UNIVERSITY OF SARGODHA, SARGODHA

NOTIFICATION

No. UOS/Acad/813 Dated: 3/.10.2013

On the recommendation of Board of Studies, the Syndicate in its 6/2013 meeting held on 24.10.2013 has approved the revised curricula of BS(CS), BS(IT), BS(SE), MSc(IT) and MS(CS) for implementation at University of Sargodha (main campus), sub-campuses and Affiliated Colleges w.e.f Fall Semester, 2013 (academic session 2013-14). Copies of approved curricula are available at annexure A, B, C, D & E respectively.

(Ch. FAROOQ AHMAD)
Assistant Registrar (Acad)
for Registrar

Distribution:

1. Chairman, Department of Computer Science & IT
2. Controller of Examinations
3. Directors, Sub-Campuses
4. Chief Executive of Sub-Campuses
5. All Affiliated Colleges
6. Notification File
7. Web developer (for uploading on University Website)

CC:

- Secretary to Vice-Chancellor
- P.A to Registrar

Revised Curriculum of BS Computer Science for Main Campus, Sub Campuses, and Affiliated Colleges

Department of Computer Science & Information Technology

University of Sargodha

(Applicable from Fall 2013)

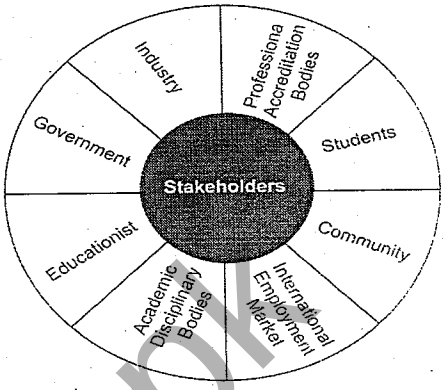
Table of Contents

Guidelines for Affiliated Colleges

- BSCS program shall be offered under Term System observing University of Sargodha's Affiliation Rules & Regulations.
- There shall be two terms in a calendar academic year.
- The affiliated college(s)/institutions shall follow the approved curriculum and course matrix. Necessary modification/changes shall be communicated to the affiliated Colleges/Institutions, if any.
- For specialization elective courses, the affiliated institution(s)/college(s) shall follow "Regular Track". However, the administration of any affiliated institution must get prior permission from the competent authority to offer any specialization tracks from the approved curriculum. For this purpose, the institution's administration needs to show/demonstrate the availability of appropriate human resource along with necessary educational provisions before the start of the term in which specialization track shall be offered. The recommendations of the Convener BOS shall be solicited to make the recommendations for the Institution to offer the requested specialization track already approved by the BOS. The competent authority shall give the final approval.

Underlying Principles of Computer Science Degree Programs

Curriculum plays an important role within education as it outlines the planned and structured learning experiences that an academic program provides. For an effective academic program the curriculum must meet the needs of the stakeholders and face the emerging challenges. The Department of CS & IT (UOS) realizes the rapidly changing needs of today's knowledge intensive technology driven complex work places and the changing patterns of 21st century universities' education which have removed the identity of place, the identity of time, the identity of the scholarly community, and the identity of the student community. To meet these challenges, the Department has revised the existing curriculum. The revised curriculum is based on following underlying principles:



i. The curriculum should be a broad based and provides students with the flexibility to work across many disciplines & professions.
ii. The curriculum should prepare graduates to succeed in a rapidly changing field.
iii. The curriculum should provide guidance for the expected level of mastery of topics by graduates.
iv. Should provide realistic, adoptable recommendations that provide guidance and flexibility, allowing curricular designs that are innovative and track recent developments in the field.
v. The curriculum contents should be relevant and compatible with a variety of institutions.
vi. The size of the essential knowledge must be managed.
vii. The curriculum should identify the fundamental skills and knowledge that all graduates should possess.
viii. The curriculum should provide the greatest flexibility in organizing topics into courses and curricula.

The revised curriculum has developed using top-down curriculum development approach. It has adopted a balanced and multidisciplinary approach and presents a blend of study areas which spread across the boundaries of fundamental knowledge of traditional disciplines to advanced knowledge of the emerging disciplines. Body of knowledge (BOK) of CS program covers knowledge areas which are required for the program's accreditation from the Accreditation Council and knowledge area which are required for professional certification and professional development.

