40
   b. *Six* questions each carrying 10 marks, uniformly covering modules V and VI; *four* questions have to be answered.
   c. A question can have a maximum of three sub-parts.
7. There should be at least 60% analytical/design/numerical questions.

Course code	Course Name	L-T-P-Credits	Year of Introduction
CS205	Data Structures	3-1-0-4	2016

Pre-requisite: B101-05 Introduction to Computing and Problem Solving

Course Objectives

1. To impart a thorough understanding of linear data structures such as stacks, queues and their applications.
2. To impart a thorough understanding of non-linear data structures such as trees, graphs and their applications.
3. To impart familiarity with various sorting, searching and hashing techniques and their performance comparison.
4. To impart a basic understanding of memory management.

Syllabus

Introduction to various programming methodologies, terminologies and basics of algorithms analysis, Basic Abstract and Concrete Linear Data Structures, Non-linear Data Structures, Memory Management, Sorting Algorithms, Searching Algorithms, Hashing.

Expected Outcome:

Students will be able to

1. compare different programming methodologies and define asymptotic notations to analyze performance of algorithms.
2. use appropriate data structures like arrays, linked list, stacks and queues to solve real world problems efficiently.
3. represent and manipulate data using nonlinear data structures like trees and graphs to design algorithms for various applications.
4. illustrate and compare various techniques for searching and sorting.
5. appreciate different memory management techniques and their significance.
6. illustrate various hashing techniques.

Text Books:

1. Samanta D., Classic Data Structures, Prentice Hall India, 2/e, 2009.
2. Richard F. Gilberg, Behrouz A. Forouzan, Data Structures: A Pseudocode Approach with C, 2/e, Cengage Learning, 2005.

References

1. Horwitz E., S. Sahni and S. Anderson, Fundamentals of Data Structures in C, University Press (India), 2008.
2. Aho A. V., J. E. Hopcroft and J. D. Ullman, Data Structures and Algorithms, Pearson Publication,1983.
3. Tremblay J. P. and P. G. Sorenson, Introduction to Data Structures with Applications, Tata McGraw Hill, 1995.
4. Peter Brass, Advanced Data Structures, Cambridge University Press, 2008
5. Lipschuts S., Theory and Problems of Data Structures, Schaum's Series, 1986.
6. Wirth N., Algorithms + Data Structures = Programs, Prentice Hall, 2004.
7. Hugges J. K. and J. I. Michtm, A Structured Approach to Programming, PHI, 1987.
8. Martin Barrett, Clifford Wagner, And Unix: Tools For Software Design, John Wiley, 2008 reprint.

COURSE PLAN			
Module	**Contents**	**Hours (56)**	**Sem. Exam Marks**
I	Introduction to programming methodologies – structured approach, stepwise refinement techniques, programming style, documentation – analysis of algorithms: frequency count, definition of Big O notation, asymptotic analysis of simple algorithms. Recursive and iterative algorithms.	**9**	**15%**
II	Abstract and Concrete Data Structures- Basic data structures – vectors and arrays. Applications, Linked lists:- singly linked list, doubly linked list, Circular linked list, operations on linked list, linked list with header nodes, applications of linked list: polynomials,.	**9**	**15%**
III	Applications of linked list (continued): Memory management, memory allocation and de-allocation. First-fit, best-fit and worst-fit allocation schemes Implementation of Stacks and Queues using arrays and linked list, DEQUEUE (double ended queue). Multiple Stacks and Queues, Applications.	**9**	**15%**
IV	String: - representation of strings, concatenation, substring searching and deletion. Trees: - m-ary Tree, Binary Trees – level and height of the tree, complete-binary tree representation using array, tree traversals (Recursive and non-recursive), applications. Binary search tree – creation, insertion and deletion and search operations, applications.	**10**	**15%**
V	Graphs – representation of graphs, BFS and DFS (analysis not required) applications. Sorting techniques – *Bubble sort, Selection Sort,* Insertion sort, Merge sort, Quick sort, Heaps and Heap sort. Searching algorithms (Performance comparison expected. Detailed analysis not required)	**09**	**20%**
VI	Linear and Binary search. (Performance comparison expected. Detailed analysis not required) Hash Tables – Hashing functions – Mid square, division, folding, digit analysis, collusion resolution and Overflow handling techniques.	**10**	**20%**

Question Paper Pattern:

1. There will be *five* parts in the question paper – A, B, C, D, E
2. Part A
    a. Total marks : 12
    b. *Four* questions each having *3* marks, uniformly covering module I and II; All *four* questions have to be answered.
3. Part B
    a. Total marks : 18
    b. *Three* questions each having *9* marks, uniformly covering module I and II; T*wo* questions have to be answered. Each question can have a maximum of three subparts
4. Part C
    a. Total marks : 12
    b. *Four* questions each having *3* marks, uniformly covering module III and IV; All *four* questions have to be answered.
5. Part D
    a. Total marks : 18
    b. *Three* questions each having *9* marks, uniformly covering module III and IV; T*wo* questions have to be answered. Each question can have a maximum of three subparts
6. Part E
    a. Total Marks: 40
    b. *Six* questions each carrying 10 marks, uniformly covering modules V and VI; *four* questions have to be answered.
    c. A question can have a maximum of three sub-parts.
7. There should be at least 60% analytical/numerical/design questions.

Course code	Course Name	L-T-P -Credits	Year of Introduction
CS207	ELECTRONIC DEVICES & CIRCUITS	3-0-0-3	2016

Pre-requisite: BE101-04 Introduction to Electronics Engg**.**

Course Objectives:

1. To introduce to the students the fundamental concepts of electronic devices and circuits for engineering applications
2. To develop the skill of analysis and design of various analog circuits using electronic devices
3. To provide comprehensive idea about working principle, operation and applications of electronic circuits
4. To equip the students with a sound understanding of fundamental concepts of operational amplifiers
5. To expose to the diversity of operations that operational amplifiers can perform in a wide range of applications
6. To expose to a variety of electronic circuits/systems using various analog ICs

Syllabus

RC Circuits, Diode Circuits, Regulated power supplies, **Field effect transistor,** DC analysis of BJT, RC Coupled amplifier, MOSFET amplifiers, Feedback amplifiers, Power amplifiers, Oscillators, Multivibrators, Operational Amplifier and its applications, Timer IC.

Expected Outcome:

Students will be able to

1. explain, illustrate, and design the different electronic circuits using electronic components
2. design circuits using operational amplifiers for various applications

Text Books:

1. David A Bell, Electronic Devices and Circuits, Oxford University Press, 2008
2. Salivahanan S. and V. S. K. Bhaaskaran, Linear Integrated Circuits, Tata McGraw Hill, 2008

References :

1. Neamen D., Electronic Circuits, Analysis and Design, 3/e, TMH, 2007
2. Robert Boylestad and L Nashelsky, Electronic Devices and Circuit Theory, Pearson.
3. Bogart T. F., Electronic Devices Circuits, 6/e, Pearson, 2012.
4. Maini A. K. and V. Agrawal, Electronic Devices and Circuits, Wiley India, 2011.
5. K.Gopakumar, Design and Analysis of Electronic Circuits, Phasor Books, Kollam, 2013
6. Millman J. and C. Halkias, Integrated Electronics, 2/e, McGraw-Hill, 2010.

Course Plan

Module	Contents	Hours (40)	Sem Exam Marks
1	**Wave shaping circuits:** Sinusoidal and non-sinusoidal wave shapes, Principle and working of RC differentiating and integrating circuits, Conversion of one non-sinusoidal wave shape into another. Clipping circuits - Positive, negative and biased clipper.	5	15%

	Clamping circuits - Positive, negative and biased clamper. Voltage multipliers- Voltage doubler and tripler. Simple sweep circuit using transistor as a switch.		
2	**Regulated power supplies:** Review of simple zener voltage regulator, Shunt and series voltage regulator using transistors, Current limiting and fold back protection, 3 pin regulators-78XX and 79XX, IC 723 and its use as low and high voltage regulators, DC to DC conversion, Circuit/block diagram and working of SMPS.	4	15 %
	Field effect transistors: JFET – Structure, principle of operation and characteristics, Comparison with BJT. MOSFET- Structure, Enhancement and Depletion types, principle of operation and characteristics.	3	
	FIRST INTERNAL EXAM		
3	**Amplifiers:** Introduction to transistor biasing, operating point, concept of load line, thermal stability, fixed bias, self bias, voltage divider bias. Classification of amplifiers, RC coupled amplifier - voltage gain and frequency response. Multistage amplifiers - effect of cascading on gain and bandwidth. Feedback in amplifiers - Effect of negative feedback on amplifiers. MOSFET Amplifier- Circuit diagram and working of common source MOSFET amplifier.	7	15 %
4	**Oscillators:** Classification, criterion for oscillation, analysis of Wien bridge oscillator, Hartley and Crystal oscillator. Non-sinusoidal oscillators: Astable, monostable and bi-stable multivibrators using transistors (Only design equations and working of circuit are required, Analysis not required).	5	15 %
	SECOND INTERNAL EXAM		
5	**Operational amplifiers:** Differential amplifier, characteristics of op-amps(gain, bandwidth, slew rate, CMRR, offset voltage, offset current), comparison of ideal and practical op-amp(IC741), applications of op-amps- scale changer, sign changer, adder/summing amplifier, subtractor, integrator, differentiator, Schmitt trigger, Wien bridge oscillator.	8	20 %

6	**Integrated circuits:** Active filters – Low pass and high pass (first and second order) active filters using op-amp with gain (No analysis required). D/A and A/D convertors – important specifications, Sample and hold circuit. Binary weighted resistor and R-2R ladder type D/A convertors. (concepts only). Flash, dual slope and successive approximation type A/D convertors. Circuit diagram and working of Timer IC555, astable and monostablemultivibrators using 555.	8	20 %
END SEMESTER EXAM			

Question Paper Pattern:

1. There will be *five* parts in the question paper – A, B, C, D, E
2. Part A
   a. Total marks : 12
   b. *Four* questions each having 3 marks, uniformly covering module I and II; All *four* questions have to be answered.
3. Part B
   a. Total marks : 18
   b. *Three* questions each having 9 marks, uniformly covering module I and II; T*wo* questions have to be answered. Each question can have a maximum of three subparts
4. Part C
   a. Total marks : 12
   b. *Four* questions each having 3 marks, uniformly covering module III and IV; All *four* questions have to be answered.
5. Part D
   a. Total marks : 18
   b. *Three* questions each having 9 marks, uniformly covering module III and IV; T*wo* questions have to be answered. Each question can have a maximum of three subparts
6. Part E
   a. Total Marks: 40
   b. *Six* questions each carrying 10 marks, uniformly covering modules V and VI; *four* questions have to be answered.
   c. A question can have a maximum of three sub-parts.
7. There should be at least 60% analytical/numerical/design questions.

Course No.	Course Name	L-T-P - Credits	Year of Introduction
CS231	DATA STRUCTURES LAB	0-0-3-1	2016

Pre-requisite: CS205 Data structures

Course Objectives

1. To implement basic linear and non-linear data structures and their major operations.
2. To implement applications using these data structures.
3. To implement algorithms for various sorting techniques.

List of Exercises/Experiments : (Minimum 12 are to be done)

1. Implementation of Stack and Multiple stacks using one dimensional array. **
2. Application problems using stacks: Infix to post fix conversion, postfix and pre-fix evaluation, MAZE problem etc. **
3. Implementation of Queue, DEQUEUE and Circular queue using arrays.
4. Implementation of various linked list operations. **
5. Implementation of stack, queue and their applications using linked list.
6. Implementation of trees using linked list
7. Representation of polynomials using linked list, addition and multiplication of polynomials. **
8. Implementation of binary trees using linked lists and arrays- creations, insertion, deletion and traversal. **
9. Implementation of binary search trees – creation, insertion, deletion, search
10. Application using trees
11. Implementation of sorting algorithms – bubble, insertion, selection, quick (recursive and non-recursive), merge sort (recursive and non-recursive), and heap sort.**
12. Implementation of searching algorithms – linear search, binary search.**
13. Representation of graphs and computing various parameters (in degree, out degree etc.) - adjacency list, adjacency matrix.
14. Implementation of BFS, DFS for each representation.
15. Implementation of hash table using various mapping functions, various collision and overflow resolving schemes.**
16. Implementation of various string operations.

17. Simulation of first-fit, best-fit and worst-fit allocations.

18. Simulation of a basic memory allocator and garbage collector using doubly linked list.

** *mandatory.*

Expected Outcome:

Students will be able to:

1. appreciate the importance of structure and abstract data type, and their basic usability in different applications
2. analyze and differentiate different algorithms based on their time complexity.
3. implement linear and non-linear data structures using linked lists.
4. understand and apply various data structure such as stacks, queues, trees, graphs, etc. to solve various computing problems.
5. implement various kinds of searching and sorting techniques, and decide when to choose which technique.
6. identify and use a suitable data structure and algorithm to solve a real world problem.

Course No.	Course Name	L-T-P - Credits	Year of Introduction
CS233	ELECTRONICS CIRCUITS LAB	0-0-3-1	2016

Pre-requisite: CS207 Electronic devices & circuits

Course Objectives:

1. To introduce the working of analog electronic circuits.
2. To design, implement and demonstrate analog circuits using electronic components.
3. To provide hands-on experience to the students so that they are able to put theoretical concepts to practice.
4. To use computer simulation tools such as PSPICE, or Multisim to the simulation of electronic circuits.
5. To create an ability to develop descriptions, explanations, predictions and models using evidence .
6. To create an ability to communicate effectively the scientific procedures and explanations about the experiments in oral/report forms.

List of Exercises/Experiments :

(Minimum 13 experiments are to be done in the semester, at least 6 each should be selected from the first(Exp. 1-10) and second(Exp. 11-20) half. Experiment no. 18 is compulsory).

1. Forward and reverse characteristics of PN diode and Zener diode
2. Input and output characteristics of BJT in CE configuration and evaluation of parameters
3. RC integrating and differentiating circuits-Transient response with different time constant
4. RC low pass and high pass circuits- Frequency response with sinusoidal input
5. Clipping circuits (Positive, negative and biased) - Transient and transfer characteristics
6. Clamping circuits (Positive, negative and biased)- Transient characteristics
7. Bridge Rectifier - with and without filter- ripple factor and regulation
8. Simple Zener regulator- Line and load characteristics
9. RC coupled CE amplifier – Mid band gain and frequency response
10. RC phase shift or Wien bridge oscillator using transistor
11. Astable and Monostable multivibrators using transistors
12. Series voltage regulator (Two transistors)- Line and load characteristics
13. Voltage regulator using LM 723)- Line and load characteristics
14. Astable and mono stable multivibrators using 555 Timer
15. Inverting and non-inverting amplifier using op-amp IC741
16. Instrumentation amplifier using op-amp IC741
17. RC phase shift or Wien bridge oscillator using op-amp IC741
18. Simulation of simple circuits (at least 6 from above) using any SPICE software(Transient, AC and DC analysis)

Expected Outcome:

Students will be able to:

1. identify basic electronic components, design and develop electronic circuits.
2. Design and demonstrate functioning of various discrete analog circuits
3. Be familiar with computer simulation of electronic circuits and how to use it proficiently for design and development of electronic circuits.
4. Understand the concepts and their applications in engineering.
5. Communicate effectively the scientific procedures and explanations in formal technical presentations/reports.

Semester IV

Course Code	*Course Name*	*L-T-P*	*Credits*	*Exam Slot*
MA202	Probability Distributions, Transforms and Numerical Methods	3-1-0	4	A
CS202	Computer Organization and Architecture	3-1-0	4	B
CS204	Operating Systems	3-1-0	4	C
CS206	Object Oriented Design and Programming	2-1-0	3	D
CS208	Principles of Database Design	2-1-0	3	E
HS210/ HS200	Life Skills/Business Economics	3-0-0/ 2-0-2	3	**F**
CS232	Free and Open Source Software Lab	0-0-3	1	S
CS234	Digital Systems Lab	0-0-3	1	T

Total Credits = 23 **Hours 28/27** **Cumulative Credits= 94**

Course code	Course Name	L-T-P -Credits	Year of Introduction
CS202	Computer Organization and Architecture	3-1-0-4	2016

Pre-requisite: CS203 Switching theory and logic design

Course Objectives

1. To impart an understanding of the internal organization and operations of a computer.
2. To introduce the concepts of processor logic design and control logic design.

Syllabus

Fundamental building blocks and functional units of a computer. Execution phases of an instruction. Arithmetic Algorithms. Design of the processing unit – how arithmetic and logic operations are performed. Design of the control unit – hardwired and microprogrammed control. I/O organisation – interrupts, DMA, different interface standards. Memory Subsystem – different types.

Expected outcome

Students will be able to:

1. identify the basic structure and functional units of a digital computer.
2. analyze the effect of addressing modes on the execution time of a program.
3. design processing unit using the concepts of ALU and control logic design.
4. identify the pros and cons of different types of control logic design in processors.
5. select appropriate interfacing standards for I/O devices.
6. identify the roles of various functional units of a computer in instruction execution.

Text Books:

1. Hamacher C., Z. Vranesic and S. Zaky, *Computer Organization* ,5/e, McGraw Hill, 2011.
2. Mano M. M., Digital Logic & Computer Design, 4/e, Pearson Education, 2013.

References:

1. Mano M. M., Digital Logic & Computer Design, 4/e, Pearson Education, 2013.
2. Patterson D.A. and J. L. Hennessey, Computer Organization and Design, 5/e, Morgan Kauffmann Publishers, 2013.
3. William Stallings, Computer Organization and Architecture: Designing for Performance, Pearson, 9/e, 2013.
4. Chaudhuri P., Computer Organization and Design, 2/e, Prentice Hall, 2008.
5. Rajaraman V. and T. Radhakrishnan, Computer Organization and Architecture, Prentice Hall, 2011.
6. Messmer H. P., The Indispensable PC Hardware Book, 4/e, Addison-Wesley, 2001

Course Plan

Module	Contents	Hours (51)	Sem.ExamMarks
I	**Basic Structure of computers**–functional units – basic operational concepts –bus structures – software. Memory locations and addresses – memory operations – instructions and instruction sequencing – addressing modes – ARM Example (programs not required). Basic I/O operations – stacks subroutine calls.	6	15%

II	**Basic processing unit** – fundamental concepts – instruction cycle - execution of a complete instruction –multiple- bus organization – sequencing of control signals. **Arithmetic algorithms: A**lgorithms for multiplication and division of binary and BCD numbers — array multiplier —Booth's multiplication algorithm — restoring and non-restoring division — algorithms for floating point, multiplication and division.	10	15%
FIRST INTERNAL EXAMINATION			
III	**I/O organization:** accessing of I/O devices – interrupts –direct memory access –buses –interface circuits –standard I/O interfaces (PCI, SCSI, USB)	8	15%
IV	**Memory system :** basic concepts –semiconductor RAMs –memory system considerations – semiconductor ROMs –flash memory –cache memory and mapping functions.	9	15%
SECOND INTERNAL EXAMINATION			
V	**Processor Logic Design:** Register transfer logic – inter register transfer – arithmetic, logic and shift micro operations –conditional control statements. **Processor organization:**–design of arithmetic unit, logic unit, arithmetic logic unit and shifter –status register –processor unit –design of accumulator.	9	20%
VI	**Control Logic Design:** Control organization – design of hardwired control –control of processor unit –PLA control. **Micro-programmed control:** Microinstructions –horizontal and vertical micro instructions – micro-program sequencer –micro programmed CPU organization.	9	20%
END SEMESTER EXAM			

Question Paper Pattern:

1. There will be *five* parts in the question paper – A, B, C, D, E
2. Part A
    a. Total marks : 12
    b. *Four* questions each having 3 marks, uniformly covering module I and II; All *four* questions have to be answered.
3. Part B
    a. Total marks : 18
    b. *Three* questions each having 9 marks, uniformly covering module I and II; T*wo* questions have to be answered. Each question can have a maximum of three subparts
4. Part C
    a. Total marks : 12
    b. *Four* questions each having 3 marks, uniformly covering module III and IV; All *four* questions have to be answered.
5. Part D
    a. Total marks : 18
    b. *Three* questions each having 9 marks, uniformly covering module III and IV; T*wo* questions have to be answered. Each question can have a maximum of three subparts
6. Part E
    a. Total Marks: 40
    b. *Six* questions each carrying 10 marks, uniformly covering modules V and VI; *four* questions have to be answered.
    c. A question can have a maximum of three sub-parts.
7. There should be at least 60% analytical/numerical/design questions..

Course code	Course Name	L-T-P -Credits	Year of Introduction
CS204	Operating Systems	3-1-0-4	2016

Pre-requisite: CS205 Data structures

Course Objectives

1. To impart fundamental understanding of the purpose, structure, functions of operating system.
2. To impart the key design issues of an operating system

Syllabus

Basic concepts of Operating System, its structure, Process management, inter-process communication, process synchronization, CPU Scheduling, deadlocks, Memory Management, swapping, segmentation, paging, Storage Management - disk scheduling, RAID, File System Interface-implementation. Protection.

Expected outcome

Students will be able to:

1. identify the significance of operating system in computing devices.
2. exemplify the communication between application programs and hardware devices through system calls.
3. compare and illustrate various process scheduling algorithms.
4. apply appropriate memory and file management schemes.
5. illustrate various disk scheduling algorithms.
6. appreciate the need of access control and protection in an operating system.

Text Book:

1. Abraham Silberschatz, Peter B Galvin, Greg Gagne, Operating System Concepts, 9/e, Wiley India, 2015.

References:

1. Garry Nutt, Operating Systems: 3/e, Pearson Education, 2004
2. Bhatt P. C. P., An Introduction to Operating Systems: Concepts and Practice, 3/e, Prentice Hall of India, 2010.
3. William Stallings, Operating Systems: Internals and Design Principles, Pearson, Global Edition, 2015.
4. Andrew S Tanenbaum, Herbert Bos, Modern Operating Systems, Pearson, 4/e, 2015.
5. Madnick S. and J. Donovan, Operating Systems, McGraw Hill, 2001.
6. Hanson P. B., Operating System Principle, Prentice Hall of India, 2001.
7. Deitel H. M., An Introduction to Operating System Principles, Addison-Wesley, 1990.

Course Plan

Module	Contents	Hours (52)	Sem. Exam marks

I	**Introduction**: Functions of an operating system. Single processor, multiprocessor and clustered systems – overview. Kernel Data Structures – Operating Systems used in different computing environments. **Operating System Interfaces and implementation -** User Interfaces, System Calls – examples. Operating System implementation - approaches. Operating System Structure – Monolithic, Layered, Micro-kernel, Modular. System Boot process.	7	15%
II	**Process Management**: Process Concept – Processes-States – Process Control Block – Threads. Scheduling – Queues – Schedulers – Context Switching. Process Creation and Termination. **Inter Process Communication**: Shared Memory, Message Passing, Pipes.	9	15%
FIRST INTERNAL EXAMINATION			
III	**Process Synchronization**: Critical Section-Peterson's solution. Synchronization – Locks, Semaphores, Monitors, Classical Problems – Producer Consumer, Dining Philosophers and Readers-Writers Problems	9	15%
IV	**CPU Scheduling** – Scheduling Criteria – Scheduling Algorithms. **Deadlocks** – Conditions, Modeling using graphs. Handling – Prevention – Avoidance – Detection-Recovery.	8	15%
SECOND INTERNAL EXAMINATION			
V	**Memory Management**: Main Memory – Swapping – Contiguous Memory allocation – Segmentation – Paging – Demand paging	9	20%
VI	**Storage Management:** *Overview of mass storage structure- disks and tapes. Disk structure – accessing disks.* Disk scheduling and management. Swap Space. **File System Interface**: File Concepts – Attributes – operations – types – structure – access methods. File system mounting. Protection. File system implementation. Directory implementation – allocation methods. Free space Management. **Protection**– Goals, Principles, Domain. Access Matrix.	10	20%
END SEMESTER EXAM			

Question Paper Pattern:

1. There will be *five* parts in the question paper – A, B, C, D, E
2. Part A
    a. Total marks : 12
    b. *Four* questions each having *3* marks, uniformly covering module I and II; All *four* questions have to be answered.
3. Part B
    a. Total marks : 18
    b. *Three* questions each having *9* marks, uniformly covering module I and II; T*wo* questions have to be answered. Each question can have a maximum of three subparts
4. Part C
    a. Total marks : 12
    b. *Four* questions each having *3* marks, uniformly covering module III and IV; All *four* questions have to be answered.
5. Part D
    a. Total marks : 18
    b. *Three* questions each having *9* marks, uniformly covering module III and IV; T*wo* questions have to be answered. Each question can have a maximum of three subparts
6. Part E
    a. Total Marks: 40
    b. *Six* questions each carrying 10 marks, uniformly covering modules V and VI; *four* questions have to be answered.
    c. A question can have a maximum of three sub-parts.
7. There should be at least 60% analytical/numerical/design questions.