It is universally accepted that each profession needs both a specific skill set and an appropriate mindset. Developing an appropriate mindset of the prospective computing graduates requires a body of knowledge which enriches students' experiences, thoughts, beliefs, assumptions, and attitudes about the special characteristics of that specific domain. Therefore, the course contents and related practical experiences are designed to meet the professional requirements of the respective domain. For this the revised curriculum mainly focuses on following six (6) key areas:

i. Knowledge: Theoretical learning of concepts and principles regarding a particular subject(s).
ii. Skills: Capability of using learnt knowledge and applying it according to the context
iii. Competencies: The ability to do things satisfactory- not necessarily outstandingly or even well, but rather to a minimum level of acceptable performance.
iv. Expertise: Level of proficiency and innovative ways of applying learnt knowledge. (Competitive edge)
v. Dispositions: Habits of mind or tendencies to respond to certain situations in certain ways. The role of dispositions in computing education is very important. For example, having the disposition to be a programmer is much better that just having programming skills.
vi. Values: Moral, ethical and professional practices.

To strengthen the curriculum further, specialization tracks have also been integrated within the curriculum's BOK. These specialization tracks are designed according to what the industry is looking for in an employee and the learning interests of students. Furthermore, life skills including desired dispositions, soft skills, public speaking, critical thinking & reasoning, 21st Century literacies, personal attributes, entrepreneurship, attitude towards lifelong learning, professional practices and other social skills have not considered discrete items, rather threaded into the entire fabric of the curriculum.

Curriculum
for
BS Computer Science Program

BSCS Program'sRationale

Computer Science is the systematic study of the feasibility, structure, expression, and mechanization of the methodical processes (or algorithms) that underlie the acquisition, representation, processing, storage, communication of, and access to information, whether such information is encoded in bits and bytes in a computer memory or transcribed in genes and protein structures in a human cell.

Computer Science spans a wide range, from its theoretical and algorithmic foundations to cutting-edge developments in robotics, computer vision, intelligent systems, bioinformatics, image processing, computational biology, computational lenses, and other exciting areas. Computer scientists develop new programming approaches for software development, devise new ways to use computers and develop effective ways to solve computing problems. While other disciplines produce graduates with more immediately relevant job-related skills, computer science offers a comprehensive foundation for research and innovation.

Recent developments in computer hardware, software and communication technologies have offered new exciting opportunities and challenges for creation of innovative learning environments for Computer Science and its curricula design. The challenge of getting all newly emerging technologies incorporated into the curriculum is becoming pivotal for the effectiveness of curricula. There is a need for curricula structures that are really able to meet the challenges of 21st century knowledge driven complex work places. The key rationale behind the BS Computer Science program is to prepare a curriculum that provide integration of all components and the foundations that allow accessing all of the new knowledge and technology to fulfill the vision of future.

Program's Aims &Objectives

BSCS Program is committed to create, expand, disseminate and teach the computer science body of knowledge through academics, applications and research which positively impact society locally, nationally, and internationally.

BSCS program aims to develop students' critical professional thinking and intuition. The program's curriculum provides a balanced mixture of learning experiences to make the graduates capable of sound professional decisions. As a result, the successful graduates will be able to assume responsible positions in business, government, and education at the research, development, and planning levels. The program also provides an excellent foundation for further formal learning and training. The program is also expected to provide environments to put into practice, the principles and techniques learnt during the course of implementation of the program's curriculum. Some of the key objectives of the program are listed below:

- The program should provide a broad understanding of the field through introducing concepts, theory, techniques, and through intensive education/training in focused areas of

Computer Science.

- The program should encourage students to develop and use abstract models in addition to apply respective technology in practical situations.
- The program should promote students' special communication skills both orally and in writing. They must be able to produce well-organized reports/presentations/projects, which clearly delineate objectives, methods of solution, results, and conclusions for a complex task.
- The program should provide formal foundations for higher learning and education.
- The program should be dynamic and flexible enough to maintain its body of knowledge in line with the latest scientific and technological developments in the field.
- The program should provide professional orientation to prepare students for industry.

Program's Outcome

The program will produce Computer Scientists of great character, competence, vision and driveequipped with up-to-date knowledge, marketable skills, valuable competencies, unique expertise, globally compatible dispositions and culturally and professionally acceptable values to take on appropriate professional roles in computer science domain or proceed to further or higher education or training.