Course code	Course Name	L-T-P - Credits	Year of Introduction
CS206	Object Oriented Design and Programming	2-1-0-3	2016

Pre-requisite: CS205 Data structures

Course Objectives

1. To introduce basic concepts of object oriented design techniques.
2. To give a thorough understanding of Java language.
3. To provide basic exposure to the basics of multithreading, database connectivity etc.
4. To impart the techniques of creating GUI based applications.

Syllabus

Object oriented concepts, Object oriented systems development life cycle, Unified Modeling Language, Java Overview, Classes and objects, Parameter passing, Overloading, Inheritance, Overriding, Packages, Exception Handling, Input/Output, Threads and multithreading, Applets, Event Handling mechanism, Working with frames and graphics, AWT Controls, Swings, Java database connectivity.

Expected outcome.

Students will be able to:

1. apply object oriented principles in software design process.
2. develop Java programs for real applications using java constructs and libraries.
3. understand and apply various object oriented features like inheritance, data abstraction, encapsulation and polymorphism to solve various computing problems using
   Java language.
4. implement Exception Handling in java.
5. use graphical user interface and Event Handling in java.
6. develop and deploy Applet in java.

Text Books:

1. Herbert Schildt, Java: The Complete Reference, 8/e, Tata McGraw Hill, 2011.
2. Bahrami A., Object Oriented Systems Development using the Unified Modeling Language, McGraw Hill, 1999.

References:

1. Y. Daniel Liang, Introduction to Java Programming, 7/e, Pearson, 2013.
2. Nageswararao R., Core Java: An Integrated Approach, Dreamtech Press, 2008.
3. Flanagan D., Java in A Nutshell, 5/e, O'Reilly, 2005.
4. Barclay K., J. Savage, Object Oriented Design with UML and Java, Elsevier, 2004.
5. Sierra K., Head First Java, 2/e, O'Reilly, 2005.
6. Balagurusamy E., Programming JAVA a Primer, 5/e, McGraw Hill, 2014.
7.

Course Plan

Module	Contents	Hours (42)	Sem. ExamMarks
I	Object oriented concepts, Object oriented systems development life cycle. Unified Modeling Language, UML class diagram, Use-case diagram. Java Overview: Java virtual machine, *data types, operators, control statements,* Introduction to Java programming.	08	15%

II	Classes fundamentals, objects, methods, constructors, parameter passing, overloading, access control keywords.	07	15%
FIRST INTERNAL EXAMINATION			
III	Inheritance basics, method overriding, abstract classes, interface. Defining and importing packages. Exception handling fundamentals, multiple catch and nested try statements.	06	15%
IV	Input/Output: files, stream classes, reading console input. Threads: thread model, use of Thread class and Runnable interface, thread synchronization, multithreading.	06	15%
SECOND INTERNAL EXAMINATION			
V	String class - basics. Applet basics and methods. Event Handling: delegation event model, event classes, sources, listeners.	07	20%
VI	Introduction to AWT: working with frames, graphics, color, font. AWT Control fundamentals. Swing overview. Java database connectivity: JDBC overview, creating and executing queries, dynamic queries.	08	20%
END SEMESTER EXAM			

Question Paper Pattern:

1. There will be *five* parts in the question paper – A, B, C, D, E
2. Part A
    a. Total marks : 12
    b. *Four* questions each having 3 marks, uniformly covering module I and II; All *four* questions have to be answered.
3. Part B
    a. Total marks : 18
    b. *Three* questions each having 9 marks, uniformly covering module I and II; T*wo* questions have to be answered. Each question can have a maximum of three subparts
4. Part C
    a. Total marks : 12
    b. *Four* questions each having 3 marks, uniformly covering module III and IV; All *four* questions have to be answered.
5. Part D
    a. Total marks : 18
    b. *Three* questions each having 9 marks, uniformly covering module III and IV; T*wo* questions have to be answered. Each question can have a maximum of three subparts

6. Part E
    a. Total Marks: 40
    b. *Six* questions each carrying 10 marks, uniformly covering modules V and VI; *four* questions have to be answered.
    c. A question can have a maximum of three sub-parts.

7. There should be at least 60% analytical/design questions.

Course code	Course Name	L-T-P - Credits	Year of Introduction
CS208	Principles of Database Design	2-1-0-3	2016

Pre-requisite: CS205 Data structures

Course Objectives

- To impart the basic understanding of the theory and applications of database management systems.
- To give basic level understanding of internals of database systems.
- To expose to some of the recent trends in databases.

Syllabus:

Types of data, database and DBMS, Languages and users. Software Architecture, E-R and Extended E-R Modelling, Relational Model – concepts and languages, relational algebra and tuple relational calculus, SQL, views, assertions and triggers, relational db design, FDs and normal forms, Secondary storage organization, indexing and hashing, query optimization, concurrent transaction processing and recovery principles, recent topics.

Expected outcome.

Students will be able to:

1. define, explain and illustrate the fundamental concepts of databases.
2. construct an Entity-Relationship (E-R) model from specifications and to perform the transformation of the conceptual model into corresponding logical data structures.
3. model and design a relational database following the design principles.
4. develop queries for relational database in the context of practical applications
5. define, explain and illustrate fundamental principles of data organization, query optimization and concurrent transaction processing.
6. appreciate the latest trends in databases.

Text Books:

1. Elmasri R. and S. Navathe, *Database Systems: Models, Languages, Design andApplication Programming*, Pearson Education, 2013.
2. Sliberschatz A., H. F. Korth and S. Sudarshan, *Database System Concepts*, 6/e, McGraw Hill, 2011.

References:

1. Powers S., *Practical RDF*, O'Reilly Media, 2003.
2. Plunkett T., B. Macdonald, *et al.*, *Oracle Big Data Hand Book*, Oracle Press, 2013.

Course Plan

Module	Contents	Hours (42)	Sem. Exam Marks
I	**Introduction:** Data: structured, semi-structured and unstructured data**,** Concept & Overview of DBMS, Data Models, Database Languages, Database Administrator, Database Users, Three Schema architecture of DBMS. Database architectures and classification. (Reading: Elmasri Navathe, Ch. 1 and 2. Additional Reading: Silbershatz, Korth, Ch. 1) **Entity-Relationship Model:** Basic concepts, Design Issues, Mapping Constraints, Keys, Entity-	06	15%

	Relationship Diagram, Weak Entity Sets, Relationships of degree greater than 2 (Reading: Elmasri Navathe, Ch. 7.1-7.8)		
II	**Relational Model:** Structure of relational Databases, Integrity Constraints, synthesizing ER diagram to relational schema (Reading: Elmasri Navathe, Ch. 3 and 8.1, Additional Reading: Silbershatz, Korth, Ch. 2.1-2.4) **Database Languages:** Concept of DDL and DML relational algebra (Reading: Silbershatz, Korth, Ch 2.5-2.6 and 6.1-6.2, Elmasri Navathe, Ch. 6.1-6.5)	**06**	**15%**
FIRST INTERNAL EXAM			
III	**Structured Query Language (SQL**): Basic SQL Structure, examples, Set operations, Aggregate Functions, nested sub-queries (Reading: Elmasri Navathe, Ch. 4 and 5.1) **Views, assertions and triggers** (Reading: Elmasri Navathe, Ch. 5.2-5.3, Optional reading: Silbershatz, Korth Ch. 5.3).	**07**	**15%**
IV	**Relational Database Design:** Different anomalies in designing a database, normalization, functional dependency (FD), Armstrong's Axioms, closures, Equivalence of FDs, minimal Cover (proofs not required). Normalization using functional dependencies, INF, 2NF, 3NF and BCNF, lossless and dependency preserving decompositions (Reading: Elmasri and Navathe, Ch. 14.1-14.5, 15.1-15.2. Additional Reading: Silbershatz, Korth Ch. 8.1-8.5)	**07**	**15%**
SECOND INTERNAL EXAM			
V	**Physical Data Organization**: index structures, primary, secondary and clustering indices, Single level and Multi-level indexing, B+-Trees (basic structure only, algorithms not needed), (Reading Elmasri and Navathe, Ch. 17.1-17.4) **Query Optimization**: heuristics-based query optimization, (Reading Elmasri and Navathe, Ch. 18.1, 18.7)	**07**	**20%**
VI	**Transaction Processing Concepts:** overview of concurrency control and recovery acid properties, serial and concurrent schedules, conflict serializability. Two-phase locking, failure classification, storage structure, stable storage, log based recovery, deferred database modification, check-pointing, (Reading Elmasri and Navathe, Ch. 20.1-20.5 (except 20.5.4-20.5.5) , Silbershatz, Korth Ch. 15.1 (except 15.1.4-15.1.5), Ch. 16.1 – 16.5) R**ecent topics (preliminary ideas only):** Semantic Web and RDF(Reading: Powers Ch.1, 2), GIS, biological databases (Reading: Elmasri and Navathe Ch. 23.3-23.4) Big Data (Reading: Plunkett and Macdonald, Ch. 1, 2)	**09**	**20%**
END SEMESTER EXAM			

Question Paper Pattern:

1. There will be *five* parts in the question paper – A, B, C, D, E
2. Part A
    a. Total marks : 12
    b. *Four* questions each having 3 marks, uniformly covering module I and II; All *four* questions have to be answered.
3. Part B
    a. Total marks : 18
    b. *Three* questions each having 9 marks, uniformly covering module I and II; T*wo* questions have to be answered. Each question can have a maximum of three subparts
4. Part C
    a. Total marks : 12
    b. *Four* questions each having 3 marks, uniformly covering module III and IV; All *four* questions have to be answered.
5. Part D
    a. Total marks : 18
    b. *Three* questions each having 9 marks, uniformly covering module III and IV; T*wo* questions have to be answered. Each question can have a maximum of three subparts
6. Part E
    a. Total Marks: 40
    b. *Six* questions each carrying 10 marks, uniformly covering modules V and VI; *four* questions have to be answered.
    c. A question can have a maximum of three sub-parts.
7. There should be at least 60% analytical/numerical/design questions.

Course code	Course Name	L-T-P-Credits	Year of Introduction
CS232	Free and Open Source Software Lab	0-0-3-1	2016

Pre-requisite: CS204 Operating systems

Course Objectives: To expose students to FOSS environment and introduce them to use open source packages in open source platform.

List of Exercises/Experiments:

1. Getting started with Linux basic commands for directory operations, displaying directory structure in tree format etc.
2. Linux commands for operations such as redirection, pipes, filters, job control, changing ownership/permissions of files/links/directory.
3. Advanced linux commands curl, wget, ftp, ssh and grep
4. Shell Programming : Write shell script to show various system configuration like
   - Currently logged user and his login name
   - Your current shell
   - Your home directory
   - Your operating system type
   - Your current path setting
   - Your current working directory
   - Number of users currently logged in
5. Write shell script to show various system configurations like
   - your OS and version, release number, kernel version
   - all available shells
   - computer CPU information like processor type, speed etc
   - memory information
   - hard disk information like size of hard-disk, cache memory, model etc
   - File system (Mounted)
6. Write a shell script to implement a menu driven calculator with following functions
   1. Addition
   2. Subtraction
   3. Multiplication
   4. Division
   5. Modulus
7. Write a script called addnames that is to be called as follows
   ./addnames ulist username
   Here *ulist* is the name of the file that contains list of user names and *username* is a particular student's username. The script should
   - check that the correct number of arguments was received and print a message, in case the number of arguments is incorrect
   - check whether the ulist file exists and print an error message if it does not
   - check whether the username already exists in the file. If the username exists, print a message stating that the name already exists. Otherwise, add the username to the end of the list.

8. Version Control System setup and usage using GIT. Try the following features.
   - Creating a repository
   - Checking out a repository
   - Adding content to the repository
   - Committing the data to a repository
   - Updating the local copy
   - Comparing different revisions
   - Revert
   - Conflicts and a conflict Resolution
9. Shell script which starts on system boot up and kills every process which uses more than a specified amount of memory or CPU.
10. Introduction to packet management system : Given a set of RPM or DEB, build and maintain, and serve packages over http or ftp. Configure client systems to access the package repository.
11. Perform simple text processing using Perl, Awk.
12. Running PHP : simple applications like login forms after setting up a LAMP stack
13. Virtualisation environment (e.g., xen, kqemu, virtualbox or lguest) to test applications, new kernels and isolate applications. It could also be used to expose students to other alternate OS such as freeBSD
14. Compiling from source : learn about the various build systems used like the auto* family, cmake, ant etc. instead of just running the commands. This could involve the full process like fetching from a cvs and also include autoconf, automake etc.,
15. Kernel configuration, compilation and installation : Download / access the latest kernel source code from *kernel.org*, compile the kernel and install it in the local system. Try to view the source code of the kernel
16. GUI Programming: Create scientific calculator – using any one of Gambas, GTK, QT
17. Installing various software packages. Either the package is yet to be installed or an older version is present. The student can practice installing the latest version. (Internet access is needed).
    - Install samba and share files to windows
    - Install Common Unix Printing System(CUPS)
18. Set up the complete network interface by configuring services such as gateway, DNS, IP tables etc. using *ifconfig*

Expected outcome:

The students will be able to:

1. Identify and apply various Linux commands
2. Develop shell scripts and GUI for specific needs
3. Use tools like GIT
4. Perform basic level application deployment, kernel configuration and installation, packet management and installation etc.

Course code	Course Name	L-T-P - Credits	Year of Introduction
CS234	DIGITAL SYSTEMS LAB	0-0-3-1	2016

Pre-requisite: CS203 Switching theory and logic design

Course Objectives:

1. To familiarize students with digital ICs, the building blocks of digital circuits
2. To provide students the opportunity to set up different types of digital circuits and study their behaviour

List of Exercises/Experiments : (minimum 12 exercises/experiments are mandatory)

1. Familiarizations and verification of the truth tables of basic gates and universal gates.
2. Verification of Demorgan's laws for two variables.
3. Implementation of half adder and full adder circuits using logic gates.
4. Implementation of half subtractor and full subtractor circuits using logic gates.
5. Implementation of parallel adder circuit.
6. Realization of 4 bit adder/subtractor and BCD adder circuits using IC 7483.
7. Implementation of a 2 bit magnitude comparator circuit using logic gates.
8. Design and implementation of code convertor circuits
9. a) BCD to excess 3 code b) binary to gray code
10. Implementation of multiplexer and demultiplexer circuits using logic gates. Familiarization with various multiplexer and demultiplexer ICs.
11. Realization of combinational circuits using multiplexer/demultiplexer ICs.
12. Implementation of SR, D, JK, JK master slave and T flip flops using logic gates. Familiarization with IC 7474 and IC 7476.
13. Implementation of shift registers using flip flop Integrated Circuits.
14. Implementation of ring counter and Johnson counter using flip flop Integrated Circuits.
15. Realization of asynchronous counters using flip flop ICs.
16. Realization of synchronous counters using flip flop ICs. Familiarization with various counter Integrated Circuits.
17. Implementation of a BCD to 7 segment decoder and display.
18. Simulation of Half adder, Full adder using VHDL.

(Note: The experiments may be done using hardware components and/or VHDL)

Course outcome:

Students will be able to:

1. identify and explain the digital ICs and their use in implementing digital circuits.
2. design and implement different kinds of digital circuits.

Semester V

Course Code	Course Name	L-T-P	Credits	Exam Slot
CS301	Theory of Computation	3-1-0	4	A
CS303	System Software	2-1-0	3	B
CS305	Microprocessors and Microcontrollers	2-1-0	3	C
CS307	Data Communication	3-0-0	3	D
CS309	Graph Theory and Combinatorics	2-0-2	3	E
	Elective 1	3-0-0	3	F
CS341	Design Project	0-1-2	2	S
CS331	System Software Lab	0-0-3	1	T
CS333	Application Software Development Lab	0-0-3	1	U

Total Credits = 23 **Hours: 29** **Cumulative Credits= 117**

Elective 1:-
1. CS361 Soft Computing
2. CS363 Signals and Systems
3. CS365 Optimization Techniques
4. CS367 Logic for Computer Science
5. CS369 Digital System Testing & Testable Design

Course code	Course Name	L-T-P Credits	Year of Introduction
CS301	THEORY OF COMPUTATION	3-1-0-4	2016

Prerequisite: Nil

Course Objectives

- To introduce the concept of formal languages.
- To discuss the Chomsky classification of formal languages with discussion on grammar and automata for regular, context-free, context sensitive and unrestricted languages.
- To discuss the notions of decidability and halting problem.

Syllabus

Introduction to Automata Theory, Structure of an automaton, classification of automata, grammar and automata for generating each class of formal languages in the Chomsky Hierarchy, decidability and Halting problem.

Expected Outcome

The Students will be able to

i. Classify formal languages into regular, context-free, context sensitive and unrestricted languages.
ii. Design finite state automata, regular grammar, regular expression and Myhill- Nerode relation representations for regular languages.
iii. Design push-down automata and context-free grammar representations for context-free languages.
iv. Design Turing Machines for accepting recursively enumerable languages.
v. Understand the notions of decidability and undecidability of problems, Halting problem.

Text Books

1. John E Hopcroft, Rajeev Motwani and Jeffrey D Ullman, Introduction to Automata Theory, Languages, and Computation, 3/e, Pearson Education, 2007
2. John C Martin, Introduction to Languages and the Theory of Computation, TMH, 2007
3. Michael Sipser, Introduction To Theory of Computation, Cengage Publishers, 2013

References

1. Dexter C. Kozen, Automata and Computability, Springer1999.

Course Plan

Module	Contents	Hours	End Sem. Exam Marks
I	Introduction to Automata Theory and its significance. **Type 3 Formalism:** Finite state automata – Properties of transition functions, Designing finite automata, NFA, Finite Automata with Epsilon Transitions, Equivalence of NFA and DFA, Conversion of NFA to DFA, Equivalence and Conversion of NFA with and without Epsilon Transitions.	**10**	**15 %**
II	Myhill-Nerode Theorem, Minimal State FA Computation. Finite State Machines with Output- Mealy and Moore machine (Design Only), Two- Way Finite Automata. Regular Grammar, Regular Expressions, Equivalence of regular expressions and NFA with epsilon transitions. Converting Regular Expressions to NFA with epsilon transitions Equivalence of DFA and regular expressions, converting DFA to Regular Expressions.	**10**	**15 %**

FIRST INTERNAL EXAM			
III	Pumping Lemma for Regular Languages, Applications of Pumping Lemma. Closure Properties of Regular sets (Proofs not required), Decision Problems related with Type 3 Formalism **Type 2 Formalism:-** Context-Free Languages (CFL), Context-Free Grammar (CFG), Derivation trees, Ambiguity, Simplification of CFG, Chomsky Normal Form, Greibach normal forms	**09**	**15 %**
IV	Non-Deterministic Pushdown Automata (NPDA), design. Equivalence of acceptance by final state and empty stack in PDA. Equivalence between NPDA and CFG, Deterministic Push Down Automata, Closure properties of CFLs (Proof not required), Decision Problems related with Type 3 Formalism.	**08**	**15 %**
SECOND INTERNAL EXAM			
V	Pumping Lemma for CFLs, Applications of Pumping Lemma. **Type 1 Formalism:** Context-sensitive Grammar. Linear Bounded Automata (Design not required) **Type 0 Formalism:** Turing Machine (TM) – Basics and formal definition, TMs as language acceptors, TMs as Transducers, Designing Turing Machines.	**09**	**20 %**
VI	Variants of TMs -Universal Turing Machine, Multi- tape TMs, Non Deterministic TMs, Enumeration Machine (Equivalence not required), Recursively Enumerable Languages, Recursive languages, Properties of Recursively Enumerable Languages and Recursive Languages, Decidability and Halting Problem. Chomsky Hierarchy	**08**	**20 %**
END SEMESTER EXAM			

Question Paper Pattern

1. There will be *five* parts in the question paper – A, B, C, D, E
2. Part A
   a. Total marks : 12 b. *Four* questions each having *3* marks, uniformly covering modules I and II; All*four* questions have to be answered.
3. Part B
   a. Total marks : 18 b. *Three* questions each having *9* marks, uniformly covering modules I and II; T*wo* questions have to be answered. Each question can have a maximum of three subparts.
4. Part C
   a. Total marks : 12 b. *Four* questions each having *3* marks, uniformly covering modules III and IV; All*four* questions have to be answered.
5. Part D
   a. Total marks : 18 b. *Three* questions each having *9* marks, uniformly covering modules III and IV; *Two* questions have to be answered. Each question can have a maximum of three subparts
6. Part E
   a. Total Marks: 40 b. *Six* questions each carrying 10 marks, uniformly covering modules V and VI; *four* questions have to be answered. A question can have a maximum of three sub-parts.

There should be at least 60% analytical/numerical questions.

Course code	Course Name	L-T-P Credits	Year of Introduction
CS303	SYSTEM SOFTWARE	2-1-0-3	2016

Prerequisite: Nil

Course Objectives

- To make students understand the design concepts of various system software like Assembler, Linker, Loader and Macro pre-processor, Utility Programs such as Text Editor and Debugger.

Syllabus

Different types of System Software, SIC & SIC/XE Architecture and Programming, Basic Functions of Assembler, Assembler Design, Single pass and 2 Pass Assemblers and their Design, Linkers and Loaders, Absolute Loader and Relocating loader, Design of Linking Loader, Macro Processor and its design, Fundamentals of Text Editor Design, Operational Features of Debuggers

Expected Outcome

The Students will be able to

i. distinguish different software into different categories..
ii. design, analyze and implement one pass, two pass or multi pass assembler.
iii. design, analyze and implement loader and linker.
iv. design, analyze and implement macro processors.
v. critique the features of modern editing /debugging tools.

Text book

1. Leland L. Beck, System Software: An Introduction to Systems Programming, 3/E, Pearson Education Asia, 1997.

References

1 D.M. Dhamdhere, Systems Programming and Operating Systems, Second Revised Edition, Tata McGraw Hill.
2. http://gcc.gnu.org/onlinedocs/gcc-2.95.3/cpp_1.html - The C Preprocessor
3. J Nithyashri, System Software, Second Edition, Tata McGraw Hill.
4. John J. Donovan, Systems Programming, Tata McGraw Hill Edition 1991.
5. Jonathan Corbet, Alessandro Rubini, Greg Kroah-Hartman, Linux Device Drivers, Third Edition, O.Reilly Books
6. M. Beck, H. Bohme, M. Dziadzka, et al., Linux Kernel Internals, Second Edition, Addison Wesley Publications,
7. Peter Abel, IBM PC Assembly Language and Programming, Third Edition, Prentice Hall of India.
8. Writing UNIX device drivers - George Pajari – Addison Wesley Publications (Ebook : http://tocs.ulb.tu-darmstadt.de/197262074.pdf).

Course Plan

Module	Contents	Hours	End Sem Exam. Marks

I	***Introduction :*** System Software Vs. Application Software, Different System Software– Assembler, Linker, Loader, Macro Processor, Text Editor, Debugger, Device Driver, Compiler, Interpreter, Operating System(Basic Concepts only) SIC & SIC/XE Architecture, Addressing modes, SIC & SIC/XE Instruction set, Assembler Directives and Programming.	**2** **6**	**15%**
II	***Assemblers*** Basic Functions of Assembler. Assembler output format – Header, Text and End Records- Assembler data structures, Two pass assembler algorithm, Hand assembly of SIC/XE program, Machine dependent assembler features.	**6**	**15 %**
FIRST INTERNAL EXAM			
III	***Assembler design options:*** Machine Independent assembler features – program blocks, Control sections, Assembler design options- Algorithm for Single Pass assembler, Multi pass assembler, Implementation example of MASM Assembler	**7**	**15 %**
IV	***Linker and Loader*** Basic Loader functions - Design of absolute loader, Simple bootstrap Loader, Machine dependent loader features- Relocation, Program Linking, Algorithm and data structures of two pass Linking Loader, Machine dependent loader features, Loader Design Options.	**7**	**15 %**
SECOND INTERNAL EXAM			
V	***Macro Preprocessor:-*** Macro Instruction Definition and Expansion. One pass Macro processor Algorithm and data structures, Machine Independent Macro Processor Features, Macro processor design options	**7**	**20 %**
VI	***Device drivers:*** Anatomy of a device driver, Character and block device drivers, General design of device drivers ***Text Editors:*** Overview of Editing, User Interface, Editor Structure. ***Debuggers :-*** Debugging Functions and Capabilities, Relationship with other parts of the system, Debugging Methods- By Induction, Deduction and Backtracking.	**2** **2** **4**	**20 %**
END SEMESTER EXAM			

Question Paper Pattern

1. There will be *five* parts in the question paper – A, B, C, D, E
2. Part A
    a. Total marks : 12
    b. *Four* questions each having *3* marks, uniformly covering modules I and II; All*four* questions have to be answered.
3. Part B
    a. Total marks : 18
    b. *Three* questionseach having *9* marks, uniformly covering modules I and II; T*wo* questions have to be answered. Each question can have a maximum of three subparts.
4. Part C
    a. Total marks : 12
    b. *Four* questions each having *3* marks, uniformly covering modules III and IV; All*four* questions have to be answered.
5. Part D
    a. Total marks : 18
    b. *Three* questions each having *9* marks, uniformly covering modules III and IV; *Two* questions have to be answered. Each question can have a maximum of three subparts
6. Part E
    a. Total Marks: 40
    b. *Six* questions each carrying 10 marks, uniformly covering modules V and VI; *four* questions have to be answered.
    c. A question can have a maximum of three sub-parts.