Program's Structure

The structure of a BS Computer Science program meets the needs of students with formal computing experience and relevant skills. The students are expected to learn theoretical and practical understanding of the entire field of Computer Science. The program structure is dynamic and provides basis for various options including Breadth-Based, Depth-Based, and Integrated Breadth & Depth-Based specializations. Student may choose a particular option, which is the most appropriate to their planned future career. Followings are the program's details:

Specialization Tracks

Students can opt one of the following specialization tracks:

1. Regular Track
2. Computer Science
3. Web Engineering
4. Database Management Systems
5. Software Engineering
6. Computer Network

Degree Requirement

Minimum credit hours shall be 138 for BS Computer Science program including elective courses& a Capstone Project.

Duration

The program shall comprise Eight (8) Semesters/Terms spread over Four (4) calendar years with two Semesters/Terms a year as per rules of the University.

Eligibility Criteria

Minimum 2nd division or equivalent in Intermediate or equivalent qualification with mathematics.

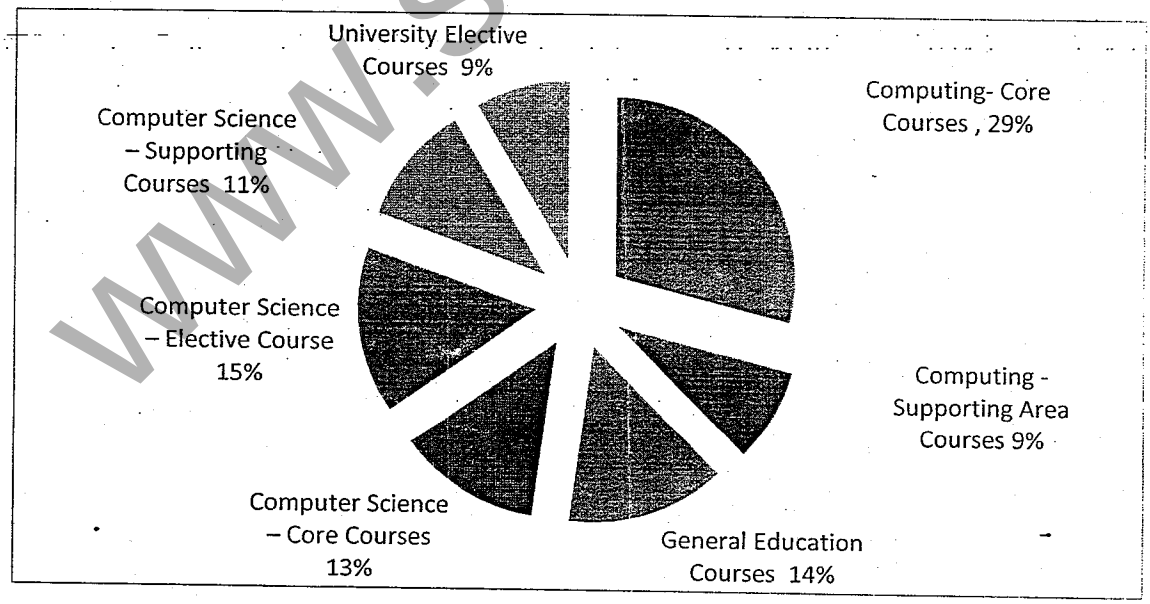
Assessment& Evaluation

University's semester and examination rules & regulations shall be followed for assessment & evaluation.

Distribution of Courses

Followings are the distribution of total credit hours:

Distribution of Courses		
Major Areas	**Credit Hours**	%
Computing- Core Courses	40	29%
Computing - Supporting Area Courses	12	9%
General Education Courses	20	14%
Computer Science – Core Courses	18	13%
Computer Science – Elective Course	21	15%
Computer Science – Supporting Courses	15	11%
University Elective Courses	12	9%
Total	**138**	**100%**



Computing Core Courses – 40Credit Hours				
#	Code	Pre-Req	Course Title	Cr. Hrs.
1	CMP-2122	-	Programming Fundamentals	4 (3+1)
2	CMP-2124	CMP-2122	Object Oriented Programming	4 (3+1)
3	CMP-2111	-	Discrete Structures	3 (3+0)
4	CMP-3113	CMP-2124	Data Structures and Algorithms	3 (3+0)
5	CMP-2210	-	Digital Logic Design	3 (3+0)
6	CMP-3621	-	Operating Systems	4 (3+1)
7	CMP-3450	-	Database Systems	4 (3+1)
8	CMP-3310	-	Software Engineering	3 (3+0)
9	CMP-2540	-	Computer Communication and Networks	3 (3+0)
10	CMP-3711	-	Human Computer Interaction	3 (3+0)
11	CMP-4970	-	Capstone Project	6 (0+6)