7. There should be at least 60% analytical/numerical questions.

Course code	Course Name	L-T-P - Credits	Year of Introduction
CS305	Microprocessors and Microcontrollers	2-1-0-3	2016

Prerequisite: CS202 Computer Organisation and Architecture

Course Objectives

- To impart basic understanding of the internal organisation of 8086 Microprocessor and 8051 microcontroller.
- To introduce the concepts of interfacing microprocessors with external devices.
- To develop Assembly language programming skills.

Syllabus

Introduction to 8086 Microprocessor; Architecture and signals, Instruction set of 8086, Timing Diagram, Assembly Language Programming, Memory and I/O interfacing, Interfacing with 8255, 8279, 8257, Interrupts and Interrupt handling, Microcontrollers - 8051 Architecture and its salient features, Instruction Set and Simple Programming Concepts.

Expected Outcome

The Students will be able to

i. Describe different modes of operations of a typical microprocessor and microcontroller.
ii. Design and develop 8086 assembly language programs using software interrupts and various assembler directives.
iii. Interface microprocessors with various external devices.
iv. Analyze and compare the features of microprocessors and microcontrollers.
v. Design and develop assembly language programs using 8051 microcontroller.

Text Books

1. Bhurchandi and Ray, *Advanced Microprocessors and Peripherals*, Third Edition McGraw Hill, 2012
2. Raj Kamal, *Microcontrollers: Architecture, Programming, Interfacing and System Design*, Pearson Education, 2011.
3. Douglas V. Hall, SSSP Rao, *Microprocessors and Interfacing*, Third Edition, McGrawHill Education, 2012.

References

1. Barry B. Brey, *The Intel Microprocessors – Architecture, Programming and Interfacing*, Eigth Edition, Pearson Education, 2015
2. A. NagoorKani, *Microprocessors and Microcontrollers*, Second Edition, Tata McGraw Hill, 2012.

Course Plan

Module	Contents	Hours	End Sem. Exam Marks
I	Evolution of microprocessors, 8086 Microprocessor - Architecture and signals, Memory organisation, Minimum and maximum mode of operation, Minimum mode Timing Diagram. Comparison of 8086 and 8088.	07	15%
II	8086 Addressing Modes, 8086 Instruction set and Assembler Directives - Assembly Language Programming with Subroutines, Macros, Passing Parameters, Use of stack.	08	15%

FIRST INTERNAL EXAM			
III	Interrupts - Types of Interrupts and Interrupt Service Routine. Handling Interrupts in 8086, Interrupt programming. Basic Peripherals and their Interfacing with 8086 - Programmable Interrupt Controller - 8259 - Architecture.	**07**	**15%**
IV	Interfacing Memory, I/O, 8255 - Detailed study - Architecture, Control word format and modes of operation, Architecture and modes of operation of 8279 and 8257 (Just mention the control word, no need to memorize the control word format)	**07**	**15%**
SECOND INTERNAL EXAM			
V	Microcontrollers - Types of Microcontrollers - Criteria for selecting a microcontroller - Example Applications. Characteristics and Resources of a microcontroller. Organization and design of these resources in a typical microcontroller - 8051. 8051 Architecture, Register Organization, Memory and I/O addressing, Interrupts and Stack.	**08**	**20%**
VI	8051 Addressing Modes, Different types of instructions and Instruction Set, Simple programs. Peripheral Chips for timing control - 8254/8253.	**08**	**20%**
END SEMESTER EXAM			

Question Paper Pattern

1. There will be *five* parts in the question paper – A, B, C, D, E
2. Part A
   a. Total marks : 12
   b. *Four* questions each having *3* marks, uniformly covering modules I and II; All*four* questions have to be answered.
3. Part B
   a. Total marks : 18
   b. *Three*questions each having *9* marks, uniformly covering modules I and II; T*wo* questions have to be answered. Each question can have a maximum of three subparts.
4. Part C
   a. Total marks : 12
   b. *Four* questions each having *3* marks, uniformly covering modules III and IV;All*four* questions have to be answered.
5. Part D
   a. Total marks : 18
   b. *Three*questionseach having *9* marks, uniformly covering modules III and IV; *Two* questions have to be answered. Each question can have a maximum of three subparts
6. Part E
   a. Total Marks: 40
   b. *Six* questions each carrying 10 marks, uniformly covering modules V and VI; *four* questions have to be answered.
   c. A question can have a maximum of three sub-parts.
7. There should be at least 60% analytical/numerical questions.

Course code.	Course Name	L-T-P-Credits	Year of Introduction
CS307	DATA COMMUNICATION	3-0-0-3	2016

Prerequisite: Nil

Course Objectives

- To introduce fundamental communication models.
- To discuss various time domain and frequency domain concepts of data communication.
- To introduce the concepts of encoding, multiplexing and spread spectrum.

Syllabus

Data Transmission, Transmission Impairments, Channel Capacity, Transmission media, Wireless propagation, Signal encoding Techniques, Multiplexing, Digital data transmission techniques, Sampling theorem, Error detection and correction, Spread spectrum, Basic principles of switching.

Expected Outcome

The Students will be able to

i. Identify and list the various issues present in the design of a data communication system.
ii. Apply the time domain and frequency domain concepts of signals in data communication.
iii. Compare and select transmission media based on transmission impairments and channel capacity.
iv. Select and use appropriate signal encoding techniques and multiplexing techniques for a given scenario.
v. Design suitable error detection and error correction algorithms to achieve error free data communication and explain different switching techniques.

Text Books

1. Curt M. White, Fundamentals of Networking and Communication 7/e, Cengage learning. [Chapter 3,4,9,10]
2. Forouzan B. A., Data Communications and Networking, 5/e, Tata McGraw Hill, 2013. [Chapters:3,4, 5, 6,7,8]
3. Schiller J., Mobile Communications, 2/e, Pearson Education, 2009. [Chapters:2,3]
4. William Stallings, Data and Computer Communication 9/e, Pearson Education, Inc. [Chapters: 4, 5, 6, 7, 8, 9].

References

1. Forouzan B. A., Data Communications and Networking, 4/e, Tata McGraw Hill, 2007.
2. Tanenbaum A. S. and D. Wetherall, Computer Networks, Pearson Education, 2013.

COURSE PLAN

Module	Contents	Hours	End Sem. Exam Marks

I	Data Transmission: Communication model Simplex, half duplex and full duplex transmission - Periodic Analog signals: Sine wave, phase, wavelength, time and frequency domain, bandwidth - Digital Signals; Digital data Transmission:- Analog & Digital data, Analog & Digital signals, Analog &Digital transmission – Transmission Impairments: Attenuation, Delay distortion, Noise - Channel capacity: Nyquist Bandwidth, Shannon's Capacity formula.	**08**	**15%**
II	Transmission media - Guided Transmission Media: Twisted pair, Coaxial cable, optical fiber, Wireless Transmission, Terrestrial microwave, Satellite microwave. Wireless Propagation: Ground wave propagation, Sky Wave propagation, LoS Propagation.	**07**	**15%**
FIRST INTERNAL EXAM			
III	Signal Encoding techniques - Digital Data Digital Signals: NRZ, Multilevel binary, Biphase - Digital Data Analog Signals : ASK, FSK, PSK - Analog Data Digital Signals: Sampling theorem, PCM, Delta Modulation - Analog Data Analog Signals: AM, FM, PM.	**07**	**15%**
IV	Multiplexing- Space Division Multiplexing-Frequency Division Multiplexing: Wave length Division Multiplexing - Time Division multiplexing: Characteristics, Digital Carrier system, SONET/SDH- Statistical time division multiplexing: Cable Modem - Code Division Multiplexing. Multiple Access– CDMA.	**07**	**15%**
SECOND INTERNAL EXAM			
V	Digital Data Communication Techniques - Asynchronous transmission, Synchronous transmission-Detecting and Correcting Errors-Types of Errors-Error Detection: Parity check, Cyclic Redundancy Check (CRC) - Error Control Error Correction: Forward Error Correction and Hamming Distance.	**06**	**20%**
VI	Spread Spectrum Techniques-Direct Sequence Spread Spectrum (DSSS), Frequency Hopping Spread Spectrum (FHSS). Basic principles of switching - Circuit Switched Networks, Structure of Circuit Switch - Packet Switching: Datagram Networks, Virtual Circuit Networks, Structure of packet switches.	**07**	**20%**
END SEMESTER EXAM			

Question Paper Pattern

1. There will be *five* parts in the question paper – A, B, C, D, E
2. Part A
    a. Total marks : 12
    b. *Four* questions each having 3 marks, uniformly covering modules I and II;All*four* questions have to be answered.
3. Part B

a. Total marks : 18
b. *Three*questions each having *9* marks, uniformly covering modules I and II; T*wo* questions have to be answered. Each question can have a maximum of three subparts.

4. Part C
   a. Total marks : 12
   b. *Four* questions each having *3* marks, uniformly covering modules III and IV;All*four* questions have to be answered.
5. Part D
   a. Total marks : 18
   b. *Three*questionseach having *9* marks, uniformly covering modules III and IV;*Two* questions have to be answered. Each question can have a maximum of three subparts
6. Part E
   a. Total Marks: 40
   b. *Six* questions each carrying 10 marks, uniformly covering modules V and VI; *four* questions have to be answered.
   c. A question can have a maximum of three sub-parts.
7. There should be at least 60% analytical/numerical questions.

Course code	Course Name	L-T-P Credits	Year of Introduction
CS309	GRAPH THEORY AND COMBINATORICS	2-0-2-3	2016

Prerequisite: Nil

Course Objectives

- To introduce the fundamental concepts in graph theory, including properties and characterization of graphs/ trees and Graphs theoretic algorithms

Syllabus

Introductory concepts of graphs, Euler and Hamiltonian graphs, Planar Graphs, Trees, Vertex connectivity and edge connectivity, Cut set and Cut vertices, Matrix representation of graphs, Graphs theoretic algorithms.

Expected Outcome

The Students will be able to

i. Demonstrate the knowledge of fundamental concepts in graph theory, including properties and characterization of graphs and trees.
ii. Use graphs for solving real life problems.
iii. Distinguish between planar and non-planar graphs and solve problems.
iv. Develop efficient algorithms for graph related problems in different domains of engineering and science.

Text Books

1. Douglas B. West, Introduction to Graph Theory, Prentice Hall India Ltd., 2001
2. Narasingh Deo, Graph theory, PHI, 1979.
3. Robin J. Wilson, Introduction to Graph Theory, Longman Group Ltd., 2010

References

1. R. Diestel, *Graph Theory*, free online edition, 2016: diestel-graph-theory.com/basic.html.

Course Plan

Module	Contents	Hours	End Sem. Exam Marks
I	**Introductory concepts** - What is graph – Application of graphs – finite and infinite graphs – Incidence and Degree – Isolated vertex, pendent vertex and Null graph. Paths and circuits – Isomorphism, sub graphs, walks, paths and circuits, Connected graphs, disconnect graphs.	09	15 %
II	Euler graphs, Hamiltonian paths and circuits, Dirac's theorem for Hamiltonicity, Travelling salesman problem. Directed graphs – types of digraphs, Digraphs and binary relation	10	15 %
	FIRST INTERNAL EXAM		
III	Trees – properties, pendent vertex, Distance and centres - Rooted and binary tree, counting trees, spanning trees.	07	15 %
IV	Vertex Connectivity, Edge Connectivity, Cut set and Cut Vertices, Fundamental circuits, Planar graphs, Different representation of planar graphs, Euler's theorem, Geometric dual, Combinatorial dual.	09	15 %
	SECOND INTERNAL EXAM		

V	Matrix representation of graphs- Adjacency matrix, Incidence Matrix, Circuit matrix, Fundamental Circuit matrix and Rank, Cut set matrix, Path matrix	**08**	**20 %**
VI	Graphs theoretic algorithms - Algorithm for computer representation of a graph, algorithm for connectedness and components, spanning tree, shortest path.	**07**	**20 %**
END SEMESTER EXAM			

Question Paper Pattern

1. There will be *five* parts in the question paper – A, B, C, D, E
2. Part A
   a. Total marks : 12
   b. *Four* questions each having *3* marks, uniformly covering modules I and II; All*four* questions have to be answered.
3. Part B
   a. Total marks : 18
   b. *Three*questions each having *9* marks, uniformly covering modules I and II; T*wo* questions have to be answered. Each question can have a maximum of three subparts.
4. Part C
   a. Total marks : 12
   b. *Four* questions each having *3* marks, uniformly covering modules III and IV; All*four* questions have to be answered.
5. Part D
   a. Total marks : 18
   b. *Three*questions each having *9* marks, uniformly covering modules III and IV; *Two* questions have to be answered. Each question can have a maximum of three subparts.
6. Part E
   a. Total Marks: 40
   b. *Six* questions each carrying 10 marks, uniformly covering modules V and VI; *four* questions have to be answered.
   c. A question can have a maximum of three sub-parts.
7. There should be at least 60% analytical/numerical questions.

Course code	Course Name	L-T-P Credits	Year of Introduction
CS331	SYSTEM SOFTWARE LAB	0-0-3-1	2016

Prerequisite: Nil

Course Objectives

- To build an understanding on design and implementation of different types of system software.

List of Exercises/Experiments: (Exercises/experiments marked with * are mandatory from each part. Total 12 Exercises/experiments are mandatory)

Part A

1. Simulate the following non-preemptive CPU scheduling algorithms to find turnaround time and waiting time.
   a) FCFS b) SJF c) Round Robin (pre-emptive) d) Priority
2. Simulate the following file allocation strategies.
   a) Sequential b) Indexed c) Linked
3. Implement the different paging techniques of memory management.
4. Simulate the following file organization techniques *
   a) Single level directory b) Two level directory c) Hierarchical
5. Implement the banker's algorithm for deadlock avoidance.*
6. Simulate the following disk scheduling algorithms. *
   a) FCFS b)SCAN c) C-SCAN
7. Simulate the following page replacement algorithms
   a) FIFO b)LRU c) LFU
8. Implement the producer-consumer problem using semaphores. *
9. Write a program to simulate the working of the dining philosopher's problem.*

Part B

10. Implement the symbol table functions: create, insert, modify, search, and display.
11. Implement pass one of a two pass assembler. *
12. Implement pass two of a two pass assembler. *
13. Implement a single pass assembler. *
14. Implement a two pass macro processor *
15. Implement a single pass macro processor.
16. Implement an absolute loader.
17. Implement a relocating loader.
18. Implement pass one of a direct-linking loader.
19. Implement pass two of a direct-linking loader.
20. Implement a simple text editor with features like insertion / deletion of a character, word, and sentence.
21. Implement a symbol table with suitable hashing.*

Expected Outcome

The students will be able to

i. Compare and analyze CPU Scheduling Algorithms like FCFS, Round Robin, SJF, and Priority.
ii. Implement basic memory management schemes like paging.
iii. Implement synchronization techniques using semaphores etc.
iv. Implement banker's algorithm for deadlock avoidance.
v. Implement memory management schemes and page replacement schemes and file allocation and organization techniques.
vi. Implement system software such as loaders, assemblers and macro processor.

Course code	Course Name	L-T-P - Credits	Year of Introduction
CS333	APPLICATION SOFTWARE DEVELOPMENT LAB	0-0-3-1	2016

Pre-requisite : CS208 Principles of Database Design

Course Objectives

- To introduce basic commands and operations on database.
- To introduce stored programming concepts (PL-SQL) using Cursors and Triggers .
- To familiarize front end tools of database.

List of Exercises/Experiments: (Exercises/experiments marked with * are mandatory. Total 12 Exercises/experiments are mandatory)

1. Creation of a database using DDL commands and writes DQL queries to retrieve information from the database.
2. Performing DML commands like Insertion, Deletion, Modifying, Altering, and Updating records based on conditions.
3. Creating relationship between the databases. *
4. Creating a database to set various constraints. *
5. Practice of SQL TCL commands like Rollback, Commit, Savepoint.
6. Practice of SQL DCL commands for granting and revoking user privileges.
7. Creation of Views and Assertions *
8. Implementation of Build in functions in RDBMS *
9. Implementation of various aggregate functions in SQL *
10. Implementation of Order By, Group By& Having clause. *
11. Implementation of set operators, nested queries and Join queries *
12. Implementation of various control structures using PL/SQL *
13. Creation of Procedures and Functions *
14. Creation of Packages *
15. Creation of database Triggers and Cursors *
16. Practice various front-end tools and report generation.
17. Creating Forms and Menus
18. Mini project (Application Development using Oracle/ MySQL using Database connectivity)*
    a. Inventory Control System.
    b. Material Requirement Processing.
    c. Hospital Management System.
    d. Railway Reservation System.
    e. Personal Information System.
    f. Web Based User Identification System.
    g. Timetable Management System.
    h. Hotel Management System.

Expected Outcome

The students will be able to

i. Design and implement a database for a given proble\\\\m using database design principles.
ii. Apply stored programming concepts (PL-SQL) using Cursors and Triggers.
iii. Use graphical user interface, Event Handling and Database connectivity to develop and deploy applications and applets.
iv. Develop medium-sized project in a team.

Course code	Course Name	L-T-P Credits	Year of Introduction
CS361	SOFT COMPUTING	3-0-0-3	2016

Prerequisite: Nil

Course Objectives

- To introduce the concepts in Soft Computing such as Artificial Neural Networks, Fuzzy logic-based systems, genetic algorithm-based systems and their hybrids.

Syllabus

Introduction to Soft Computing, Artificial Neural Networks, Fuzzy Logic and Fuzzy systems, Genetic Algorithms, hybrid systems.

Expected Outcome

The Students will be able to

1. Learn soft computing techniques and their applications.
2. Analyze various neural network architectures.
3. Define the fuzzy systems.
4. Understand the genetic algorithm concepts and their applications.
5. Identify and select a suitable Soft Computing technology to solve the problem; construct a solution and implement a Soft Computing solution.

Text Books

1. S. N. Sivanandam and S. N.Deepa, Principles of soft computing – John Wiley & Sons, 2007.
2. Timothy J. Ross, Fuzzy Logic with engineering applications , John Wiley & Sons, 2016.

References

1. N. K. Sinha and M. M. Gupta, Soft Computing & Intelligent Systems: Theory & Applications-Academic Press /Elsevier. 2009.
2. Simon Haykin, Neural Network- A Comprehensive Foundation- Prentice Hall International, Inc.1998
3. R. Eberhart and Y. Shi, Computational Intelligence: Concepts to Implementation, Morgan Kaufman/Elsevier, 2007.
4. Driankov D., Hellendoorn H. and Reinfrank M., An Introduction to Fuzzy Control-Narosa Pub., 2001.
5. Bart Kosko, Neural Network and Fuzzy Systems- Prentice Hall, Inc., Englewood Cliffs, 1992
6. Goldberg D.E., Genetic Algorithms in Search, Optimization, and Machine Learning-Addison Wesley, 1989.

Course Plan

Module	Contents	Hours	End Sem. Exam Marks
I	Introduction to Soft Computing Artificial neural networks - biological neurons, Basic models of artificial neural networks – Connections, Learning, Activation Functions, McCulloch and Pitts Neuron, Hebb network.	**07**	**15%**
II	Perceptron networks – Learning rule – Training and testing algorithm, Adaptive Linear Neuron, Back propagation Network – Architecture, Training algorithm	**07**	**15%**
FIRST INTERNAL EXAM			

III	Fuzzy logic - fuzzy sets - properties - operations on fuzzy sets, fuzzy relations - operations on fuzzy relations	**07**	**15%**
IV	Fuzzy membership functions, fuzzification, Methods of membership value assignments – intuition – inference – rank ordering, Lambda – cuts for fuzzy sets, Defuzzification methods	**07**	**15%**
SECOND INTERNAL EXAM			
V	Truth values and Tables in Fuzzy Logic, Fuzzy propositions, Formation of fuzzy rules - Decomposition of rules – Aggregation of rules, Fuzzy Inference Systems - Mamdani and Sugeno types, Neuro-fuzzy hybrid systems – characteristics - classification	**07**	**20%**
VI	Introduction to genetic algorithm, operators in genetic algorithm - coding - selection - cross over – mutation, Stopping condition for genetic algorithm flow, Genetic-neuro hybrid systems, Genetic-Fuzzy rule based system	**07**	**20%**
END SEMESTER EXAMINATION			

Question Paper Pattern

1. There will be *five* parts in the question paper – A, B, C, D, E
2. Part A
   a. Total marks : 12
   b. *Four*questions each having *3* marks, uniformly covering modules I and II; All*four* questions have to be answered.
3. Part B
   a. Total marks : 18
   b. *Three*questions each having *9* marks, uniformly covering modules I and II; T*wo* questions have to be answered. Each question can have a maximum of three sub-parts
4. Part C
   a. Total marks : 12
   b. *Four* questions each having *3* marks, uniformly covering modules III and IV;All*four* questions have to be answered.
5. Part D
   a. Total marks : 18
   b. *Three*questions each having *9* marks, uniformly covering modules III and IV; *Two* questions have to be answered. Each question can have a maximum of three subparts
6. Part E
   a. Total Marks: 40
   b. *Six* questions each carrying 10 marks, uniformly covering modules V and VI; *four* questions have to be answered.
   c. A question can have a maximum of three sub-parts.
7. There should be at least 60% analytical/numerical/design questions.

Course code	Course Name	L-T-P-Credits	Year of Introduction
CS365	OPTIMIZATION TECHNIQUES	3-0-0-3	2016

Prerequisite: Nil

Course Objectives

- To build an understanding on the basics of optimization techniques.
- To introduce basics of linear programming and meta- heuristic search techniques.

Syllabus

Basics of Operations Research - Formulation of optimization problems - Linear Programming - Transportation Problem - Assignment Problem - Network flow Problem - Tabu Search - Genetic Algorithm - Simulated Annealing – Applications.

Expected Outcome

The Students will be able to

i. Formulate mathematical models for optimization problems.
ii. Analyze the complexity of solutions to an optimization problem.
iii. Design programs using meta-heuristic search concepts to solve optimization problems.
iv. Develop hybrid models to solve an optimization problem.

Text Books

1. G. Zapfel, R. Barune and M. Bogl, Meta heuristic search concepts: A tutorial with applications to production and logistics, Springer, 2010.
2. Hamdy A. Taha, Operations Research – An introduction, Pearson Education, 2010.
3. Rao S.S., Optimization Theory and Applications, Wiley Eastern, 1984.

References

1. Gass S. I., Introduction to Linear Programming, Tata McGraw Hill.
2. Goldberg, Genetic algorithms in Search, optimization and Machine Learning, Addison Wesley, 1989.
3. K. Deb, Optimization for engineering design – algorithms and examples, Prentice Hall of India, 2004.
4. Reeves C., Modern heuristic techniques for combinatorial problems, Orient Longman, 1993.