Computing Supporting Area Elective Courses - 12 Credit Hours				
#	Code	Pre-Req	Course Title	Cr. Hrs.
12	MATH-2213	-	Calculus and Analytical Geometry	3 (3+0)
13	MATH-2110	-	Probability and Statistics	3 (3+0)
14	MATH-3215	-	Linear Algebra	3 (3+0)
15	PHY-2210	-	Basic Electronics	3 (3+0)

General Education Courses – 20 Credit Hours				
#	Code	Pre-Req	Course Title	Cr. Hrs.
16	ENG-2411	-	Functional English (English-I)	3 (3+0)
17	ENG-2412	-	Communication Skills (English-II)	3 (3+0)
18	ENG-2413	-	Technical and Business Writing (English-III)	3 (3+0)
19	SS-2311	-	Islamic Studies/Ethics	2 (2+0)
20	SS-2312	-	Pakistan Studies	2 (2+0)
21	ICT-2021	-	Introduction to Information & Communication Technologies	4(3+1)
22	SS-4910	-	Professional Practices	3 (3+0)

University Elective Courses – 12 Credit Hours				
#	Code	Pre-Req	Course Title	Cr. Hrs.
23	MNG-2210	-	Financial Accounting	3 (3+0)
24	MNG-2212	-	Principles of Management	3 (3+0)
25	SS-2410	-	Principles of Psychology	3 (3+0)
26	SS-2511	-	Principles of Philosophy	3(3+0)
27	SS-2XXX	-	Foreign/Regional Language (French, German, Sindhi, Punjabi etc.)	3 (3+0)

28	CS-4931	-	Operations Research	3 (3+0)
29	SE-4349	CMP-3310	Software Project Management	3 (3+0)

Computer Science – Core Courses - 18 Credit Hours				
#	Code	Pre-Req	Course Title	Cr. Hrs.
30	CS-3210	CMP-2210	Computer Organization and Assembly Language	3 (3+0)
31	CS-3131	CMP-2111	Theory of Automata & Formal Languages	3 (3+0)
32	CS-3143	CMP-2111	Design and Analysis of Algorithms	3 (3+0)
33	CS-3811	CMP-2111	Artificial Intelligence	3 (3+0)
34	CS-4240	CS-3210	Computer Architecture & Organization	3 (3+0)
35	CS-4141	CS-3131	Compiler Construction	3 (3+0)

Computer Science Supporting Courses - 15 Credit Hours				
#	Code	Pre-Req	Course Title	Cr. Hrs.
36	MATH-2214	-	Multivariable Calculus	3 (3+0)
37	MATH-2215	-	Differential Equations	3 (3+0)
38	CS-3941	-	Numerical Computing	3 (3+0)
39	SE-3311	CMP-2124	Object Oriented Analysis and Design	3 (3+0)
40	CS-3513	CMP-2540	Internet Architecture and Protocols	3 (3+0)

BS Computer Science Specialization Tracks

Regular Track Elective Courses (21 Credit Hours - Any 7 Courses)				
41	CS-3743	-	Multimedia Systems and Design	3(3+0)
42	CS-3548	CMP-2122	Web Systems and Technologies	3(3+0)
43	CS-4745	CS-3548	Enterprise Application Development	3(3+0)
44	CS-4548	CMP-2124	Mobile Application Development	3(3+0)
45	CS-4746	CMP-3310	E-Commerce Applications Development	3(3+0)
46	CS-4544	CMP-3621	Cloud Computing	3(3+0)
47	CS-4863	CS-3143	Principles of Soft Computing	3(3+0)
48	CS-4140	CS-3131	Theory of Programming Languages	3(3+0)

Computer Science Specialization Elective Courses (21 Credit Hours - Any 7 Courses)				
49	CS-3743	-	Multimedia Systems and Design	3(3+0)
50	CS-3548	CMP-2122	Web Systems and Technologies	3(3+0)
51	CS-4745	CS-3548	Enterprise Application Development	3(3+0)
52	CS-4140	CS-3131	Theory of Programming Languages	3(3+0)
53	CS-4711	CS-3143	Computer Graphics	3(3+0)
54	CS-4863	CS-3143	Principles of Soft Computing	3(3+0)
55	CS-4812	-	Artificial Neural Networks	3(3+0)
56	CS-3641	CMP-2122	System Programming	3(3+0)