COURSE PLAN

Module	Contents	Hours	End Sem. Exam Marks
I	Decision-making procedure under certainty and under uncertainty - Operations Research-Probability and decision- making- Queuing or Waiting line theory-Simulation and Monte- Carlo Technique- Nature and organization of optimization problems- Scope and hierarchy of optimization- Typical applications of optimization.	08	15%
II	Essential features of optimization problems - Objective function- Continuous functions - Discrete functions - Unimodal functions - Convex and concave functions, Investment costs and operating costs in objective function - Optimizing profitably constraints-Internal and external constraints-Formulation of optimization problems. Continuous functions - Discrete functions - Unimodal functions - Convex and concave functions.	07	15%

FIRST INTERNAL EXAM			
III	Necessary and sufficient conditions for optimum of unconstrained functions-Numerical methods for unconstrained functions - One-dimensional search - Gradient-free search with fixed step size. Linear Programming - Basic concepts of linear programming - Graphical interpretation-Simplex method - Apparent difficulties in the Simplex method.	**06**	**15%**
IV	Transportation Problem, Loops in transportation table, Methods of finding initial basic feasible solution, Tests for optimality. Assignment Problem, Mathematical form of assignment problem, methods of solution.	**06**	**15%**
SECOND INTERNAL EXAM			
V	Network analysis by linear programming and shortest route, maximal flow problem. Introduction to Non-traditional optimization, Computational Complexity – NP-Hard, NP-Complete. Tabu Search-Basic Tabu search, Neighborhood, Candidate list, Short term and Long term memory	**07**	**20%**
VI	Genetic Algorithms- Basic concepts, Encoding, Selection, Crossover, Mutation. Simulated Annealing - Acceptance probability, Cooling, Neighborhoods, Cost function. Application of GA and Simulated Annealing in solving sequencing and scheduling problems and Travelling salesman problem.	**08**	**20%**
END SEMESTER EXAM			

Question Paper Pattern

1. There will be *five* parts in the question paper – A, B, C, D, E
2. Part A
   a. Total marks : 12
   b. *Four* questions each having 3 marks, uniformly covering modules I and II; All*four* questions have to be answered.
3. Part B
   a. Total marks : 18
   b. *Three*questions each having 9 marks, uniformly covering modules I and II; *Two* questions have to be answered. Each question can have a maximum of three subparts.
4. Part C
   a. Total marks : 12
   b. *Four* questions each having 3 marks, uniformly covering modules III and IV; All*four* questions have to be answered.
5. Part D
   a. Total marks : 18
   b. *Three*questions each having 9 marks, uniformly covering modules III and IV; *Two* questions have to be answered. Each question can have a maximum of three subparts

6. Part E
    a. Total Marks: 40
    b. *Six* questions each carrying 10 marks, uniformly covering modules V and VI; *four* questions have to be answered.
    c. A question can have a maximum of three sub-parts.

7. There should be at least 60% analytical/numerical questions.

Semester VI

Course Code	Course Name	L-T-P	Credits	Exam Slot
CS302	Design and Analysis of Algorithms	3-1-0	4	A
CS304	Compiler Design	3-0-0	3	B
CS306	Computer Networks	3-0-0	3	C
CS308	Software Engineering and Project Management	3-0-0	3	D
HS300	Principles of Management	3-0-0	3	E
	Elective 2	3-0-0	3	F
CS332	Microprocessor Lab	0-0-3	1	S
CS334	Network Programming Lab	0-0-3	1	T
CS352	Comprehensive Exam	0-1-1	2	U

Total Credits = 23 **Hours: 27** **Cumulative Credits= 140**

Elective 2:-

1. CS362 Computer Vision
2. CS364 Mobile Computing
3. CS366 Natural Language Processing
4. CS368 Web Technologies
5. CS372 High Performance Computing

Course code	Course Name	L-T-P - Credits	Year of Introduction
CS302	Design and Analysis of Algorithms	3-1-0-4	2016

Prerequisite: Nil

Course Objectives

- To introduce the concepts of Algorithm Analysis, Time Complexity, Space Complexity.
- To discuss various Algorithm Design Strategies with proper illustrative examples.
- To introduce Complexity Theory.

Syllabus

Introduction to Algorithm Analysis, Notions of Time and Space Complexity, Asymptotic Notations, Recurrence Equations and their solutions, Master's Theorem, Divide and Conquer and illustrative examples, AVL trees, Red-Black Trees, Union-find algorithms, Graph algorithms, Divide and Conquer, Dynamic Programming, Greedy Strategy, Back Tracking and Branch and Bound, Complexity classes

Expected outcome

The students will be able to

i. Analyze a given algorithm and express its time and space complexities in asymptotic notations.
ii. Solve recurrence equations using Iteration Method, Recurrence Tree Method and Master's Theorem.
iii. Design algorithms using Divide and Conquer Strategy.
iv. Compare Dynamic Programming and Divide and Conquer Strategies.
v. Solve Optimization problems using Greedy strategy.
vi. Design efficient algorithms using Back Tracking and Branch Bound Techniques for solving problems.
vii. Classify computational problems into P, NP, NP-Hard and NP-Complete.

Text Books

1. Ellis Horowitz, SartajSahni, SanguthevarRajasekaran, Computer Algorithms, Universities Press, 2007 [Modules 3,4,5]
2. Thomas H. Cormen, Charles E. Leiserson, Ronald L. Rivest, Clifford Stein, Introduction to Algorithms, MIT Press, 2009 [Modules 1,2,6]

References

1. Alfred V. Aho, John E. Hopcroft and Jeffrey D. Ullman, The Design and Analysis of Computer Algorithms, Pearson Education, 1999.
2. Anany Levitin, Introduction to the Design and Analysis of Algorithms, Pearson, 3rd Edition, 2011.
3. Gilles Brassard, Paul Bratley, Fundamentals of Algorithmics, Pearson Education, 1995.
4. Richard E. Neapolitan, Kumarss Naimipour, Foundations of Algorithms using C++ Psuedocode, Second Edition, 1997.

Course Plan

Module	Contents	Hours	End Sem. Exam Marks

I	***Introduction to Algorithm Analysis***Time and Space Complexity- Elementary operations and Computation of Time Complexity- Best, worst and Average Case Complexities- Complexity Calculation of simple algorithms ***Recurrence Equations:***Solution of Recurrence Equations – Iteration Method and Recursion Tree Methods	**04** **04**	**15 %**
II	***Master's Theorem***(Proof not required) – examples, Asymptotic Notations and their properties- Application of Asymptotic Notations in Algorithm Analysis- Common Complexity Functions ***AVL Trees*** – rotations, Red-Black Trees insertion and deletion (Techniques only; algorithms not expected). B-Trees – insertion and deletion operations. Sets- Union and find operations on disjoint sets.	**05** **05**	**15%**
FIRST INTERNAL EXAM			
III	***Graphs*** – DFS and BFS traversals, complexity, Spanning trees – Minimum Cost Spanning Trees, single source shortest path algorithms, Topological sorting, strongly connected components.	**07**	**15%**
IV	***Divide and Conquer:***The Control Abstraction, 2 way Merge sort, Strassen's Matrix Multiplication, Analysis ***Dynamic Programming :*** The control Abstraction- The Optimality Principle- Optimal matrix multiplication, Bellman-Ford Algorithm	**04** **05**	**15%**
SECOND INTERNAL EXAM			
V	Analysis, Comparison of Divide and Conquer and Dynamic Programming strategies ***Greedy Strategy:*** - The Control Abstraction- the Fractional Knapsack Problem, Minimal Cost Spanning Tree Computation- Prim's Algorithm – Kruskal's Algorithm.	**02** **04** **03**	**20%**
VI	***Back Tracking:*** -The Control Abstraction – The N Queen's Problem, 0/1 Knapsack Problem ***Branch and Bound:***Travelling Salesman Problem. ***Introduction to Complexity Theory :-***Tractable and Intractable Problems- The P and NP Classes- Polynomial Time Reductions - The NP- Hard and NP-Complete Classes	**03** **03** **03**	**20%**
END SEMESTER EXAM			

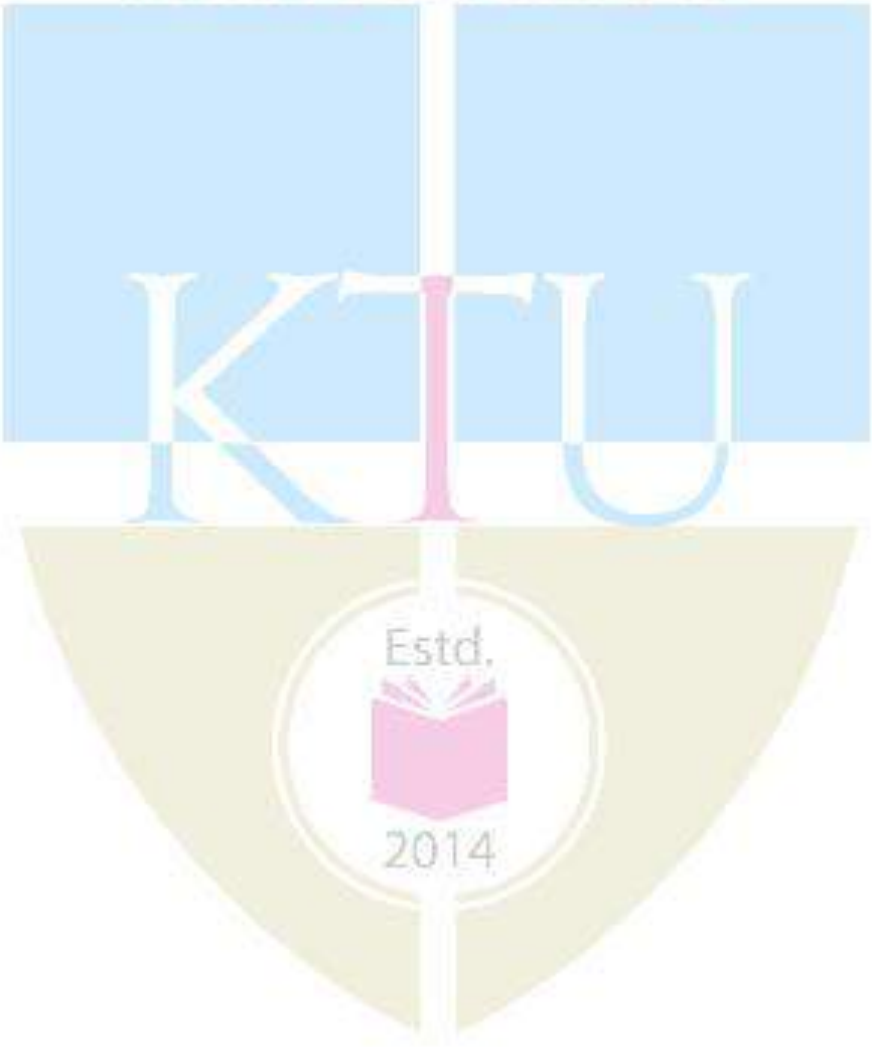
Question Paper Pattern

1. There will be *five* parts in the question paper – A, B, C, D, E
2. Part A
   a. Total marks : 12
   b. *Four* questions each having *3* marks, uniformly covering modules I and II; All*four* questions have to be answered.
3. Part B
   a. Total marks : 18
   b. *Three* questions each having *9* marks, uniformly covering modules I and II; *Two* questions have to be answered. Each question can have a maximum of three subparts.
4. Part C

a. Total marks : 12
b. *Four* questions each having *3* marks, uniformly covering modules III and IV; All*four* questions have to be answered.

5. Part D
   a. Total marks : 18
   b. *Three* questions each having *9* marks, uniformly covering modules III and IV; *Two* questions have to be answered. Each question can have a maximum of three subparts
6. Part E
   a. Total Marks: 40
   b. *Six* questions each carrying 10 marks, uniformly covering modules V and VI; *four* questions have to be answered.
   c. A question can have a maximum of three sub-parts.

7. There should be at least 60% analytical/numerical questions.



Course code	Course Name	L-T-P Credits	Year of Introduction
CS304	COMPILER DESIGN	3-0-0-3	2016

Prerequisite: Nil

Course Objectives

- To provide a thorough understanding of the internals of Compiler Design.

Syllabus

Phases of compilation, Lexical analysis, Token Recognition, Syntax analysis, Bottom Up and Top Down Parsers, Syntax directed translation schemes, Intermediate Code Generation, Triples and Quadruples, Code Optimization, Code Generation.

Expected Outcome

The students will be able to

i. Explain the concepts and different phases of compilation with compile time error handling.
ii. Represent language tokens using regular expressions, context free grammar and finite automata and design lexical analyzer for a language.
iii. Compare top down with bottom up parsers, and develop appropriate parser to produce parse tree representation of the input.
iv. Generate intermediate code for statements in high level language.
v. Design syntax directed translation schemes for a given context free grammar.
vi. Apply optimization techniques to intermediate code and generate machine code for high level language program.

Text Books

1. Aho A. Ravi Sethi and D Ullman. Compilers – Principles Techniques and Tools, Addison Wesley, 2006.
2. D. M.Dhamdhare, System Programming and Operating Systems,Tata McGraw Hill & Company, 1996.

References

1. Kenneth C. Louden, Compiler Construction – Principles and Practice, Cengage Learning Indian Edition, 2006.
2. Tremblay and Sorenson, The Theory and Practice of Compiler Writing, Tata McGraw Hill & Company,1984.

Course Plan

Module	Contents	Hours	End Sem. Exam Marks
I	Introduction to compilers – Analysis of the source program, Phases of a compiler, Grouping of phases, compiler writing tools – bootstrapping **Lexical Analysis**: The role of Lexical Analyzer, Input Buffering, Specification of Tokens using Regular Expressions, Review of Finite Automata, Recognition of Tokens.	**07**	**15%**
II	**Syntax Analysis:** Review of Context-Free Grammars – Derivation trees and Parse Trees, Ambiguity. **Top-Down Parsing**: Recursive Descent parsing, Predictive parsing, LL(1) Grammars.	**06**	**15%**

FIRST INTERNAL EXAM			
III	**Bottom-Up Parsing**: Shift Reduce parsing – Operator precedence parsing (Concepts only) LR parsing – Constructing SLR parsing tables, Constructing, Canonical LR parsing tables and Constructing LALR parsing tables.	**07**	**15%**
IV	**Syntax directed translation**: Syntax directed definitions, Bottom- up evaluation of S-attributed definitions, L- attributed definitions, Top-down translation, Bottom-up evaluation of inherited attributes. **Type Checking :** Type systems, Specification of a simple type checker.	**08**	**15%**
SECOND INTERNAL EXAM			
V	**Run-Time Environments:** Source Language issues, Storage organization, Storage-allocation strategies. **Intermediate Code Generation (ICG)**: Intermediate languages – Graphical representations, Three-Address code, Quadruples, Triples. Assignment statements, Boolean expressions.	**07**	**20%**
VI	**Code Optimization:**Principal sources of optimization, Optimization of Basic blocks **Code generation**: Issues in the design of a code generator. The target machine, A simple code generator.	**07**	**20%**
END SEMESTER EXAM			

Question Paper Pattern

1. There will be *five* parts in the question paper – A, B, C, D, E
2. Part A

a. Total marks : 12 b.. *Four* questions each having *3* marks, uniformly covering modules I and II; All*four* questions have to be answered.

3. Part B

a. Total marks : 18 b. *Three* questionseach having *9* marks, uniformly covering modules I and II; *Two* questions have to be answered. Each question can have a maximum of three subparts.

4. Part C

a. Total marks : 12 b. *Four* questions each having *3* marks, uniformly covering modules III and IV; All *four* questions have to be answered.

5. Part D

a. Total marks : 18 b. *Three* questions each having *9* marks, uniformly covering modules III and IV; *Two* questions have to be answered. Each question can have a maximum of three subparts

6. Part E

b. Total Marks: 40 b. *Six* questions each carrying 10 marks, uniformly covering modules V and VI; *four* questions have to be answered.

c. A question can have a maximum of three sub-parts.

7. There should be at least 60% analytical/numerical questions.

Course code	Course Name	L-T-P - Credits	Year of Introduction
CS306	Computer Networks	3-0-0-3	2016

Prerequisite: Nil

Course Objectives

- To build an understanding of the fundamental concepts of computer networking.
- To introduce the basic taxonomy and terminology of computer networking.
- To introduce advanced networking concepts.

Syllabus

Concept of layering, LAN technologies (Ethernet), Flow and error control techniques, switching, IPv4/IPv6, routers and routing algorithms (distance vector, link state), TCP/UDP and sockets, congestion control, Application layer protocols.

Expected Outcome

The students will be able to

i. Visualise the different aspects of networks, protocols and network design models.
ii. Examine various Data Link layer design issues and Data Link protocols.
iii. Analyse and compare different LAN protocols.
iv. Compare and select appropriate routing algorithms for a network.
v. Examine the important aspects and functions of network layer, transport layer and application layer in internetworking.

Text Books

1. Andrew S. Tanenbaum, Computer Networks, 4/e, PHI.
2. Behrouz A. Forouzan, Data Communications and Networking, 4/e, Tata McGraw Hill.
3. Larry L. Peterson & Bruce S. Dave, Computer Networks-A Systems Approach, 5/e, Morgan Kaufmann, 2011.

References

1. Fred Halsall, Computer Networking and the Internet, 5/e.
2. James F. Kurose, Keith W. Ross, Computer Networking: A Top-Down Approach, 6/e.
3. Keshav, An Engineering Approach to Computer Networks, Addison Wesley, 1998.
4. Request for Comments (RFC) Pages - IETF -https://www.ietf.org/rfc.html
5. W. Richard Stevens. TCP/IP Illustrated volume 1, Addison-Wesley, 2005.
6. William Stallings, Computer Networking with Internet Protocols, Prentice-Hall, 2004.

Course Plan

Module	Contents	Hours	End Sem. Exam Marks
I	Introduction – Uses – Network Hardware – LAN –MAN – WAN, Internetworks – Network Software – Protocol hierarchies – Design issues for the layers – Interface & Service – Service Primitives. Reference models – OSI – TCP/IP.	07	15%
II	Data Link layer Design Issues – Flow Control and ARQ techniques. Data link Protocols – HDLC. DLL in Internet. MAC Sub layer – IEEE 802 FOR LANs & MANs, IEEE 802.3, 802.4, 802.5. Bridges - Switches – High Speed LANs - Gigabit Ethernet. Wireless LANs - 802.11 a/b/g/n, 802.15.PPP	08	15%
FIRST INTERNAL EXAMINATION			

III	Network layer – Routing – Shortest path routing, Flooding, Distance Vector Routing, Link State Routing, RIP, OSPF, Routing for mobile hosts.	**07**	**15%**
IV	Congestion control algorithms – QoS. Internetworking – Network layer in internet. IPv4 - IP Addressing – Classless and Classfull Addressing. Sub-netting.	**07**	**15%**
SECOND INTERNAL EXAMINATION			
V	Internet Control Protocols – ICMP, ARP, RARP, BOOTP. Internet Multicasting – IGMP, Exterior Routing Protocols – BGP. IPv6 – Addressing – Issues, ICMPv6.	**07**	**20%**
VI	Transport Layer – TCP & UDP. Application layer –FTP, DNS, Electronic mail, MIME, SNMP. Introduction to World Wide Web.	**07**	**20%**
END SEMESTER EXAM			

Question Paper Pattern

1. There will be *five* parts in the question paper – A, B, C, D, E
2. Part A
   a. Total marks : 12
   b. *Four* questions each having *3* marks, uniformly covering modules I and II;All*four* questions have to be answered.
3. Part B
   a. Total marks : 18
   b. *Three* questions each having *9* marks, uniformly covering modules I and II; *Two* questions have to be answered. Each question can have a maximum of three subparts.
4. Part C
   a. Total marks : 12
   b. *Four* questions each having *3* marks, uniformly covering modules III and IV; All*four* questions have to be answered.
5. Part D
   a. Total marks : 18
   b. *Three* questions each having *9* marks, uniformly covering modules III and IV; *Two* questions have to be answered. Each question can have a maximum of three subparts
6. Part E
   a. Total Marks: 40
   b. *Six* questions each carrying 10 marks, uniformly covering modules V and VI; *four* questions have to be answered.
   c. A question can have a maximum of three sub-parts.

7. There should be at least 60% analytical/numerical questions.

Course code	Course Name	L-T-P-Credits	Year of Introduction
CS308	Software Engineering and Project Management	3-0-0-3	2016

Pre-requisite: Nil

Course Objectives

- To introduce the fundamental concepts of software engineering.
- To build an understanding on various phases of software development.
- To introduce various software process models.

Syllabus

Introduction to software engineering, Software process models, Software development phases, Requirement analysis, Planning, Design, Coding, Testing, Maintenance.

Expected Outcome

The students will be able to

i. Identify suitable life cycle models to be used.
ii. Analyze a problem and identify and define the computing requirements to the problem.
iii. Translate a requirement specification to a design using an appropriate software engineering methodology.
iv. Formulate appropriate testing strategy for the given software system.
v. Develop software projects based on current technology, by managing resources economically and keeping ethical values.

References

1. Ian Sommerville, Software Engineering, University of Lancaster, Pearson Education, Seventh edition, 2004.
2. K. K.Aggarwal and Yogesh Singh, Software Engineering, New age International Publishers, Second edition, 2005.
3. Roger S. Pressman, Software Engineering : A practitioner's approach, McGraw Hill publication, Eighth edition, 2014
4. S.A. Kelkar, Software Project Management: A concise study, PHI, Third edition, 2012.
5. Walker Royce, Software Project Management : A unified frame work, Pearson Education, 1998

COURSE PLAN

Module	Contents	Hours	End Sem. Exam Marks
I	Introduction to software engineering- scope of software	07	15%

	engineering – historical aspects, economic aspects, maintenance aspects, specification and design aspects, team programming aspects. Software engineering a layered technology – processes, methods and tools. Software process models – prototyping models, incremental models, spiral model, waterfall model.		
II	Process Framework Models: Capability maturity model (CMM), ISO 9000. Phases in Software development – requirement analysis- requirements elicitation for software, analysis principles, software prototyping, specification.	**06**	**15%**
FIRST INTERNAL EXAM			
III	Planning phase – project planning objective, software scope, empirical estimation models- COCOMO, single variable model, staffing and personal planning. Design phase – design process, principles, concepts, effective modular design, top down, bottom up strategies, stepwise refinement.	**07**	**15%**
IV	Coding – programming practice, verification, size measures, complexity analysis, coding standards. Testing – fundamentals, white box testing, control structure testing, black box testing, basis path testing, code walk-throughs and inspection, testing strategies-Issues, Unit testing, integration testing, Validation testing, System testing.	**07**	**15%**
SECOND INTERNAL EXAM			
V	Maintenance-Overview of maintenance process, types of maintenance. Risk management: software risks - risk identification-risk monitoring and management. Project Management concept: People – Product-Process-Project.	**07**	**20%**
VI	Project scheduling and tracking: Basic concepts-relation between people and effort-defining task set for the software project-selecting software engineering task Software configuration management: Basics and standards User interface design - rules. Computer aided software engineering tools - CASE building blocks, taxonomy of CASE tools, integrated CASE environment.	**08**	**20%**
END SEMESTER EXAM			

Question Paper Pattern

1. There will be *five* parts in the question paper – A, B, C, D, E
2. Part A
   a. Total marks : 12
   b. *Four* questions each having 3 marks, uniformly covering modules I and II;

All*four* questions have to be answered.

3. Part B
   a. Total marks : 18
   b. *Three* questions each having *9* marks, uniformly covering modules I and II; *Two* questions have to be answered. Each question can have a maximum of three subparts.
4. Part C
   a. Total marks : 12
   b. *Four* questions each having 3 marks, uniformly covering modules III and IV; All*four* questions have to be answered.
5. Part D
   a. Total marks : 18
   b. *Three* questions each having *9* marks, uniformly covering modules III and IV; *Two* questions have to be answered. Each question can have a maximum of three subparts
6. Part E
   a. Total Marks: 40
   b. *Six* questions each carrying 10 marks, uniformly covering modules V and VI; *four* questions have to be answered.
   c. A question can have a maximum of three sub-parts.

7. There should be at least 60% analytical/numerical questions.

Course code	Course Name	L-T-P-Credits	Year of Introduction
CS332	MICROPROCESSOR LAB	0-0-3-1	2016

Pre-requisite: CS305 Microprocessors and Microcontrollers

Course Objectives

- To practice assembly language programming on 8086.
- To practice fundamentals of interfacing/programming various peripheral devices with microprocessor/microcontroller.

List of Exercises/ Experiments: (Minimum 12 Exercises/ Experiments are mandatory. Exercises/ Experiments marked with * are mandatory)

I. Assembly Language Programming Exercises/Experiments using 8086 Trainer kit

1. Implementation of simple decimal arithmetic and bit manipulation operations.*
2. Implementation of code conversion between BCD, Binary, Hexadecimal and ASCII.
3. Implementation of searching and sorting of 16-bit numbers.
4. Programming exercises using stack and subroutines.*

II. Exercises/Experiments using MASM (PC Required)

5. Study of Assembler and Debugging commands.
6. Implementation of decimal arithmetic(16 and 32 bit) operations.*
7. Implementation of String manipulations.*
8. Implementation of searching and sorting of 16-bit numbers.
9. Implementation of Matrix operations like addition, transpose, multiplication etc.