Multimedia Systems & Game Development Specialization Elective Courses (21 Credit Hours - Any 7 Courses)				
57	CS-3743	-	Multimedia Systems and Design	3(3+0)
58	CS-3548	CMP-2122	Web Systems and Technologies	3(3+0)
59	CS-4745	CS-3548	Enterprise Application Development	3(3+0)
60	CS-4711	CS-3143 MATH-3215	Computer Graphics	3(3+0)
61	CS-4742	-	3D Modeling & Animation	3(3+0)
62	CS-4548	CMP-2124	Mobile Application Development	3(3+0)
63	CS-4741	CMP-3113	Computer Game Development	3(3+0)

Web Engineering Specialization Elective Courses (21 Credit Hours - Any 7 Courses)				
64	CS-3548	CMP-2122	Web Systems and Technologies	3(3+0)
65	CS-4745	CS-3548	Enterprise Application Development	3(3+0)
66	CS-3743	-	Multimedia Systems and Design	3(3+0)
67	CS-4746	CMP-3310	E-Commerce Applications Development	3(3+0)
68	CS-4544	CMP-3621	Cloud Computing	3(3+0)
69	CS-4548	CMP-2124	Mobile Application Development	3(3+0)
70	CS-4513	CS-3548	Web Engineering	3(3+0)
71	CS-4545	CS-3548	Mobile Computing	3(3+0)

Database Management Systems Specialization Elective Courses (21 Credit Hours - Any 7 Courses)				
72	CS-3548	CMP-2122	Web Systems and Technologies	3(3+0)
73	CS-3743	-	Multimedia Systems and Design	3(3+0)
74	CS-3441	CMP-3450	Database Administration & Management	3(3+0)
75	CS-4441	CMP-3450	Data Warehousing	3(3+0)
76	CS-4442	CMP-3450	Data Mining	3(3+0)
77	CS-4461	CMP-3450	Enterprise Resource Planning Systems	3(3+0)
78	CS-4443	CS-4441	Business Intelligence and Analytics	3(3+0)
79	CS-4444	CS-3450	Advance Database Management	3(3+0)

Software Engineering Specialization Elective Courses (21 Credit Hours - Any 7 Courses)				
80	CS-3548	CMP-2122	Web Systems and Technologies	3(3+0)
81	CS-4745	CS-3548	Enterprise Application Development	3(3+0)
82	CS-3743	-	Multimedia Systems and Design	3(3+0)
83	SE-3342	CMP-3310	Software Requirement Engineering	3(3+0)
84	SE-4343	SE-3342	Software Design and Architecture	3(3+0)
85	SE-4341	CMP-3310	Software Quality Engineering	3(3+0)
86	SE-4342	CMP-3310	Software Engineering Economics	3(3+0)
87	SE-4344	CMP-3310	System Integration and Architecture	3(3+0)
88	SE-4345	CMP-3310	Design Patterns	3(3+0)

Networking Specialization Elective Courses(21 Credit Hours - Any 7 Courses)				
89	CS-4541	CS-4511	Data & Network Security	3(3+0)
90	CS-3541	CMP-2540	Network Design and Management	3(3+0)
91	CS-4543	CS-3513	Mobile and Wireless Networks	3(3+0)
92	CS-4511	CMP-2540	System and Network Administration	3(3+0)
93	CS-3542	CMP-2122	Network Programming	3(3+0)
94	CS-4544	CMP-3621	Cloud Computing	3(3+0)
95	CS-4461	CMP-3450	Enterprise Resource Planning Systems	3(3+0)
96	CS-3548	CMP-2122	Web Systems and Technologies	3(3+0)
97	CS-4561	CMP-2540	Information Security	3 (3+0)

Course Coding Scheme

Scheme for Course Code				
Discipline Code	Course Level	Course Category	Course Type	Course Number
2-4 Letters	1 Digit	1 Digit	1 Digit	1 Digits
XX - XXXX	0-9	0-9	0-9	0-9

Course Level		
Level	**Degree**	**Course Type**
1	**Under-Graduate**	Non-Credited Courses
2		Foundation + Core Level 1 Courses
3		Core Level 2 + Specialization Level 1
4		Specialization Level 2
5	**Graduate (MS/M.PHIL)**	Core + Specialization Level 1
6		Specialization Level 2
7	**PHD**	Specified
8		Specified

Course Type	
0	General
1	Theory Breadth
2	Theory + Practical (Breadth)
3	Multidisciplinary (Breadth)
4	Theory Depth
5	Theory + Practical (Depth)
6	Multidisciplinary (Depth)
7	Practical
8	Seminar
9	Research