III. Interfacing Exercises/Experiments with 8086 trainer kit through Assembly Language Programming

10. Interfacing with stepper motor - Rotate through any given sequence.*
11. Interfacing with 8255 (mode0 and mode1 only).*
12. Interfacing with 8279 (Rolling message, 2 key lock out and N-key roll over implementation).*
13. Interfacing with 8253/54 Timer/Counter.
14. Interfacing with Digital-to-Analog Converter.*
15. Interfacing with Analog-to- Digital Converter.
16. Interfacing with 8259 Interrupt Controller.

IV. Exercises/Experiments using 8051 trainer kit

17. Familiarization of 8051 trainer kit by executing simple Assembly Language programs such as decimal arithmetic and bit manipulation.*
18. Implementation of Timer programming (in mode1).
19. Implementation of stepper motor interfacing, ADC/DAC interfacing and sensor interfacing with 8251 through Assembly Language programming.

Expected Outcome

The students will be able to

i. Develop assembly language programs for problem solving using software interrupts and various assembler directives.

ii. Implement interfacing of various I/O devices to the microprocessor/microcontroller through assembly language programming.

Course code	Course Name	L-T-P-Credits	Year of Introduction
CS334	Network Programming Lab	0-0-3-1	2016

Pre-requisite: CS307 Data Communication

Course Objectives

- To introduce Network related commands and configuration files in Linux Operating System.
- To introduce tools for Network Traffic Analysis and Network Monitoring.
- To practice Network Programming using Linux System Calls.
- To design and deploy Computer Networks.

List of Exercises/ Experiments (12 Exercises/ Experiments are to be completed . Exercises/ Experiments marked with * are mandatory)

1. Getting started with Basics of Network configurations files and Networking Commands in Linux.
2. To familiarize and understand the use and functioning of System Calls used for Operating system and network programming in Linux.
3. Familiarization and implementation of programs related to Process and thread.
4. Implement the First Readers-Writers Problem.
5. Implement the Second Readers-Writers problem.
6. Implement programs for Inter Process Communication using PIPE, Message Queue and Shared Memory.
7. Implement Client-Server communication using Socket Programming and TCP as transport layer protocol.*
8. Implement Client-Server communication using Socket Programming and UDP as transport layer protocol.*
9. Implement a multi user chat server using TCP as transport layer protocol.*
10. Implement Concurrent Time Server application using UDP to execute the program at remoteserver. Client sends a time request to the server, server sends its system time back to the client. Client displays the result.*
11. Implement and simulate algorithm for Distance vector routing protocol.
12. Implement and simulate algorithm for Link state routing protocol.
13. Implement Simple Mail Transfer Protocol.*
14. Develop concurrent file server which will provide the file requested by client if it exists. If not server sends appropriate message to the client. Server should also send its process ID (PID) to clients for display along with file or the message.*
15. Using Wireshark observe data transferred in client server communication using UDP and identify the UDP datagram.
16. Using Wireshark observe Three Way Handshaking Connection Establishment, Data Transfer and Three Way Handshaking Connection Termination in client server communication using TCP.
17. Develop a packet capturing and filtering application using raw sockets.
18. Design and configure a network with multiple subnets with wired and wireless LANs using required network devices. Configure the following services in the network- TELNET, SSH, FTP server, Web server, File server, DHCP server and DNS server.*
19. Install network simulator NS-2 in any of the Linux operating system and simulate wired and wireless scenarios.

Expected Outcome

The students will be able to

1. Use network related commands and configuration files in Linux Operating System.
2. Develop operating system and network application programs.
3. Analyze network traffic using network monitoring tools.

Course code	Course Name	L-T-P - Credits	Year of Introduction
CS364	Mobile Computing	3-0-0-3	2016

Pre-requisite: CS307 Data Communication

Course Objectives

- To impart basic understanding of the wireless communication systems.
- To expose students to various aspects of mobile and ad-hoc networks.

Syllabus

Mobile Computing Application and Services, Mobile Computing Architecture, Emerging Technologies, Intelligent Networks and Internet, Wireless LAN, MAC layer routing, Mobile transport layer Security Issues in mobile computing.

Expected Outcome

Student is able to

1. Explain various Mobile Computing application, services and architecture.
2. Understand various technology trends for next generation cellular wireless networks.
3. Describe protocol architecture of WLAN technology.
4. Understand Security Issues in mobile computing.

Text Books

1. Asoke K. Talukder, Hasan Ahmad, Mobile Computing Technology- Application and Service Creation, 2nd Edition, McGraw Hill Education.
2. Jochen Schiller, Mobile Communications, Pearson Education Asia, 2008.
3. Jonathan Rodriguez , Fundamentals of 5G Mobile Networks, ,Wiley Publishers, 2015
4. Theodore S. Rappaport, Wireless Communications Principles and Practice, 2/e, PHI, New Delhi, 2004.

References

1. Andrew S. Tanenbaum, Computer Networks, PHI, Third edition, 2003.

Course Plan

Module	Contents	Hours	End Sem. Exam Marks
I	Introduction to mobile computing, Middleware and Gateways, Application and services, Internet-Ubiquitous networks, Architecture and three-tier architecture for Mobile Computing, Design consideration for Mobile Computing.	06	15%
II	Spread spectrum – Direct sequence, Frequency hoping. Medium Access Control - SDMA, FDMA, TDMA, CDMA, Cellular concepts- channel assignment strategy- hand off strategy interface and system capacity- improving coverage and capacity in cellular system, Satellite Systems-GEO, LEO, MEO. Wireless Communication Systems- Telecommunication Systems- GSM- GSM services & features, architecture -DECT features & characteristics, architecture.	06	15%
FIRST INTERNAL EXAM			
III	Wireless LANS: Wireless LAN Standards – IEEE 802 Protocol Architecture, IEEE 802.11 System Architecture, Protocol Architecture & Services, Cellular Networks: Channel allocation, multiple access, location management, Handoffs. MAC Layer & Management, Routing - Classification of Routing	07	15%

	Algorithms, Algorithms such as DSR, AODV, DSDV, Mobile Agents, Service Discovery.		
IV	Mobile internet-mobile network layer-mobile IP-dynamic host configuration protocol-, mobile transport layer-implications of TCP on mobility-indirect TCP-snooping TCP- mobile TCP transmission-selective retransmission, Transaction oriented TCP- Support for mobility-file systems-WAP.	**07**	**15%**
SECOND INTERNAL EXAM			
V	Mobile Transport Layer - Conventional TCP/IP Protocols, Indirect TCP, Snooping TCP, Mobile TCP, Other Transport Layer Protocols for Mobile Networks. Protocols and Platforms for Mobile Computing - WAP, Bluetooth, XML, J2ME, JavaCard, PalmOS, Linux for Mobile Devices, Android.	**08**	**20%**
VI	Security issues in mobile computing, Information Security, Components of Information Security, Next Generation Networks-LTE – Architecture & Interface – LTE radio planning and tools, 5G architecture, MIMO, Super core concept, Features and Application Case Study – Setting up anadhoc network system, LiFi.	**08**	**20%**
END SEMESTER EXAM			

Question Paper Pattern

1. There will be *five* parts in the question paper – A, B, C, D, E
2. Part A
   a. Total marks : 12
   b. *Four* questions each having *3* marks, uniformly covering modules I and II; All*four* questions have to be answered.
3. Part B
   a. Total marks : 18
   b. *Three*questions each having *9* marks, uniformly covering modules I and II; *Two* questions have to be answered. Each question can have a maximum of three subparts.
4. Part C
   a. Total marks : 12
   b. *Four*questions each having *3* marks, uniformly covering modules III and IV; All*four* questions have to be answered.
5. Part D
   a. Total marks : 18
   b. *Three* questions each having *9* marks, uniformly covering modules III and IV; *Two* questions have to be answered. Each question can have a maximum of three subparts
6. Part E
   a. Total Marks: 40
   b. *Six* questions each carrying 10 marks, uniformly covering modules V and VI; *four* questions have to be answered.
   c. A question can have a maximum of three sub-parts.

Course code	Course Name	L-T-P - Credits	Year of Introduction
CS368	Web Technologies	3-0-0-3	2016

Prerequisite: Nil

Course Objectives

- To impart the design, development and implementation of Dynamic Web Pages.
- To develop programs for Web using Scripting Languages.
- To give an introduction to Data Interchange formats in Web.

Syllabus

Basics of Internet and World Wide Web, HTML and XHTML, Cascading Style Sheets, Frameworks, Basics of JavaScript, JQuery, Introduction to XML and JSON, Overview of PHP

Expected Outcome

The student will be able to

i. Understand different components in web technology and to know about CGI and CMS.
ii. Develop interactive Web pages using HTML/XHTML.
iii. Present a professional document using Cascaded Style Sheets.
iv. Construct websites for user interactions using JavaScript and JQuery.
v. Know the different information interchange formats like XML and JSON.
vi. Develop Web applications using PHP.

Text Books

1. P. J. Deitel, H.M. Deitel, Internet &World Wide Web How To Program, 4/e, Pearson International Edition 2010.
2. Robert W Sebesta, Programming the World Wide Web, 7/e, Pearson Education Inc., 2014.

References

1. Bear Bibeault and Yehuda Katz, jQuery in Action, Second Edition, Manning Publications.[Chapter 1]
   Black Book, Kogent Learning Solutions Inc. 2009.
2. Bob Boiko, Content Management Bible, 2nd Edition, Wiley Publishers. [Chapter 1, 2]
3. Chris Bates, Web Programming Building Internet Applications, 3/e, Wiley India Edition 2009.
4. Dream Tech, Web Technologies: HTML, JS, PHP, Java, JSP, ASP.NET, XML, AJAX,
5. Jeffrey C Jackson, Web Technologies A Computer Science Perspective, Pearson Education Inc. 2009.
6. Lindsay Bassett, Introduction to JavaScript Object Notation: A To-the-Point Guide to JSON 1st Edition, O'Reilly.[Chapter 1,2,3,4]
7. Matthew MacDonald, WordPress: The Missing Manual, 2nd Edition, O'Reilly Media. [Chapter 1]

Web Resources

1. www.w3.org/CGI/
2. old.tree.ro/en/strategy-white-papers/content-management-systems.pdf
3. httpd.apache.org/download.cgi
4. https://alistapart.com/article/frameworks
5. http://getbootstrap.com/css/
6. https://www.w3.org/TR/WD-DOM/introduction.html

Course Plan

Module	Contents	Hours	End Sem. Exam Marks

I	**Introduction to the Internet:** The World Wide Web, Web Browsers, Web Servers, Uniform Resource Locators, Multipurpose Internet Mail Extensions, The Hypertext Transfer Protocol. Common Gateway Interface(CGI), Content Management System – Basics *Case Study:* Apache Server, WordPress.	**06**	**15%**
II	**Introduction to HTML/XHTML :** Origins and Evolution of HTML and XHTML, Basic Syntax of HTML, Standard HTML Document Structure, Basic Text Markup, Images, Hypertext Links, Lists, Tables, Forms, HTML5, Syntactic Differences between HTML and XHTML.	**07**	**15%**
FIRST INTERNAL EXAM			
III	**Introduction to Styles sheets and Frameworks** **Cascading Style Sheets:** Levels of Style Sheets - Style Specification Formats, Selector Forms, Property-Value Forms, Font Properties, List Properties, Alignment of Text, Color, The Box Model, Background Images, The span and div Tags. **Frameworks:** Overview and Basics of Responsive CSS Frameworks - Bootstrap.	**06**	**15%**
IV	**Introduction to JavaScript and jQuery** **The Basics of JavaScript:** Overview of JavaScript, Object Orientation and JavaScript, General Syntactic Characteristics- Primitives, Operations, and Expressions, Screen Output and Keyboard Input, Control Statements, Object Creation and Modification,Arrays, Functions. Callback Functions, Java Script HTML DOM. **Introduction to jQuery:** Overview and Basics.	**07**	**15%**
SECOND INTERNAL EXAMINATION			
V	**Introduction to Data Interchange Formats** **XML:** The Syntax of XML, XML Document Structure, Namespaces, XML Schemas, Displaying Raw XML Documents, Displaying XML Documents with CSS, XSLT Style Sheets, XML Applications. **JSON**(Basics Only): Overview, Syntax, Datatypes, Objects, Schema, Comparison with XML.	**08**	**20%**
VI	**Introduction to PHP**: Origins and Uses of PHP, Overview of PHP - General Syntactic Characteristics - Primitives, Operations, and Expressions - Control Statements, Arrays, Functions, Pattern Matching, Form Handling, Cookies, Session Tracking.	**08**	**20%**
END SEMESTER EXAM			

Assignment:

It is highly recommended to give assignment based on:

1. JavaScript Frameworks (like AngularJS or/and NodeJS)
2. Any PHP web app based on frameworks(like Laravel, CodeIgniter, CakePHP, Zend etc.)

Question Paper Pattern

1. There will be *five* parts in the question paper – A, B, C, D, E
2. Part A
   a. Total marks : 12
   b. *Four* questions each having *3* marks, uniformly covering modules I and II; All *four* questions have to be answered.
3. Part B
   a. Total marks : 18
   b. *Three* questions each having *9* marks, uniformly covering modules I and II; *Two* questions have to be answered. Each question can have a maximum of three subparts.
4. Part C
   a. Total marks : 12
   b. *Four* questions each having *3* marks, uniformly covering modules III and IV; All *four* questions have to be answered.
5. Part D
   a. Total marks : 18
   b. *Three* questions each having *9* marks, uniformly covering modules III and IV; *Two* questions have to be answered. Each question can have a maximum of three subparts
6. Part E
   a. Total Marks: 40
   b. *Six* questions each carrying 10 marks, uniformly covering modules V and VI; *four* questions have to be answered.
   c. A question can have a maximum of three sub-parts.

Semester VII

Course Code	Course Name	L-T-P	Credits	Exam Slot
CS401	Computer Graphics	4-0-0	4	A
CS403	Programming Paradigms	3-0-0	3	B
CS405	Computer System Architecture	3-0-0	3	C
CS407	Distributed Computing	3-0-0	3	D
CS409	Cryptography and Network Security	3-0-0	3	E
	Elective 3	3-0-0	3	F
CS451	Seminar & Project Preliminary	0-1-4	2	S
CS431	Compiler Design Lab	0-0-3	1	T
Total Credits = 22	**Hours: 27**		**Cumulative Credits= 162**	

Elective 3:-

1. CS461 Computational Geometry
2. CS463 Digital Image Processing
3. CS465 Bio Informatics
4. CS467 Machine Learning
5. CS469 Computational complexity

Course code	Course Name	L-T-P Credits	Year of Introduction
CS401	COMPUTER GRAPHICS	4-0-0-4	2016

Course Objectives :

- To introduce concepts of graphics input and display devices.
- To discuss line and circle drawing algorithms.
- To introduce 2D and 3D transformations and projections.
- To introduce fundamentals of image processing.

Syllabus:

Basic Concepts in Computer Graphics. Input devices. Display devices. Line and circle drawing Algorithms. Solid area scan-conversion. Polygon filling. Two dimensional transformations. Windowing, clipping. 3D Graphics, 3D transformations. Projections – Parallel, Perspective. Hidden Line Elimination Algorithms. Image processing – digital image representation – edge detection – Robert, Sobel, Canny edge detectors. Scene segmentation and labeling – region-labeling algorithm – perimeter measurement.

Expected Outcome:

The Students will be able to :

i. compare various graphics devices
ii. analyze and implement algorithms for line drawing, circle drawing and polygon filling
iii. apply geometrical transformation on 2D and 3D objects
iv. analyze and implement algorithms for clipping
v. apply various projection techniques on 3D objects
vi. summarize visible surface detection methods
vii. interpret various concepts and basic operations of image processing

Text Books:

1. Donald Hearn and M. Pauline Baker, Computer Graphics, PHI, 2e, 1996
2. E. Gose, R. Johnsonbaugh and S. Jost., Pattern Recognition and Image Analysis, PHI PTR, 1996 (Module VI – Image Processing part)
3. William M. Newman and Robert F. Sproull , Principles of Interactive Computer Graphics. McGraw Hill, 2e, 1979
4. Zhigang Xiang and Roy Plastock, Computer Graphics (Schaum's outline Series), McGraw Hill, 1986.

References:

1. David F. Rogers , Procedural Elements for Computer Graphics, Tata McGraw Hill, 2001.
2. M. Sonka, V. Hlavac, and R. Boyle, Image Processing, Analysis, and Machine Vision, Thomson India Edition, 2007.
3. Rafael C. Gonzalez and Richard E. Woods, Digital Image Processing. Pearson, 2017

Course Plan			
Module	**Contents**	**Hours**	**End Sem. Exam Marks**
I	Basic concepts in Computer Graphics – Types of Graphic Devices – Interactive Graphic inputs – Raster Scan and Random Scan Displays.	7	15%
II	Line Drawing Algorithm- DDA, Bresenham's algorithm – Circle Generation Algorithms –Mid point circle algorithm, Bresenham's algorithm- Scan Conversion-frame buffers – solid area scan conversion – polygon filling algorithms	8	15%
FIRST INTERNAL EXAM			
III	Two dimensional transformations. Homogeneous coordinate systems – matrix formulation and concatenation of transformations. Windowing concepts –Window to Viewport Transformation- Two dimensional clipping-Line clipping – Cohen Sutherland, Midpoint Subdivision algorithm	8	15%
IV	Polygon clipping-Sutherland Hodgeman algorithm, Weiler-Atherton algorithm, Three dimensional object representation-Polygon surfaces, Quadric surfaces – Basic 3D transformations	8	15%
SECOND INTERNAL EXAM			
V	Projections – Parallel and perspective projections – vanishing points. Visible surface detection methods– Back face removal- Z-Buffer algorithm, A-buffer algorithm, Depth-sorting method, Scan line algorithm.	9	20%
VI	Image processing – Introduction - Fundamental steps in image processing – digital image representations – relationship between pixels – gray level histogram –spatial convolution and correlation – edge detection – Robert, Prewitt, Sobel.	8	20%
END SEMESTER EXAM			

Question Paper Pattern (End semester exam)

1. There will be ***FOUR*** parts in the question paper – **A, B, C, D**
2. **Part A**
    a. **Total marks : 40**
    b. ***TEN*** questions, each have **4 marks**, covering **all the SIX modules** (***THREE*** questions from **modules I & II**; ***THREE*** questions from **modules III & IV**; ***FOUR*** questions from **modules V & VI**).
    All the TEN questions have to be answered.
3. **Part B**
    a. **Total marks : 18**
    b. ***THREE*** questions, each having **9 marks**. One question is from **module I**; one question is from **module II**; one question ***uniformly*** covers **modules I & II**.
    c. ***Any TWO*** questions have to be answered.
    d. Each question can have ***maximum THREE*** subparts.
4. **Part C**
    a. **Total marks : 18**
    b. ***THREE*** questions, each having **9 marks**. One question is from **module III**; one question is from **module IV**; one question ***uniformly*** covers **modules III & IV**.
    c. ***Any TWO*** questions have to be answered.
    d. Each question can have ***maximum THREE*** subparts.
5. **Part D**
    a. **Total marks : 24**
    b. ***THREE*** questions, each having **12 marks**. One question is from **module V**; one question is from **module VI**; one question ***uniformly*** covers **modules V & VI**.
    c. ***Any TWO*** questions have to be answered.
    d. Each question can have ***maximum THREE*** subparts.
6. There will be ***AT LEAST* 50%** analytical/numerical questions in all possible combinations of question choices.

Course code	Course Name	L-T-P Credits	Year of Introduction
CS403	PROGRAMMING PARADIGMS	3-0-0-3	2016

Course Objectives:

- To introduce the basic constructs that underlie all programming languages
- To introduce the basics of programming language design and implementation
- To introduce the organizational framework for learning new programming languages.

Syllabus:

Names, Scopes, and Bindings - Binding Time, Scope Rules, Storage Management, Overloading, Polymorphism; Control Flow - Expression Evaluation, Structured and Unstructured Flow, Non-determinacy; Data Types - Type Systems, Type Checking, Equality Testing and Assignment; Subroutines and Control Abstraction - Static and Dynamic Links, Calling Sequences, Parameter Passing, Exception Handling, Co-routines; Functional and Logic Languages; Data Abstraction and Object Orientation -Encapsulation, Inheritance, Dynamic Method Binding; Innovative features of Scripting Languages; Concurrency - Threads, Synchronization, Language-Level Mechanisms; Run-time program Management.

Expected Outcome:

The Students will be able to :

i. compare scope and binding of names in different programming languages
ii. analyze control flow structures in different programming languages
iii. appraise data types in different programming languages
iv. analyze different control abstraction mechanisms
v. appraise constructs in functional, logic and scripting languages
vi. analyze object oriented constructs in different programming languages
vii. compare different concurrency constructs
viii. interpret the concepts of run- time program management

Text book:

1. Scott M L, Programming Language Pragmatics, 3rd Edn., Morgan Kaufmann Publishers, 2009.

References:

1. David A Watt, Programming Language Design Concepts, Wiley Dreamtech, 2004
2. Ghezzi C and M. Jazayeri, Programming Language Concepts, 3rd Edn, Wiley.1997
3. Kenneth C Louden, Programming Languages: Principles and Practice, 3rd Edn., Cengage Learning, 2011.
4. Pratt T W, M V Zelkowitz, and T. V. Gopal, Programming Languages: Design and Implementation, 4th Edn., Pearson Education, 2001
5. R W Sebesta, Concepts of Programming Languages, 11th Edn., Pearson Education, 2015
6. Ravi Sethi, Programming Languages: Concepts & Constructs, 2nd Edn., Pearson Education, 2006
7. Tucker A B and R E Noonan, Programming Languages: Principles and Paradigms, 2nd Edn,McGraw Hill, 2006.

Course Plan			
Module	**Contents**	**Hours**	**End Sem. Exam Marks**
I	Names, Scopes and Bindings:- Names and Scopes, Binding Time, Scope Rules, Storage Management, Binding of Referencing Environments. Control Flow: - Expression Evaluation, Structured and Unstructured Flow, Sequencing, Selection, Iteration, Recursion, Non-determinacy.	7	15 %
II	Data Types:-Type Systems, Type Checking, Records and Variants, Arrays, Strings, Sets, Pointers and Recursive Types, Lists, Files and Input/Output, Equality Testing and Assignment.	7	15 %
FIRST INTERNAL EXAM			
III	Subroutines and Control Abstraction: - Static and Dynamic Links, Calling Sequences, Parameter Passing, Generic Subroutines and Modules, Exception Handling, Co-routines.	7	15 %
IV	Functional and Logic Languages:- Lambda Calculus, Overview of Scheme, Strictness and Lazy Evaluation, Streams and Monads, Higher-Order Functions, Logic Programming in Prolog, Limitations of Logic Programming.	7	15 %
SECOND INTERNAL EXAM			
V	Data Abstraction and Object Orientation:-Encapsulation, Inheritance, Constructors and Destructors, Aliasing, Overloading, Polymorphism, Dynamic Method Binding, Multiple Inheritance. Innovative features of Scripting Languages:-Scoping rules, String and Pattern Manipulation, Data Types, Object Orientation.	7	20 %
VI	Concurrency:- Threads, Synchronization. Run-time program Management:- Virtual Machines, Late Binding of Machine Code, Reflection, Symbolic Debugging, Performance Analysis.	7	20 %
END SEMESTER EXAM			

Question Paper Pattern (End semester exam)

1. There will be ***FOUR*** parts in the question paper – **A, B, C, D**
2. **Part A**
    a. **Total marks : 40**
    b. ***TEN*** questions, each have **4 marks**, covering **all the SIX modules** (***THREE*** questions from **modules I & II**; ***THREE*** questions from **modules III & IV**; ***FOUR*** questions from **modules V & VI**).
    All the TEN questions have to be answered.
3. **Part B**
    a. **Total marks : 18**
    b. ***THREE*** questions, each having **9 marks**. One question is from **module I**; one question is from **module II**; one question ***uniformly*** covers **modules I & II**.
    c. ***Any TWO*** questions have to be answered.
    d. Each question can have ***maximum THREE*** subparts.
4. **Part C**
    a. **Total marks : 18**
    b. ***THREE*** questions, each having **9 marks**. One question is from **module III**; one question is from **module IV**; one question ***uniformly*** covers **modules III & IV**.
    c. ***Any TWO*** questions have to be answered.
    d. Each question can have ***maximum THREE*** subparts.
5. **Part D**
    a. **Total marks : 24**
    b. ***THREE*** questions, each having **12 marks**. One question is from **module V**; one question is from **module VI**; one question ***uniformly*** covers **modules V & VI**.
    c. ***Any TWO*** questions have to be answered.
    d. Each question can have ***maximum THREE*** subparts.
6. There will be ***AT LEAST* 50%** analytical/numerical questions in all possible combinations of question choices.

Course code	Course Name	L-T-P –Credits	Year of Introduction
CS405	COMPUTER SYSTEM ARCHITECTURE	3-0-0-3	2016

Course Objectives:

- To impart a basic understanding of the parallel architecture and its operations
- To introduce the key features of high performance computers

Syllabus:

Basic concepts of parallel computer models, SIMD computers, Multiprocessors and multi-computers, Cache Coherence Protocols, Multicomputers, Pipelining computers and Multithreading.

Expected outcome :

The Students will be able to :

i. summarize different parallel computer models
ii. analyze the advanced processor technologies
iii. interpret memory hierarchy
iv. compare different multiprocessor system interconnecting mechanisms
v. interpret the mechanisms for enforcing cache coherence
vi. analyze different message passing mechanisms
vii. analyze different pipe lining techniques
viii. appraise concepts of multithreaded and data flow architectures

Text Book:

- K. Hwang and Naresh Jotwani, Advanced Computer Architecture, Parallelism, Scalability, Programmability, TMH, 2010.

References:

1. H P Hayes, Computer Architecture and Organization, McGraw Hill, 1978.
2. K. Hwang & Briggs , Computer Architecture and Parallel Processing, McGraw Hill International, 1986
3. M J Flynn, Computer Architecture: Pipelined and Parallel Processor Design, Narosa Publishing House, 2012.
4. M Sasikumar, D Shikkare and P Raviprakash, Introduction to Parallel Processing, PHI, 2014.
5. P M Kogge, The Architecture of Pipelined Computer, McGraw Hill, 1981.
6. P V S Rao , Computer System Architecture, PHI, 2009.
7. Patterson D. A. and Hennessy J. L., Morgan Kaufmann , Computer Organization and Design: The Hardware/Software Interface, Morgan Kaufmann Pub, 4/e, 2010.

Course Plan			
Module	**Contents**	**Hours**	**End Sem. Exam Marks**
I	Parallel computer models – Evolution of Computer Architecture, System Attributes to performance, Amdahl's law for a fixed workload. Multiprocessors and Multicomputers, Multivector and SIMD computers, Architectural development tracks, Conditions of parallelism.	6	15%
II	Processors and memory hierarchy – Advanced processor technology- Design Space of processors, Instruction Set Architectures, CISC Scalar Processors, RISC Scalar Processors, Superscalar and vector processors, Memory hierarchy technology.	8	15%
FIRST INTERNAL EXAM			
III	Multiprocessors system interconnects - Hierarchical bus systems, Cross bar switch and multiport memory, Multistage and combining networks. Cache Coherence and Synchronization Mechanisms, Cache Coherence Problem, Snoopy Bus Protocol, Directory Based Protocol, Hardware Synchronization Problem	7	15%
IV	Message Passing Mechanisms-Message Routing schemes, Flow control Strategies, Multicast Routing Algorithms. Pipelining and Superscalar techniques – Linear Pipeline processors and Nonlinear pipeline processors	8	15%
SECOND INTERNAL EXAM			
V	Instruction pipeline design, Arithmetic pipeline deign - Super Scalar Pipeline Design	8	20%
VI	Multithreaded and data flow architectures - Latency hiding techniques, Principles of multithreading - Multithreading Issues and Solutions, Multiple context Processors, Fine-grain Multicomputer- Fine-grain Parallelism. Dataflow and hybrid architecture	8	20%
END SEMESTER EXAM			

Question Paper Pattern (End semester exam)

1. There will be ***FOUR*** parts in the question paper – **A, B, C, D**
2. **Part A**
   a. **Total marks : 40**
   b. *TEN* questions, each have **4 marks**, covering **all the SIX modules** (*THREE* questions from **modules I & II**; *THREE* questions from **modules III & IV**; *FOUR* questions from **modules V & VI**).
   All the TEN questions have to be answered.
3. **Part B**
   a. **Total marks : 18**
   b. *THREE* questions, each having **9 marks**. One question is from **module I**; one question is from **module II**; one question ***uniformly*** covers **modules I & II**.
   c. ***Any TWO*** questions have to be answered.
   d. Each question can have ***maximum THREE*** subparts.
4. **Part C**
   a. **Total marks : 18**
   b. *THREE* questions, each having **9 marks**. One question is from **module III**; one question is from **module IV**; one question ***uniformly*** covers **modules III & IV**.
   c. ***Any TWO*** questions have to be answered.
   d. Each question can have ***maximum THREE*** subparts.
5. **Part D**
   a. **Total marks : 24**
   b. *THREE* questions, each having **12 marks**. One question is from **module V**; one question is from **module VI**; one question ***uniformly*** covers **modules V & VI**.
   c. ***Any TWO*** questions have to be answered.
   d. Each question can have ***maximum THREE*** subparts.
6. There will be ***AT LEAST*** **60%** analytical/numerical questions in all possible combinations of question choices.

Course code	Course Name	L-T-P – Credits	Year of Introduction
CS407	DISTRIBUTED COMPUTING	3-0-0-3	2016

Course Objectives:

- To introduce fundamental principles of distributed systems, technical challenges and key design issues.
- To impart knowledge of the distributed computing models, algorithms and the design of distributed system.

Syllabus:

Introduction to distributed computing, Design issues, Distributed Computing Models, System models, Inter-process communication, Distributed file system, Name Service , Distributed mutual exclusion , Distributed system design.

Expected Outcome

The Students will be able to :

i. distinguish distributed computing paradigm from other computing paradigms
ii. identify the core concepts of distributed systems
iii. illustrate the mechanisms of inter process communication in distributed system
iv. apply appropriate distributed system principles in ensuring transparency, consistency and fault-tolerance in distributed file system
v. compare the concurrency control mechanisms in distributed transactional environment
vi. outline the need for mutual exclusion and election algorithms in distributed systems

Text Books:

1. George Coulouris, Jean Dollimore and Tim Kindberg , Distributed Systems: Concepts and Design, Fifth Edition , Pearson Education, 2011
2. Pradeep K Sinha, Distributed Operating Systems : Concepts and Design, Prentice Hall of India

References:

1. A S Tanenbaum and M V Steen , Distributed Systems: Principles and paradigms, Pearson Education, 2007
2. M Solomon and J Krammer, Distributed Systems and Computer Networks, PHI

Course Plan

Module	Contents	Hours	End Sem. Exam Marks
I	Evolution of Distributed Computing -Issues in designing a distributed system- Challenges- Minicomputer model – Workstation model - Workstation-Server model– Processor - pool model - Trends in distributed systems	7	15%
II	System models: Physical models - Architectural models - Fundamental models	6	15%

FIRST INTERNAL EXAM			
III	Interprocess communication: characteristics – group communication - Multicast Communication –Remote Procedure call - Network virtualization. Case study : Skype	7	15%
IV	Distributed file system: File service architecture - Network file system- Andrew file system- Name Service	7	15%
SECOND INTERNAL EXAM			
V	Transactional concurrency control:- Transactions, Nested transactions-Locks-Optimistic concurrency control	7	20%
VI	Distributed mutual exclusion – central server algorithm – ring based algorithm- Maekawa's voting algorithm – Election: Ring -based election algorithm – Bully algorithm	7	20%
END SEMESTER EXAM			

Question Paper Pattern

1. There will be ***FOUR*** parts in the question paper – **A, B, C, D**
2. **Part A**
   a. **Total marks : 40**
   b. *TEN* questions, each have **4 marks**, covering **all the SIX modules** (*THREE* questions from **modules I & II**; *THREE* questions from **modules III & IV**; *FOUR* questions from **modules V & VI**).
   All the TEN questions have to be answered.
3. **Part B**
   a. **Total marks : 18**
   b. *THREE* questions, each having **9 marks**. One question is from **module I**; one question is from **module II**; one question ***uniformly*** covers **modules I & II**.
   c. ***Any TWO*** questions have to be answered.
   d. Each question can have ***maximum THREE*** subparts.
4. **Part C**
   a. **Total marks : 18**
   b. *THREE* questions, each having **9 marks**. One question is from **module III**; one question is from **module IV**; one question ***uniformly*** covers **modules III & IV**.
   c. ***Any TWO*** questions have to be answered.
   d. Each question can have ***maximum THREE*** subparts.
5. **Part D**
   a. **Total marks : 24**
   b. *THREE* questions, each having **12 marks**. One question is from **module V**; one question is from **module VI**; one question ***uniformly*** covers **modules V & VI**.
   c. ***Any TWO*** questions have to be answered.
   d. Each question can have ***maximum THREE*** subparts.
6. There will be ***AT LEAST*** **50%** analytical/numerical questions in all possible combinations of question choices.

Course code	Course Name	L-T-P Credits	Year of Introduction
CS409	CRYPTOGRAPHY AND NETWORK SECURITY	3-0-0-3	2016

Course Objectives:

- To introduce fundamental concepts of symmetric and asymmetric cipher models.
- To introduce fundamental concepts of authentication.
- To introduce network security and web security protocols.

Syllabus:

Symmetric Cipher Models - Differential and linear Cryptanalysis- Block Cipher Design principles- Primitive operations- Key expansions- Inverse Cipher- Principles of Public key Cryptography Systems - Authentication functions- Message authentication codes- Hash functions- Digital signatures- Authentication protocols- Network security - Web Security - secure Socket Layer and Transport layer Security- Secure electronic transaction –Firewalls.

Expected Outcome:

The Students will be able to :

i. summarize different classical encryption techniques
ii. identify mathematical concepts for different cryptographic algorithms
iii. demonstrate cryptographic algorithms for encryption/key exchange
iv. summarize different authentication and digital signature schemes
v. identify security issues in network, transport and application layers and outline appropriate security protocols

Text Books:

1. Behrouz A. Forouzan, Cryptography and Network Security, Tata McGraw-Hill. 2010
2. William Stallings, Cryptography and Network Security, Pearson Education, 2014

References:

1. B. Schneier , Applied Cryptography, Protocols, Algorithms, and Source Code in C, 2 nd Edn, Wiley, 1995.
2. Charlie Kaufman, Radia Perlman, Mike Speciner, Network Security, PHI, 2002

Course Plan

Module	Contents	Hours	End Sem. Exam Marks
I	Symmetric Cipher Models- Substitution techniques- Transposition techniques- Rotor machines-Steganography. Simplified DES- Block Cipher principles- The Data Encryption Standard, Strength of DES- Differential and linear Cryptanalysis. Block Cipher Design principles- Block Cipher modes of operations.	7	15 %
II	IDEA: Primitive operations- Key expansions- One round, Odd round, Even Round- Inverse keys for decryption. AES: Basic Structure- Primitive operation- Inverse Cipher- Key Expansion, Rounds, Inverse Rounds. Stream Cipher –RC4.	7	15 %
FIRST INTERNAL EXAM			

III	Public key Cryptography: - Principles of Public key Cryptography Systems, Number theory- Fundamental Theorem of arithmetic, Fermat's Theorem, Euler's Theorem, Euler's Totient Function, Extended Euclid's Algorithm, Modular arithmetic. RSA algorithm- Key Management - Diffie-Hellman Key Exchange, Elliptic curve cryptography	7	15 %
IV	Authentication requirements- Authentication functions- Message authentication codes- Hash functions- SHA -1, MD5, Security of Hash functions and MACs- Authentication protocols-Digital signatures-Digital signature standards.	7	15 %
SECOND INTERNAL EXAM			
V	Network security: Electronic Mail Security: Pretty good privacy- S/MIME. IP Security: Architecture- authentication Header- Encapsulating Security payload- Combining Security associations- Key management.	7	20 %
VI	Web Security: Web Security considerations- secure Socket Layer and Transport layer Security- Secure electronic transaction. Firewalls-Packet filters- Application Level Gateway- Encrypted tunnels.	7	20 %
END SEMESTER EXAM			

Question Paper Pattern (End semester exam)

1. There will be ***FOUR*** parts in the question paper – **A, B, C, D**
2. **Part A**
   a. **Total marks : 40**
   b. ***TEN*** questions, each have **4 marks**, covering **all the SIX modules** (***THREE*** questions from **modules I & II**; ***THREE*** questions from **modules III & IV**; ***FOUR*** questions from **modules V & VI**). ***All*** questions have to be answered.
3. **Part B**
   a. **Total marks : 18**
   b. ***THREE*** questions, each having **9 marks**. One question is from **module I**; one question is from **module II**; one question ***uniformly*** covers **modules I & II**.
   c. ***Any TWO*** questions have to be answered.
   d. Each question can have ***maximum THREE*** subparts.
4. **Part C**
   a. **Total marks : 18**
   b. ***THREE*** questions, each having **9 marks**. One question is from **module III**; one question is from **module IV**; one question ***uniformly*** covers **modules III & IV**.
   c. ***Any TWO*** questions have to be answered.
   d. Each question can have ***maximum THREE*** subparts.
5. **Part D**
   a. **Total marks : 24**
   b. ***THREE*** questions, each having **12 marks**. One question is from **module V**; one question is from **module VI**; one question ***uniformly*** covers **modules V & VI**.
   c. ***Any TWO*** questions have to be answered.
   d. Each question can have ***maximum THREE*** subparts.
6. There will be ***AT LEAST* 60%** analytical/numerical questions in all possible combinations of question choices.

Course code	Course Name	L-T-P - Credits	Year of Introduction
CS431	COMPILER DESIGN LAB	0-0-3-1	2016

Pre-requisite : CS331 System Software Lab

Course Objectives:

- To implement the different Phases of compiler.
- To implement and test simple optimization techniques.
- To give exposure to compiler writing tools.

List of Exercises/Experiments :

1. Design and implement a lexical analyzer for given language using C and the lexical analyzer should ignore redundant spaces, tabs and new lines.
2. Implementation of Lexical Analyzer using Lex Tool
3. Generate YACC specification for a few syntactic categories.
   a) Program to recognize a valid arithmetic expression that uses operator +, – , * and /.
   b) Program to recognize a valid variable which starts with a letter followed by any number of letters or digits.
   c) Implementation of Calculator using LEX and YACC
   d) Convert the BNF rules into YACC form and write code to generate abstract syntax tree
4. Write program to find ε – closure of all states of any given NFA with ε transition.
5. Write program to convert NFA with ε transition to NFA without ε transition.
6. Write program to convert NFA to DFA
7. Write program to minimize any given DFA.
8. Develop an operator precedence parser for a given language.
9. Write program to find Simulate First and Follow of any given grammar.
10. Construct a recursive descent parser for an expression.
11. Construct a Shift Reduce Parser for a given language.
12. Write a program to perform loop unrolling.
13. Write a program to perform constant propagation.
14. Implement Intermediate code generation for simple expressions.
15. Implement the back end of the compiler which takes the three address code and produces the 8086 assembly language instructions that can be assembled and run using an 8086 assembler. The target assembly instructions can be simple move, add, sub, jump etc.

Expected Outcome:

The Student will be able to :

i. Implement the techniques of Lexical Analysis and Syntax Analysis.
ii. Apply the knowledge of Lex & Yacc tools to develop programs.
iii. Generate intermediate code.
iv. Implement Optimization techniques and generate machine level code.

Course code	Course Name	L-T-P Credits	Year of Introduction
CS465	BIOINFORMATICS	3-0-0-3	2016

Course Objectives:

- To introduce concepts and data representations in bioinformatics
- To introduce fundamentals of Sequence alignment and Gene Recognition
- To discuss predictive methods using DNA and Protein Sequences

Syllabus:

Introduction to bioinformatics and molecular biology: Databases tools and their uses, Data searches and Pairwise Alignments, Multiple Sequence Alignments, Molecular Phylogenetic, Genomics and Gene Recognition, Protein and RNA structure Prediction

Expected Outcome:

The Students will be able to :

i. interpret the concepts of bioinformatics
ii. identify different types of biological sequence
iii. analyse multiple sequences and find conserved regions
iv. predict RNA and Protein secondary structures
v. analyse genomic sequences and identify encoded gene regions

References:

1. S C Rastogi, N Mendiratta and P Rastogi, " Bioinformatics: Methods and Applications" , ISBN : 978-81-203-4785-4, published by PHI Learning Private Limited, New Delhi, 2015.
2. D E Krane and M L Raymer, Fundamental Concepts of Bioinformatics, ISBN 978-81-7758-757-9, Pearson Education, 2006.
3. Andreas D.Baxevanis, B F Francis Ouellette, "Bioinformatics - A Practical Guide to the Analysis of Genes and Proteins", Third Edition, 2005-2006, ISBN: 978-81-265-2192-0, published by John Wiley & Sons INC. , U.K.
4. Neil C Jones and Pavel A Pevzner, An Introduction to Bioinformatics Algorithms, MIT press, 2004.

Course Plan

Module	Contents	Hours	End Sem. Exam Marks
I	Bioinformatics and Computational Biology, Nature & Scope of Bioinformatics. The central dogma of molecular biology and bio-sequences associated with it, RNA classification –coding and non coding RNA- mRNA, tRNA, miRNA and sRNA, RNAi. DNA and RNA structure – Nucleic Acid structure and function, Genetic Code, Genes and Evolution	6	15%
II	Importance of databases - Biological databases-primary sequence databases, Composite sequence databases- Secondary databases- nucleic acid sequence databases - Protein sequence data bases - structure databases, Types of databases, Data retrieval tools - Entrez	8	15%

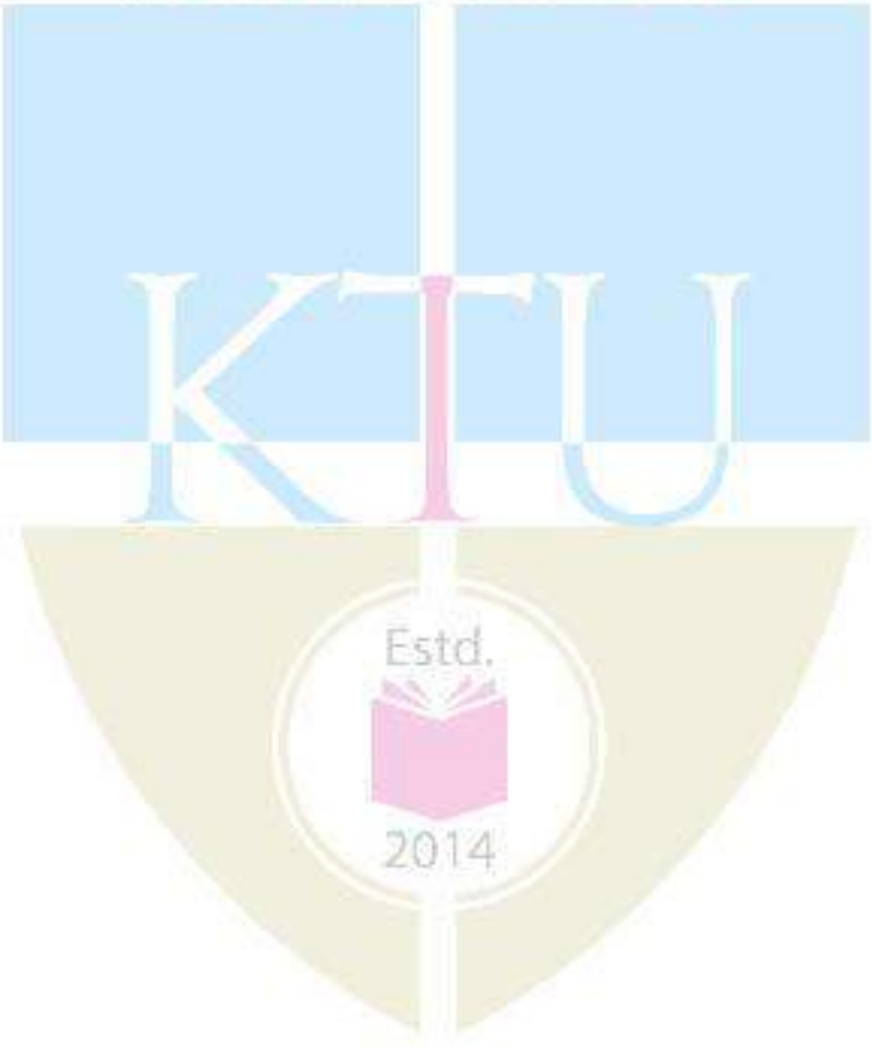
FIRST INTERNAL EXAM			
III	Sequence alignment – local/global, pairwise sequence alignment, scoring methods. Needleman and Wunsch algorithm, global and local alignments. Multiple sequence alignment. Scoring matrices: basic concept of a scoring matrix, Matrices for nucleic acid and proteins sequences, PAM and BLOSUM series, principles based on which these matrices are derived. Differences between distance & similarity matrix.	8	20%
IV	Introduction, Advantages, Phylogenetic Trees, Tree topologies, Methods for phylogenetic analysis- Distance Matrix methods, Character based methods. HMM (Hidden Markov Model): Introduction to HMM, Forward algorithm, Viterbi algorithm, applications in Bioinformatics	6	15%
SECOND INTERNAL EXAM			
V	General introduction to Gene expression in prokaryotes and eukaryotes- Prokaryotic Genomes – Gene structure, GC content, Gene Density, Eukaryotic Genomes- Gene structure, GC content, Gene Density, Gene Expression, Transposition, Gene prediction approaches.	8	20%
VI	Protein and RNA structure Prediction: Predicting RNA secondary structure - Nussinov Algorithm, Energy minimisation methods - Zuker Algorithm. Amino Acids, Polypeptide Composition, Protein Structures, Algorithm for protein folding, Structure prediction	6	15%
END SEMESTER EXAM			

Question Paper Pattern (End semester exam)

1. There will be ***FOUR*** parts in the question paper – **A, B, C, D**
2. **Part A**
   a. **Total marks : 40**
   b. ***TEN*** questions, each have **4 marks**, covering **all the SIX modules** (***THREE*** questions from **modules I & II**; ***THREE*** questions from **modules III & IV**; ***FOUR*** questions from **modules V & VI**).
   All the TEN questions have to be answered.
3. **Part B**
   a. **Total marks : 18**
   b. ***THREE*** questions, each having **9 marks**. One question is from **module I**; one question is from **module II**; one question ***uniformly*** covers **modules I & II**.
   c. ***Any TWO*** questions have to be answered.
   d. Each question can have ***maximum THREE*** subparts.
4. **Part C**
   a. **Total marks : 18**

b. ***THREE*** questions, each having **9 marks**. One question is from **module III**; one question is from **module IV**; one question ***uniformly*** covers **modules III & IV**.
c. ***Any TWO*** questions have to be answered.
d. Each question can have ***maximum THREE*** subparts.

5. **Part D**
   a. **Total marks : 24**
   b. ***THREE*** questions, each having **12 marks**. One question is from **module V**; one question is from **module VI**; one question ***uniformly*** covers **modules V & VI**.
   c. ***Any TWO*** questions have to be answered.
   d. Each question can have ***maximum THREE*** subparts.
6. There will be ***AT LEAST* 60%** analytical/numerical questions in all possible combinations of question choices.



Semester VIII

Course Code	Course Name	L-T-P	Credits	Exam Slot
CS402	Data Mining and Ware Housing	3-0-0	3	A
CS404	Embedded Systems	3-0-0	3	B
	Elective 4	3-0-0	3	C
	Elective 5 (Non Departmental)	3-0-0	3	D
CS492	Project		6	

Total Credits = 18 Hours: 30 Cumulative Credits= 180

Elective 4:-

1. CS462 Fuzzy Set Theory and Applications
2. CS464 Artificial Intelligence
3. CS466 Data Science
4. CS468 Cloud Computing
5. CS472 Principles of Information Security

Course code	Course Name	L-T-P Credits	Year of Introduction
CS402	DATA MINING AND WAREHOUSING	3-0-0-3	2016

Course Objectives:

- To introduce the concepts of data Mining and its applications
- To understand investigation ofe data using practical data mining tools.
- To introduce Association Rules Mining
- To introduce advanced Data Mining techniques

Syllabus:

Data Mining, Applications, Data Mining Models, Data Warehousing and OLAP, Challenges, Tools, Data Mining Principles, Data Preprocessing: Data Preprocessing Concepts, Data Visualization, Data Sets and Their Significance, Classification Models, Multi Resolution Spatial Data Mining, Classifiers, Association Rules Mining, Cluster Analysis, Practical Data Mining Tools, Advanced Data Mining Techniques, Web Mining, Text Mining, CRM Applications and Data Mining, Data warehousing.

Expected Outcome:

The Student will be able to :

i. identify the key process of Data mining and Warehousing
ii. apply appropriate techniques to convert raw data into suitable format for practical data mining tasks
iii. analyze and compare various classification algorithms and apply in appropriate domain
iv. evaluate the performance of various classification methods using performance metrics
v. make use of the concept of association rule mining in real world scenario
vi. select appropriate clustering and algorithms for various applications
vii. extend data mining methods to the new domains of data

Text Books:

1. Dunham M H, "Data Mining: Introductory and Advanced Topics", Pearson Education, New Delhi, 2003.
2. Jaiwei Han and Micheline Kamber, "Data Mining Concepts and Techniques", Elsevier, 2006.

References:

1. M Sudeep Elayidom, "Data Mining and Warehousing", 1st Edition, 2015, Cengage Learning India Pvt. Ltd.
2. Mehmed Kantardzic, "Data Mining Concepts, Methods and Algorithms", John Wiley and Sons, USA, 2003.
3. Pang-Ning Tan and Michael Steinbach, "Introduction to Data Mining", Addison Wesley, 2006.

Course Plan			
Module	**Contents**	**Hours**	**End Sem Exam . Marks**
I	Data Mining:- Concepts and Applications, Data Mining Stages, Data Mining Models, Data Warehousing (DWH) and On-Line Analytical Processing (OLAP), Need for Data Warehousing, Challenges, Application of Data Mining Principles, OLTP Vs DWH, Applications of DWH	6	15%
II	Data Preprocessing: Data Preprocessing Concepts, Data Cleaning, Data integration and transformation, Data Reduction, Discretization and concept hierarchy.	6	15%
FIRST INTERNAL EXAM			
III	Classification Models: Introduction to Classification and Prediction, Issues regarding classification and prediction, Decision Tree- ID3, C4.5, Naive Bayes Classifier.	6	15%
IV	Rule based classification- 1R. Neural Networks-Back propagation. Support Vector Machines, Lazy Learners-K Nearest Neighbor Classifier. Accuracy and error Measures-evaluation. Prediction:-Linear Regression and Non-Linear Regression.	6	15%
SECOND INTERNAL EXAM			
V	Association Rules Mining: Concepts, Apriori and FP-Growth Algorithm. Cluster Analysis: Introduction, Concepts, Types of data in cluster analysis, Categorization of clustering methods. Partitioning method: K-Means and K-Medoid Clustering.	8	20
VI	Hierarchical Clustering method: BIRCH. Density-Based Clustering –DBSCAN and OPTICS. Advanced Data Mining Techniques: Introduction, Web Mining- Web Content Mining, Web Structure Mining, Web Usage Mining. Text Mining. Graph mining:- Apriori based approach for mining frequent subgraphs. Social Network Analysis:- characteristics of social networks. Link mining:- Tasks and challenges.	8	20
END SEMESTER EXAMINATION			

Question Paper Pattern

1. There will be ***FOUR*** parts in the question paper – **A, B, C, D**
2. **Part A**
    a. **Total marks : 40**
    b. ***TEN*** questions, each have **4 marks**, covering **all the SIX modules** (***THREE*** questions from **modules I & II**; ***THREE*** questions from **modules III & IV**; ***FOUR*** questions from **modules V & VI**).
    All the TEN questions have to be answered.
3. **Part B**
    a. **Total marks : 18**
    b. ***THREE*** questions, each having **9 marks**. One question is from **module I**; one question is from **module II**; one question ***uniformly*** covers **modules I & II**.
    c. ***Any TWO*** questions have to be answered.
    d. Each question can have ***maximum THREE*** subparts.
4. **Part C**
    a. **Total marks : 18**
    b. ***THREE*** questions, each having **9 marks**. One question is from **module III**; one question is from **module IV**; one question ***uniformly*** covers **modules III & IV**.
    c. ***Any TWO*** questions have to be answered.
    d. Each question can have ***maximum THREE*** subparts.
5. **Part D**
    a. **Total marks : 24**
    b. ***THREE*** questions, each having **12 marks**. One question is from **module V**; one question is from **module VI**; one question ***uniformly*** covers **modules V & VI**.
    c. ***Any TWO*** questions have to be answered.
    d. Each question can have ***maximum THREE*** subparts.
6. There will be ***AT LEAST* 60%** analytical/numerical questions in all possible combinations of question choices.

Course code	Course Name	L-T-P -Credits	Year of Introduction
CS404	Embedded Systems	3-0-0-3	2016

Course Objectives:

- To introduce the technologies behind embedded computing systems.
- To introduce and discuss various software components involved in embedded system design and development.
- To expose students to the recent trends in embedded system design.

Syllabus:

Introduction to embedded systems, basic components, its characteristics. Modelling embedded systems, firmware development. Integration and testing of embedded systems, development environment. Characteristics of RTOS, interrupt handling, creating tasks in a typical RTOS. Embedded product development life cycle.

Expected Outcome:

The Student will be able to :

i. demonstrate the role of individual components involved in a typical embedded system
ii. analyze the characteristics of different computing elements and select the most appropriate one for an embedded system
iii. model the operation of a given embedded system
iv. substantiate the role of different software modules in the development of an embedded system
v. develop simple tasks to run on an RTOS
vi. examine the latest trends prevalent in embedded system design

References:

1. J Staunstrup and Wayne Wolf, Hardware / Software Co-Design: Principles and Practice, Prentice Hall.
2. Jean J. Labrose, Micro C/OS II: The Real Time Kernel, 2e, CRC Press, 2002.
3. Raj Kamal, Embedded Systems: Architecture, Programming and Design, Third Edition, McGraw Hill Education (India), 2014.
4. Shibu K.V., Introduction to Embedded Systems, McGraw Hill Education (India), 2009.
5. Steave Heath, Embedded System Design, Second Edition, Elsevier.
6. Wayne Wolf , Computers as Components-Principles of Embedded Computer System Design, Morgan Kaufmann publishers, Third edition, 2012.

Course Plan

Module	Contents	Hours	End Sem. Exam Marks
I	Fundamentals of Embedded Systems- complex systems and microprocessors- Embedded system design process .Specifications- architecture design of embedded system- design of hardware and software components- structural and behavioural description.	6	15%
II	Hardware Software Co-Design and Program Modelling – Fundamental Issues, Computational Models- Data Flow Graph, Control Data Flow Graph, State Machine,. Sequential Model, Concurrent Model, Object oriented model, UML	9	15%

FIRST INTERNAL EXAMINATION			
III	Design and Development of Embedded Product – Firmware Design and Development – Design Approaches, Firmware Development Languages.	6	15%
IV	Integration and Testing of Embedded Hardware and Firmware- Integration of Hardware and Firmware. Embedded System Development Environment – IDEs, Cross Compilers, Disassemblers, Decompilers, Simulators, Emulators and Debuggers.	6	15%
SECOND INTERNAL EXAMINATION			
V	RTOS based Design – Basic operating system services. Interrupt handling in RTOS environment. Design Principles. Task scheduling models. How to Choose an RTOS. Case Study – MicroC/OS-II.	9	20%
VI	Networks – Distributed Embedded Architectures, Networks for embedded systems, Network based design, Internet enabled systems. Embedded Product Development Life Cycle – Description – Objectives -Phases – Approaches1. Recent Trends in Embedded Computing.	6	20%
END SEMESTER EXAM			

Question Paper Pattern

1. There will be ***FOUR*** parts in the question paper – **A, B, C, D**
2. **Part A**
   a. **Total marks : 40**
   b. ***TEN*** questions, each have **4 marks**, covering **all the SIX modules** (***THREE*** questions from **modules I & II**; ***THREE*** questions from **modules III & IV**; ***FOUR*** questions from **modules V & VI**). ***All*** questions have to be answered.
3. **Part B**
   a. **Total marks : 18**
   b. ***THREE*** questions, each having **9 marks**. One question is from **module I**; one question is from **module II**; one question ***uniformly*** covers **modules I & II**.
   c. ***Any TWO*** questions have to be answered.
   d. Each question can have ***maximum THREE*** subparts.
4. **Part C**
   a. **Total marks : 18**
   b. ***THREE*** questions, each having **9 marks**. One question is from **module III**; one question is from **module IV**; one question ***uniformly*** covers **modules III & IV**.
   c. ***Any TWO*** questions have to be answered.
   d. Each question can have ***maximum THREE*** subparts.
5. **Part D**
   a. **Total marks : 24**
   b. ***THREE*** questions, each having **12 marks**. One question is from **module V**; one question is from **module VI**; one question ***uniformly*** covers **modules V & VI**.
   c. ***Any TWO*** questions have to be answered.
   d. Each question can have ***maximum THREE*** subparts.
6. There will be ***AT LEAST* 50%** analytical/numerical questions in all possible combinations of question choices.

Course code	Course Name	L-T-P - Credits	Year of Introduction
CS464	ARTIFICIAL INTELLIGENCE	3-0-0-3	2016

Course Objectives:

- To introduce basic principles that drive complex real world intelligence applications.
- To introduce and discuss the basic concepts of AI Techniques and Learning

Syllabus:

Introduction to AI, Solving Problems by Searching-uninformed, informed, heuristic, constraint Satisfaction problems -AI Representational Schemes-Learning-Advanced searches-Alpha beta pruning, Expert Systems-Natural Language Processing Concepts.

Expected Outcome:

The Student will be able to :

i. appreciate the scope and limits of the artificial intelligence (AI) field
ii. assess the applicability, strengths, and weaknesses of the basic knowledge representation
iii. interpret the role of knowledge representation, problem solving, and learning
iv. explain various search algorithms (uninformed, informed, and heuristic) for problem solving
v. comprehend the fundamentals of Natural Language Processing

Text Books:

1. E Rich, K Knight, Artificial Intelligence, 3/e, Tata McGraw Hil, 2009.
2. George.F.Luger, Artificial Intelligence- Structures and Strategies for Complex Problem Solving, 4/e, Pearson Education. 2002.

References:

1. D. Poole and A. Mackworth. Artificial Intelligence: Foundations of Computational Agents, Cambridge University Press, 2010 Available online: *http://artint.info/*
2. Dan W Patterson, Introduction to Artificial Intelligence,Pearson,2009
3. Deepak Khemeni,A First course in Artificial Intelligence,Tata McGraw Hill,2013
4. Maja J. Mataric ,Robotics Primer,MIT press,2007
5. Patrick Henry Winston,Artificial intelligence,Addisson wessley,1992
6. Stefan Edelkamp, Stefan Schroedl, Heuristic Search: Theory and Applications, Morgan Kaufman, 2011.
7. Stuart Jonathan Russell, Peter Norvig, Artificial intelligence, A modern approach,3rd edition, pearson,2010

Course Plan			
Module	**Contents**	**Hours**	**End Sem. Exam Marks**
I	**Introduction**: What is AI, The foundations of AI, History and applications, Production systems. Structures and strategies for state space search. Informed and Uninformed searches.	5	15%
II	**Search Methods:** data driven and goal driven search. Depth first and breadth first search, DFS with iterative deepening. Heuristic search-best first search, A * algorithm.AO* algorithm, Constraint Satisfaction. Crypt Arithmetic Problems	8	15%
FIRST INTERNAL EXAMINATION			
III	**AI representational schemes**- Semantic nets, conceptual dependency, scripts, frames, introduction to agent based problem solving, Machine learning-symbol based-a frame work for symbol based learning.	6	15%
IV	**Advanced Search:** Heuristics in Games, Design of good heuristic-an example. Min-Max Search Procedure, Alpha Beta pruning,	6	15%
SECOND INTERNAL EXAMINATION			
V	**Learning Concepts:** Version space search. Back propagation learning. Social and emergent models of learning-genetic algorithm, classifier systems and genetic programming.	9	20%
VI	**Expert Systems:** rule based expert systems. Natural language processing-natural language understanding problem, deconstructing language. Syntax stochastic tools for language analysis, natural language applications	9	20%
END SEMESTER EXAM			

Question Paper Pattern (End semester exam)

1. There will be ***FOUR*** parts in the question paper – **A, B, C, D**
2. **Part A**
   a. **Total marks : 40**
   b. ***TEN*** questions, each have **4 marks**, covering **all the SIX modules** (***THREE*** questions from **modules I & II**; ***THREE*** questions from **modules III & IV**; ***FOUR*** questions from **modules V & VI**).
   All the TEN questions have to be answered.

3. **Part B**
    a. **Total marks : 18**
    b. ***THREE*** questions, each having **9 marks**. One question is from **module I**; one question is from **module II**; one question ***uniformly*** covers **modules I & II**.
    c. ***Any TWO*** questions have to be answered.
    d. Each question can have ***maximum THREE*** subparts.
4. **Part C**
    a. **Total marks : 18**
    b. ***THREE*** questions, each having **9 marks**. One question is from **module III**; one question is from **module IV**; one question ***uniformly*** covers **modules III & IV**.
    c. ***Any TWO*** questions have to be answered.
    d. Each question can have ***maximum THREE*** subparts.
5. **Part D**
    a. **Total marks : 24**
    b. ***THREE*** questions, each having **12 marks**. One question is from **module V**; one question is from **module VI**; one question ***uniformly*** covers **modules V & VI**.
    c. ***Any TWO*** questions have to be answered.
    d. Each question can have ***maximum THREE*** subparts.
6. There will be ***AT LEAST* 60%** analytical/numerical questions in all possible combinations of question choices.

Course code	Course Name	L-T-P - Credits	Year of Introduction
CS472	PRINCIPLES OF INFORMATION SECURITY	3-0-0-3	2016

Course Objectives

- To introduce fundamental concepts of security.
- To introduce and discuss the relevance of security in operating system, web services etc.
- To introduce fundamental concepts of secure electronic transactions.

Syllabus

Overview of computer security, Security concepts, Need of Security, Access Control, Access control matrix, Security policies, Software vulnerabilities, Security in current domains - Wireless LAN security, Cell phone security, Secure Electronic transactions, Web Services security

Expected Outcome:

The Student will be able to :

i. appreciate the common threats faced today
ii. interpret the foundational theory behind information security
iii. design a secure system
iv. identify the potential vulnerabilities in software
v. appreciate the relevance of security in various domains
vi. develop secure web services and perform secure e-transactions

Text Books:

1. Bernard Menezes, Network security and Cryptography, Cengage Learning India, 2010.
2. M Bishop, Computer Security: Art and Science, Pearson Education, 2003.

References:

1. E Whiteman and J Mattord, Principles of information security 4th edn, Cengage Learning
2. V K Pachghare, Cryptography and information security, PHI
3. Behrousz A Forouzan, D Mukhopadhyay, Cryptography and network Security, McGraw Hill
4. W Mao, Modern Cryptography: Theory & Practice, Pearson Education, 2004.
5. C P. Fleeger and S L Fleeger, Security in Computing, 3/e, Pearson Education, 2003.

Course Plan

Module	Contents	Hours	End Sem. Exam Marks
I	**Introduction**: Overview of computer security, Security concepts, Need of Security- Threats- Deliberate software attacks, Deviation in quality of service, Attacks- malicious code, brute force, Timing attack, sniffers **Access Control Mechanisms** - Access Control, Access control matrix, Access control in OS-Discretionary and Mandatory access control, Role-based access control, case study SELinux	7	15%

II	**Security policies and models**: confidentiality policies, Bell-LaPadula model, Integrity policies, Biba model, Clark-Wilson models, Chinese wall model, waterfall model	7	15%
FIRST INTERNAL EXAMINATION			
III	**Software vulnerabilities**: Buffer and stack overflow, Cross-site scripting(XSS) , and vulnerabilities, SQL injection and vulnerabilities , Phishing.	6	15%
IV	**Malware**: Viruses, Worms and Trojans. Topological worms. Internet propagation models for worms.	6	15%
SECOND INTERNAL EXAMINATION			
V	**Security in current domains:** Wireless LAN security - WEP details. wireless LAN vulnerabilities – frame spoofing. Cellphone security - GSM and UMTS security. Mobile malware - bluetooth security issues.	8	20%
VI	**Secure Electronics transactions: F**ramework, strength and weakness, Security in current applications : Online banking , Credit Card Payment Systems. **Web Services security**: XML, SOAP, SAML, RFID	8	20%
END SEMESTER EXAM			

Question Paper Pattern (End semester exam)

1. There will be ***FOUR*** parts in the question paper – **A, B, C, D**
2. **Part A**
   a. **Total marks : 40**
   b. ***TEN*** questions, each have **4 marks**, covering **all the SIX modules** (***THREE*** questions from **modules I & II**; ***THREE*** questions from **modules III & IV**; ***FOUR*** questions from **modules V & VI**). ***All*** questions are to be answered.
3. **Part B**
   a. **Total marks : 18**
   b. ***THREE*** questions, each having **9 marks**. One question is from **module I**; one question is from **module II**; one question ***uniformly*** covers **modules I & II**.
   c. ***Any TWO*** questions have to be answered.
   d. Each question can have ***maximum THREE*** subparts.
4. **Part C**
   a. **Total marks : 18**
   b. ***THREE*** questions, each having **9 marks**. One question is from **module III**; one question is from **module IV**; one question ***uniformly*** covers **modules III & IV**.
   c. ***Any TWO*** questions have to be answered.
   d. Each question can have ***maximum THREE*** subparts.
5. **Part D**
   a. **Total marks : 24**
   b. ***THREE*** questions, each having **12 marks**. One question is from **module V**; one question is from **module VI**; one question ***uniformly*** covers **modules V & VI**.
   c. ***Any TWO*** questions have to be answered.
   d. Each question can have ***maximum THREE*** subparts.
6. There will be ***AT LEAST* 60%** analytical/numerical questions in all possible combinations of question choices.

General Subjects

Sl No.	Subject Code	Subject Name
1	MA 201	Linear Algebra & Complex Analysis
2	HS 210/ 200	Life Skills/Business Economics
3	CS 341	Design Project
4	HS 300	Principles of Management
5	CS 352	Comprehensive Exam
6	CS 451	Seminar & Project Preliminary
7	CS 492	Project

Course No.	Course Name	L-T-P - Credits	Year of Introduction
MA201	LINEAR ALGEBRA AND COMPLEX ANALYSIS	3-1-0-4	2016

Prerequisite : Nil

Course Objectives

COURSE OBJECTIVES

- To equip the students with methods of solving a general system of linear equations.
- To familiarize them with the concept of Eigen values and diagonalization of a matrix which have many applications in Engineering.
- To understand the basic theory of functions of a complex variable and conformal Transformations.

Syllabus

Analyticity of complex functions-Complex differentiation-Conformal mappings-Complex integration-System of linear equations-Eigen value problem

Expected outcome .

At the end of the course students will be able to
(i) solve any given system of linear equations
(ii) find the Eigen values of a matrix and how to diagonalize a matrix
(iii) identify analytic functions and Harmonic functions.
(iv)evaluate real definite Integrals as application of Residue Theorem
(v) identify conformal mappings(vi) find regions that are mapped under certain Transformations

Text Book:

Erwin Kreyszig: Advanced Engineering Mathematics, 10th ed. Wiley

References:

1.Dennis g Zill&Patric D Shanahan-A first Course in Complex Analysis with Applications-Jones&Bartlet Publishers
2.B. S. Grewal. Higher Engineering Mathematics, Khanna Publishers, New Delhi.
3.Lipschutz, Linear Algebra,3e **(** Schaums **Series)**McGraw Hill Education India 2005
4.Complex variables introduction and applications-second edition-Mark.J.Owitz-Cambridge Publication

Course Plan

Module	Contents	Hours	Sem. Exam Marks
I	Complex differentiation Text 1[13.3,13.4] Limit, continuity and derivative of complex functions	3	
	Analytic Functions	2	
	Cauchy–Riemann Equation(Proof of sufficient condition of analyticity & C R Equations in polar form not required)-Laplace's Equation	2	
	Harmonic functions, Harmonic Conjugate	2	15%
II	Conformal mapping: Text 1[17.1-17.4] Geometry of Analytic functions Conformal Mapping,	1	
	Mapping $w = z^2$ conformality of $w = e^z$.	2	15%

	The mapping $w = z + \frac{1}{z}$ Properties of $w = \frac{1}{z}$ Circles and straight lines, extended complex plane, fixed points Special linear fractional Transformations, Cross Ratio, Cross Ratio property-Mapping of disks and half planes Conformal mapping by $w = \sin z$ & $w = \cos z$ (Assignment: Application of analytic functions in Engineering)	1 3 3	
	FIRST INTERNAL EXAMINATION		
III	Complex Integration. Text 1[14.1-14.4] [15.4&16.1] Definition Complex Line Integrals, First Evaluation Method, Second Evaluation Method Cauchy's Integral Theorem(without proof), Independence of path(without proof), Cauchy's Integral Theorem for Multiply Connected Domains (without proof) Cauchy's Integral Formula- Derivatives of Analytic Functions(without proof)Application of derivative of Analytical Functions Taylor and Maclaurin series(without proof), Power series as Taylor series, Practical methods(without proof) Laurent's series (without proof)	2 2 2 2 2	15%
IV	Residue Integration Text 1 [16.2-16.4] Singularities, Zeros, Poles, Essential singularity, Zeros of analytic functions Residue Integration Method, Formulas for Residues, Several singularities inside the contour Residue Theorem. Evaluation of Real Integrals (i) Integrals of rational functions of $\sin\theta$ and $\cos\theta$ (ii)Integrals of the type $\int_{-\infty}^{\infty} f(x)dx$ (Type I, Integrals from 0 to ∞) (Assignment : Application of Complex integration in Engineering)	2 4 3	15%
	SECOND INTERNAL EXAMINATION		
V	Linear system of Equations Text 1(7.3-7.5) Linear systems of Equations, Coefficient Matrix, Augmented Matrix Gauss Elimination and back substitution, Elementary row operations, Row equivalent systems, Gauss elimination-Three possible cases, Row Echelon form and Information from it.	1 5	20%

	Linear independence-rank of a matrix Vector Space-Dimension-basis-vector space $\mathbf{R}^3$ Solution of linear systems, Fundamental theorem of non-homogeneous linear systems(Without proof)-Homogeneous linear systems (Theory only	2 1	
VI	Matrix Eigen value Problem Text 1.(8.1,8.3 &8.4) Determination of Eigen values and Eigen vectors-Eigen space Symmetric, Skew Symmetric and Orthogonal matrices –simple properties (without proof) Basis of Eigen vectors- Similar matrices Diagonalization of a matrix-Quadratic forms- Principal axis theorem(without proof) (Assignment-Some applications of Eigen values(8.2))	 3 2 4	20%
END SEMESTER EXAM			

QUESTION PAPER PATTERN:

Maximum Marks : 100 Exam Duration: 3 hours

The question paper will consist of 3 parts.

Part A will have 3 questions of 15 marks each uniformly covering modules I and II. Each question may have two sub questions.

Part B will have 3 questions of 15 marks each uniformly covering modules III and IV. Each question may have two sub questions.

Part C will have 3 questions of 20 marks each uniformly covering modules V and VI. Each question may have three sub questions.

Any two questions from each part have to be answered.

Course code	Course Name	L-T-P - Credits	Year of Introduction
HS200	Business Economics	3-0-0-3	2016

Prerequisite: Nil

Course Objectives

- To familiarize the prospective engineers with elementary Principles of Economics and Business Economics.
- To acquaint the students with tools and techniques that are useful in their profession in Business Decision Making which will enhance their employability;
- To apply business analysis to the "firm" under different market conditions;
- To apply economic models to examine current economic scenario and evaluate policy options for addressing economic issues
- To gain understanding of some Macroeconomic concepts to improve their ability to understand the business climate;
- To prepare and analyse various business tools like balance sheet, cost benefit analysis and rate of returns at an elementary level

Syllabus

Business Economics - basic concepts, tools and analysis, scarcity and choices , resource allocation, marginal analysis, opportunity costs and production possibility curve. Fundamentals of microeconomics - Demand and Supply Analysis, equilibrium, elasticity, production and production function, cost analysis, break-even analysis and markets. Basics of macroeconomics - the circular flow models, national income analysis, inflation, trade cycles, money and credit, and monetary policy. Business decisions - investment analysis, Capital Budgeting decisions, forecasting techniques and elementary Balance Sheet and taxation, business financing, international investments

Expected outcome .

A student who has undergone this course would be able to

i. make investment decisions based on capital budgeting methods in alignment with microeconomic and macroeconomic theories.
ii. able to analyse the profitability of the firm, economy of operation, determination of price under various market situations with good grasp on the effect of trade cycles in business.
iii. gain knowledge on Monetary theory, measures by RBI in controlling interest rate and emerging concepts like Bit Coin.
iv. gain knowledge of elementary accounting concepts used for preparing balance sheet and interpretation of balance sheet

Text Books

1. Geetika, Piyali Ghosh and Chodhury, *Managerial Economics*, Tata McGraw Hill, 2015
2. Gregory Mankiw, *Principles of Macroeconomics*, Cengage Learning, 2006.
3. M.Kasi Reddy and S.Saraswathi, *Economics and Financial Accounting*. Prentice Hall of India. New Delhi.

References:

1. Dornbusch, Fischer and Startz, *Macroeconomics*, McGraw Hill, 11th edition, 2010.
2. Khan M Y, *Indian Financial System*, Tata McGraw Hill, 7th edition, 2011.
3. Samuelson, *Managerial Economics*, 6th edition, Wiley
4. Snyder C and Nicholson W, *Fundamentals of Microeconomics*, Cengage Learning (India), 2010.
5. Truett, Managerial Economics: Analysis, Problems, Cases, 8th Edition, Wiley
6. Welch, *Economics: Theory and Practice* 7th Edition, Wiley
7. Uma Kapila, *Indian Economy Since Independence, 26th Edition: A Comprehensive and Critical Analysis of India's Economy*, 1947-2015
8. C Rangarajan, *Indian Economy, Essays on monetary and finance*, UBS Publishers'Distributors, 1998
9. A.Ramachandra Aryasri, *Managerial Economics and Financial Analysis*, Tata McGraw-Hill, New Delhi.
10. Dominick Salvatore, *Managerial Economics in Global Economy*, Thomas Western College Publishing, Singapore.
11. I.M .Pandey, *Financial Management*, Vikas Publishing House. New Delhi.
12. Dominick Salvatore, *Theory and Problems of Micro Economic Theory.* Tata Mac Graw-Hill, New Delhi.
13. T.N.Hajela.*Money, Banking and Public Finance.* Anne Books. New Delhi.
14. G.S.Gupta. *Macro Economics-Theory and Applications.* Tata Mac Graw- Hill, New Delhi.
15. Yogesh, Maheswari, *Management Economics* , PHI learning, NewDelhi, 2012
16. Timothy Taylor , *Principles of Economics*, 3rd edition, TEXTBOOK MEDIA.
17. Varshney and Maheshwari. *Managerial Economics*. Sultan Chand. New Delhi

Course Plan

Module	Contents	Hours	Sem. Exam Marks
I	**Business Economics** and its role in managerial decision making-meaning-scope-relevance-economic problems-scarcity Vs choice (2 Hrs)-Basic concepts in economics-scarcity, choice, resource allocation- Trade-off-opportunity cost-marginal analysis- marginal utility theory, Law of diminishing marginal utility -production possibility curve (2 Hrs)	4	15%
II	**Basics of Micro Economics I** Demand and Supply analysis-equillibrium-elasticity (demand and supply) (3 Hrs.) -Production concepts-average product-marginal product-law of variable proportions- Production function-Cobb Douglas function-problems (3 Hrs.)	6	15%
FIRST INTERNAL EXAMINATION			
III	**Basics of Micro Economics II** Concept of costs-marginal, average, fixed, variable costs-cost curves-shut down point-long run and short run (3 Hrs.)- Break Even Analysis-Problem-Markets-Perfect Competition, Monopoly and Monopolistic Competition, Oligopoly-Cartel and collusion (3 Hrs.).	6	15%
IV	**Basics of Macro Economics** - Circular flow of income-two sector and multi-sector models- National Income Concepts-Measurement methods-problems-Inflation, deflation (4 Hrs.)-Trade cycles-Money-stock and flow concept-Quantity theory of money-Fischer's Equation and Cambridge Equation -velocity of circulation of money-credit control methods-SLR, CRR, Open Market Operations-Repo and Reverse Repo rate-emerging concepts in money-bit coin (4 Hrs.).	8	15%

SECOND INTERNAL EXAMINATION			
V	**Business Decisions I**-Investment analysis-Capital Budgeting-NPV, IRR, Profitability Index, ARR, Payback Period (5 Hrs.)- Business decisions under certainty-uncertainty-selection of alternatives-risk and sensitivity- cost benefit analysis-resource management (4 Hrs.).	9	20%
VI	**Business Decisions II** Balance sheet preparation-principles and interpretation-forecasting techniques (7 Hrs.)-business financing-sources of capital- Capital and money markets-international financing-FDI, FPI, FII-Basic Principles of taxation-direct tax, indirect tax-GST (2 hrs.).	9	20%
END SEMESTER EXAM			

Question Paper Pattern

Max. marks: 100, Time: 3 hours

The question paper shall consist of three parts

Part A
4 questions uniformly covering modules I and II. Each question carries 10 marks
Students will have to answer any three questions out of 4 (3X10 marks =30 marks)

Part B
4 questions uniformly covering modules III and IV. Each question carries 10 marks
Students will have to answer any three questions out of 4 (3X10 marks =30 marks)

Part C
6 questions uniformly covering modules V and VI. Each question carries 10 marks
Students will have to answer any four questions out of 6 (4X10 marks =40 marks)

Note: In all parts, each question can have a maximum of four sub questions, if needed.

Course code	Course Name	L-T-P-Credits	Year of Introduction
HS210	LIFE SKILLS	2-0-2	2016

Prerequisite : Nil

Course Objectives

- To develop communication competence in prospective engineers.
- To enable them to convey thoughts and ideas with clarity and focus.
- To develop report writing skills.
- To equip them to face interview & Group Discussion.
- To inculcate critical thinking process.
- To prepare them on problem solving skills.
- To provide symbolic, verbal, and graphical interpretations of statements in a problem description.
- To understand team dynamics & effectiveness.
- To create an awareness on Engineering Ethics and Human Values.
- To instill Moral and Social Values, Loyalty and also to learn to appreciate the rights of others.
- To learn leadership qualities and practice them.

Syllabus

Communication Skill: Introduction to Communication, The Process of Communication, Barriers to Communication, Listening Skills, Writing Skills, Technical Writing, Letter Writing, Job Application, Report Writing, Non-verbal Communication and Body Language, Interview Skills, Group Discussion, Presentation Skills, Technology-based Communication.

Critical Thinking & Problem Solving: Creativity, Lateral thinking, Critical thinking, Multiple Intelligence, Problem Solving, Six thinking hats, Mind Mapping & Analytical Thinking.

Teamwork: Groups, Teams, Group Vs Teams, Team formation process, Stages of Group, Group Dynamics, Managing Team Performance & Team Conflicts.

Ethics, Moral & Professional Values: Human Values, Civic Rights, Engineering Ethics, Engineering as Social Experimentation, Environmental Ethics, Global Issues, Code of Ethics like ASME, ASCE, IEEE.

Leadership Skills: Leadership, Levels of Leadership, Making of a leader, Types of leadership, Transactions Vs Transformational Leadership, VUCA Leaders, DART Leadership, Leadership Grid & leadership Formulation.

Expected outcome

The students will be able to

- Communicate effectively.
- Make effective presentations.
- Write different types of reports.
- Face interview & group discussion.
- Critically think on a particular problem.
- Solve problems.
- Work in Group & Teams
- Handle Engineering Ethics and Human Values.
- Become an effective leader.

Resource Book:

Life Skills for Engineers, Complied by ICT Academy of Kerala, McGraw Hill Education (India) Private Ltd., 2016

References:

- Barun K. Mitra; (2011), *"Personality Development & Soft Skills*", First Edition; Oxford Publishers.
- Kalyana; (2015) "*Soft Skill for Managers*"; First Edition; Wiley Publishing Ltd.
- Larry James (2016); "*The First Book of Life Skills*"; First Edition; Embassy Books.
- Shalini Verma (2014); *"Development of Life Skills and Professional Practice"*; First Edition; Sultan Chand (G/L) & Company
- John C. Maxwell (2014); "The 5 Levels of Leadership", Centre Street, A division of Hachette Book Group Inc.

Course Plan

Module	Contents	Hours L-T-P L	P	Sem. Exam Marks
I	Need for Effective Communication, Levels of communication; Flow of communication; Use of language in communication; Communication networks; Significance of technical communication, Types of barriers; Miscommunication; Noise; Overcoming measures, Listening as an active skill; Types of Listeners; Listening for general content; Listening to fill up information; Intensive Listening; Listening for specific information; Developing effective listening skills; Barriers to effective listening skills. **Technical Writing:** Differences between technical and literary style, Elements of style; Common Errors, **Letter Writing:** Formal, informal and demi-official letters; business letters, **Job Application**: Cover letter, Differences between bio-data, CV and Resume, **Report Writing:** Basics of Report Writing; Structure of a report; Types of reports. **Non-verbal Communication and Body Language:** Forms of non-verbal communication; Interpreting body-language cues; Kinesics; Proxemics; Chronemics; Effective use of body language **Interview Skills**: Types of Interviews; Ensuring success in job interviews; Appropriate use of non-verbal communication, **Group Discussion**: Differences between group discussion and debate; Ensuring success in group discussions, **Presentation Skills**: Oral presentation and public speaking skills; business presentations, **Technology-based Communication:** Netiquettes: effective e-mail messages; power-point presentation; enhancing editing skills using computer software.	2 3	2 4 4	See evaluation scheme

II	Need for Creativity in the 21st century, Imagination, Intuition, Experience, Sources of Creativity, Lateral Thinking, Myths of creativity	2		
	Critical thinking Vs Creative thinking, Functions of Left Brain & Right brain, Convergent & Divergent Thinking, Critical reading & Multiple Intelligence.		2	
	Steps in problem solving, Problem Solving Techniques, Problem Solving through Six Thinking Hats, Mind Mapping, Forced Connections.	2		
	Problem Solving strategies, Analytical Thinking and quantitative reasoning expressed in written form, Numeric, symbolic, and graphic reasoning, Solving application problems.		2	
III	Introduction to Groups and Teams, Team Composition, Managing Team Performance, Importance of Group, Stages of Group, Group Cycle, Group thinking, getting acquainted, Clarifying expectations.	3		
	Group Problem Solving, Achieving Group Consensus.		2	
	Group Dynamics techniques, Group vs Team, Team Dynamics, Teams for enhancing productivity, Building & Managing Successful Virtual Teams. Managing Team Performance & Managing Conflict in Teams.	3		
	Working Together in Teams, Team Decision-Making, Team Culture & Power, Team Leader Development.		2	
IV	Morals, Values and Ethics, Integrity, Work Ethic, Service Learning, Civic Virtue, Respect for Others, Living Peacefully.	3		
	Caring, Sharing, Honesty, Courage, Valuing Time, Cooperation, Commitment, Empathy, Self-Confidence, Character		2	
	Spirituality, Senses of 'Engineering Ethics', variety of moral issued, Types of inquiry, moral dilemmas, moral autonomy, Kohlberg's theory, Gilligan's theory, Consensus and controversy, Models of Professional Roles, Theories about right action, Self-interest, customs and religion, application of ethical theories.	3		
	Engineering as experimentation, engineers as responsible experimenters, Codes of ethics, Balanced outlook on.	3		
	The challenger case study, Multinational corporations, Environmental ethics, computer ethics,		2	

	Weapons development, engineers as managers, consulting engineers, engineers as expert witnesses and advisors, moral leadership, sample code of Ethics like ASME, ASCE, IEEE, Institution of Engineers(India), Indian Institute of Materials Management, Institution of electronics and telecommunication engineers(IETE), India, etc.	3		
V	Introduction, a framework for considering leadership, entrepreneurial and moral leadership, vision, people selection and development, cultural dimensions of leadership, style, followers, crises. Growing as a leader, turnaround leadership, gaining control, trust, managing diverse stakeholders, crisis management Implications of national culture and multicultural leadership Types of Leadership, Leadership Traits. Leadership Styles, VUCA Leadership, DART Leadership, Transactional vs Transformational Leaders, Leadership Grid, Effective Leaders, making of a Leader, Formulate Leadership	4 2 2	 2 2	
END SEMESTER EXAM				

EVALUATION SCHEME

Internal Evaluation

(Conducted by the College)

Total Marks: 100

Part – A

(To be started after completion of Module 1 and to be completed by 30th working day of the semester)

1. Group Discussion – Create groups of about 10 students each and engage them on a GD on a suitable topic for about 20 minutes. Parameters to be used for evaluation is as follows;

(i) Communication Skills – 10 marks
(ii) Subject Clarity – 10 marks
(iii) Group Dynamics - 10 marks
(iv) Behaviors & Mannerisms - 10 marks

(Marks: 40)

Part – B

(To be started from 31st working day and to be completed before 60th working day of the semester)

2. Presentation Skills – Identify a suitable topic and ask the students to prepare a presentation (preferably a power point presentation) for about 10 minutes. Parameters to be used for evaluation is as follows;

(i)	Communication Skills*	-	10 marks
(ii)	Platform Skills**	-	10 marks
(iii)	Subject Clarity/Knowledge	-	10 marks

(Marks: 30)

* Language fluency, auditability, voice modulation, rate of speech, listening, summarizes key learnings etc.

** Postures/Gestures, Smiles/Expressions, Movements, usage of floor area etc.

Part – C

(To be conducted before the termination of semester)

3. Sample Letter writing or report writing following the guidelines and procedures. Parameters to be used for evaluation is as follows;

(i)	Usage of English & Grammar	-	10 marks
(ii)	Following the format	-	10 marks
(iii)	Content clarity	-	10 marks

(Marks: 30)

External Evaluation

(Conducted by the University)

Total Marks: 50 Time: 2 hrs.

Part – A

Short Answer questions

There will be one question from each area (five questions in total). Each question should be written in about maximum of 400 words. Parameters to be used for evaluation are as follows;

(i) Content Clarity/Subject Knowledge
(ii) Presentation style
(iii) Organization of content

(Marks: 5 x 6 = 30)

Part – B

Case Study

The students will be given a case study with questions at the end the students have to analyze the case and answer the question at the end. Parameters to be used for evaluation are as follows;

(i) Analyze the case situation
(ii) Key players/characters of the case
(iii) Identification of the problem (both major & minor if exists)
(iv) Bring out alternatives
(v) Analyze each alternative against the problem
(vi) Choose the best alternative
(vii) Implement as solution
(viii) Conclusion
(ix) Answer the question at the end of the case

(Marks: 1 x 20 = 20)

Course code	Course Name	L-T-P - Credits	Year of Introduction
HS300	Principles of Management	3-0-0-3	2016

Prerequisite : Nil

Course Objectives

- To develop ability to critically analyse and evaluate a variety of management practices in the contemporary context;
- To understand and apply a variety of management and organisational theories in practice;
- To be able to mirror existing practices or to generate their own innovative management competencies, required for today's complex and global workplace;
- To be able to critically reflect on ethical theories and social responsibility ideologies to create sustainable organisations.

Syllabus

Definition, roles and functions of a manager, management and its science and art perspectives, management challenges and the concepts like, competitive advantage, entrepreneurship and innovation. Early contributors and their contributions to the field of management. Corporate Social Responsibility. Planning, Organizing, Staffing and HRD functions, Leading and Controlling. Decision making under certainty, uncertainty and risk, creative process and innovation involved in decision making.

Expected outcome.

A student who has undergone this course would be able to

i. manage people and organisations
ii. critically analyse and evaluate management theories and practices
iii. plan and make decisions for organisations
iv. do staffing and related HRD functions

Text Book:

Harold Koontz and Heinz Weihrich, *Essentials of Management*, McGraw Hill Companies, 10th Edition.

References:

1. Daft, *New era Management*, 11th Edition, Cengage Learning
2. Griffin, *Management Principles and Applications*, 10th Edition, Cengage Learning
3. Heinz Weirich, Mark V Cannice and Harold Koontz, *Management: a Global, Innovative and Entrepreneurial Perspective*, McGraw Hill Education, 14th Edition
4. Peter F Drucker, *The Practice of Management*, McGraw Hill, New York
5. Robbins and Coulter, *Management*, 13th Edition, 2016, Pearson Education

Course Plan

Module	Contents	Hours	Sem. Exam Marks
I	Introduction to Management: definitions, managerial roles and functions; Science or Art perspectives- External environment-global, innovative and entrepreneurial perspectives of Management (3 Hrs.)– Managing people and organizations in the context of New Era- Managing for competitive advantage - the Challenges of Management (3 Hrs.)	6	15%

II	**Early Contributions and Ethics in Management**: Scientific Management- contributions of Taylor, Gilbreths, Human Relations approach-contributions of Mayo, McGregor's Theory, Ouchi's Theory Z (3 Hrs.) Systems Approach, the Contingency Approach, the Mckinsey 7-S Framework Corporate Social responsibility- Managerial Ethics. (3 Hrs)	6	15%
FIRST INTERNAL EXAMINATION			
III	**Planning:** Nature and importance of planning, -types of plans (3 Hrs.)- Steps in planning, Levels of planning - The Planning Process. – MBO (3 Hrs.).	6	15%
IV	**Organising for decision making:** Nature of organizing, organization levels and span of control in management Organisational design and structure –departmentation, line and staff concepts (3 Hrs.) Limitations of decision making- Evaluation and selecting from alternatives- programmed and non programmed decisions - decision under certainty, uncertainty and risk-creative process and innovation (3 Hrs.)	6	15%
SECOND INTERNAL EXAMINATION			
V	**Staffing and related HRD Functions:** definition, Empowerment, staff – delegation, decentralization and recentralisation of authority – Effective Organizing and culture-responsive organizations –Global and entrepreneurial organizing (3 Hrs.) Manager inventory chart-matching person with the job-system approach to selection (3 Hrs.) Job design-skills and personal characteristics needed in managers-selection process, techniques and instruments (3 Hrs.)	9	20%
VI	**Leading and Controlling:** Leading Vs Managing – Trait approach and Contingency approaches to leadership - Dimensions of Leadership (3 Hrs.) - Leadership Behavior and styles – Transactional and Transformational Leadership (3 Hrs.) Basic control process- control as a feedback system – Feed Forward Control – Requirements for effective control – control techniques – Overall controls and preventive controls – Global controlling (3 Hrs.)	9	20%
END SEMESTER EXAM			

Question Paper Pattern

Max. marks: 100, Time: 3 hours .
The question paper shall consist of three parts

Part A: 4 questions uniformly covering modules I and II. Each question carries 10 marks
Students will have to answer any three questions out of 4 (3X10 marks =30 marks)
Part B : 4 questions uniformly covering modules III and IV. Each question carries 10 marks
Students will have to answer any three questions out of 4 (3X10 marks =30 marks)
Part C: 6 questions uniformly covering modules V and VI. Each question carries 10 marks
Students will have to answer any four questions out of 6 (4X10 marks =40 marks)

Note: In all parts, each question can have a maximum of four sub questions, if needed.

Course code	Course Name	L-T-P - Credits	Year of Introduction
**341	DESIGN PROJECT	0-1-2-2	2016

Prerequisite : Nil

Course Objectives

- To understand the engineering aspects of design with reference to simple products
- To foster innovation in design of products, processes or systems
- To develop design that add value to products and solve technical problems

Course Plan

Study : Take minimum three simple products, processes or techniques in the area of specialisation, study, analyse and present them. The analysis shall be focused on functionality, strength, material, manufacture/construction, quality, reliability, aesthetics, ergonomics, safety, maintenance, handling, sustainability, cost etc. whichever are applicable. Each student in the group has to present individually; choosing different products, processes or techniques.

Design: The project team shall identify an innovative product, process or technology and proceed with detailed design. At the end, the team has to document it properly and present and defend it. The design is expected to concentrate on functionality, design for strength is not expected.

Note : The one hour/week allotted for tutorial shall be used for discussions and presentations. The project team (not exceeding four) can be students from different branches, if the design problem is multidisciplinary.

Expected outcome.

The students will be able to

i. Think innovatively on the development of components, products, processes or technologies in the engineering field
ii. Analyse the problem requirements and arrive workable design solutions

Reference:

Michael Luchs, Scott Swan, Abbie Griffin, 2015. Design Thinking. 405 pages, John Wiley & Sons, Inc

Evaluation

First evaluation (Immediately after first internal examination) 20 marks
Second evaluation (Immediately after second internal examination) 20 marks
Final evaluation (Last week of the semester) 60 marks

Note: All the three evaluations are mandatory for course completion and for awarding the final grade.

Course code	Course Name	L-T-P - Credits	Year of Introduction
**352	Comprehensive Examination	0-1-1-2	2016
Prerequisite : Nil			

Course Objectives

- To assess the comprehensive knowledge gained in basic courses relevant to the branch of study
- To comprehend the questions asked and answer them with confidence.

Assessment

Oral examination – To be conducted by the college (@ three students/hour) covering all the courses up to and including V semester– 50 marks

Written examination - To be conducted by the Dept. on the date announced by the University– common to all students of the same branch – objective type (1 hour duration)– 50 multiple choice questions (4 choices) of 1 mark each covering the six common courses of S1&S2 and six branch specific courses listed – questions are set by the University - no negative marks – 50 marks.

Note: Both oral and written examinations are mandatory. But separate minimum marks is not insisted for pass. If a students does not complete any of the two assessments, grade I shall be awarded and the final grade shall be given only after the completion of both the assessments.

The two hours allotted for the course may be used by the students for discussion, practice and for oral assessment.

Expected outcome.

- The students will be confident in discussing the fundamental aspects of any engineering problem/situation and give answers in dealing with them

Course code	Course Name	L-T-P - Credits	Year of Introduction
**451	Seminar and Project Preliminary	0-1-4-2	2016
Prerequisite : Nil			

Course Objectives

- To develop skills in doing literature survey, technical presentation and report preparation.
- To enable project identification and execution of preliminary works on final semester project

Course Plan

Seminar: Each student shall identify a topic of current relevance in his/her branch of engineering, get approval of faculty concerned, collect sufficient literature on the topic, study it thoroughly, prepare own report and present in the class.

Project preliminary:

Identify suitable project relevant to the branch of study. Form project team (not exceeding four students). The students can do the project individually also. Identify a project supervisor. Present the project proposal before the assessment board (excluding the external expert) and get it approved by the board.

The preliminary work to be completed: (1) Literature survey (2) Formulation of objectives (3) Formulation of hypothesis/design/methodology (4) Formulation of work plan (5) Seeking funds (6) Preparation of preliminary report

Note: The same project should be continued in the eighth semester by the same project team.

Expected outcome.

The students will be able to

i. Analyse a current topic of professional interest and present it before an audience
ii. Identify an engineering problem, analyse it and propose a work plan to solve it.

Evaluation

Seminar : **50 marks**

(Distribution of marks for the seminar is as follows: i. Presentation : 40% ii. Ability to answer questions : 30% & iii. Report : 30%)

Project preliminary : **50 marks**(Progress evaluation by the supervisor : 40% and progress evaluation by the assessment board excluding external expert : 60%. Two progress evaluations, mid semester and end semester, are mandatory.)

Note: All evaluations are mandatory for course completion and for awarding the final grade.

Course code	Course Name	Credits	Year of Introduction
**492	PROJECT	6	2016

Prerequisite : Nil

Course Objectives

- To apply engineering knowledge in practical problem solving
- To foster innovation in design of products, processes or systems
- To develop creative thinking in finding viable solutions to engineering problems

Course Plan

In depth study of the topic assigned in the light of the preliminary report prepared in the seventh semester
Review and finalization of the approach to the problem relating to the assigned topic
Preparing a detailed action plan for conducting the investigation, including team work
Detailed Analysis/Modelling/Simulation/Design/Problem Solving/Experiment as needed
Final development of product/process, testing, results, conclusions and future directions
Preparing a paper for Conference presentation/Publication in Journals, if possible
Preparing a report in the standard format for being evaluated by the dept. assessment board
Final project presentation and viva voce by the assessment board including external expert

Expected outcome

The students will be able to

iii. Think innovatively on the development of components, products, processes or technologies in the engineering field
iv. Apply knowledge gained in solving real life engineering problems

Evaluation

Maximum Marks : 100

(i) Two progress assessments	20% by the faculty supervisor(s)
(ii) Final project report	30% by the assessment board
(iii) Project presentation and viva voce	50% by the assessment board

Note: All the three evaluations are mandatory for course completion and for awarding the final grade.