Discipline Code	
CMP	Computing
CS	Computer Science
IT	Information Technology
SE	Software Engineering
SS	Social Studies
ENG	English
MATH	Mathematics
MNG	Management
PHY	Physics

Course Categories		
0	**Introductory & General Courses**	
1	**Programming Fundamentals & Programming Languages , Discrete Structures, Algorithms and Complexity**	
		Programming Languages
		Discrete Structures
		Algorithms and Complexity
2	**Architecture and Organization**	
		Architecture and Organization
3	**Software Engineering (SE)**	
		Software Development Fundamentals
		Software Engineering
		Systems Fundamentals
4	**Information Systems**	
		Information Management
		Information Assurance and Security
5	**Net-Centric Computing (NC)**	
		Networking and Communications
		Parallel and Distributed Computing
		Technology Infrastructure
		Platform-based Development
6	**Operating Systems (OS)**	
		Operating Systems
7	**Human-Computer Interaction, Graphics and Visual Computing (GV)**	
		Human-Computer Interaction
		Graphics and Visual Computing
8	**Intelligent Systems (IS)**	
		Intelligent Systems
9	**Computational Science , Capstone Project& Professional Issues(CN)**	
		Social Issues and Professional Issues
		Computational Science

ıdies for BS Computer Science Program

(For Regular Track)

ster 3 r. Hrs.)	Semester 4 (18 Cr. Hrs.)	Semester 5 (19 Cr. Hrs.)	Semester 6 (18 Cr. Hrs.)	Semester 7 (15Cr. Hrs.)	Semester 8 (12 Cr. Hrs.)
CMP-2122 4(3+1) Programming Fundamentals* 17	CMP-2124 4(3+1) Object Oriented Programming* 18-	CMP-3113 3(3+0) Data Structures and Algorithms* 21	CS-3143 3 (3+0) ^^ Design and Analysis of Algorithms 58	CS-3131 3 (3+0) ^^ Theory of Automata & Formal Languages 66	CS-4140 3 (3+0) Theory of Programming Languages **** 80	CMP-4970 3 (0+3) Capstone Project I * 31-	CMP-4970 3 (0+3) Capstone Project II* 31-
MATH-2213 3 (3+0) Calculus and Analytical Geometry** 32	MATH-2214 3 (3+0) ^^^Multivariable Calculus 63-	MATH-2215 3 (3+0) ^^^Differential Equations 64-	MATH-3215 3 (3+0) Linear Algebra** 35	CS-3941 3 (3+0) ^^^Numerical Computing 66-	CS-3811 3 (3+0) ^^ Artificial Intelligence 59	CS-4744 3 (3+0) Enterprise Application Development **** 73	CS-4544 3 (3+0) Cloud Computing 77
PHY-2210 3(3+0) Basic Electronics** 36-	CMP-2210 3(3+0) Digital Logic Design* 22	CS-3210 3 (3+0) ^^ Computer Organization and Assembly Language 55	CS-4240 3 (3+0) ^^ Computer Architecture 60	CMP-3521 4(3+1) Operating Systems* 24-	CMP-3711 3 (3+0) Human Computer Interaction* 30-	CS-4746 3 (3+0) E-Commerce Applications Development **** 76-	SS-4910 3 (3+0) Professional Practices*** 46-
SS-2311 2(2+0) Islamic Studies*** 42-	MATH-2110 3 (3+0) Probability and Statistics** 32-	CMP-2540 3 (3+0) Computer Communication and Networks* 28	CMP-3310 3 (3+0) Software Engineering* 27	SE-3311 3 (3+0) ^^^Object Oriented Analysis & Design 68	MNG-2212 3 (3+0) ^ Principles of Management 48	SE-4319 3 (3+0) ^ Software Project Management 53	CS-4547 3 (3+0) Mobile Application Development 74
ENG-2411 3 (3+0) Functional English *** 38-	ENG-2412 3 (3+0) Communication Skills*** 39-	ENG-2413 3 (3+0) Technical and Report Writing*** 42-	SS-2312 2 (2+0) Pakistan Studies ** Last.	SS-2511 3 (3+0) ^ Principles of Philosophy 50	CS-3743 3 (3+0) 71 Multimedia Systems and Design****	CS-4141 3 (3+0) ^^ Compiler Construction 62	
ICT-2021 4(3+1) Introduction to ICT*** 44-	CMP-2111 3 (3+0) Discrete Structures* 20	MNG-2210 3 (3+0) ^ Financial Accounting 47.	CMP-3450 4(3+1) Database Systems* 25	CS-3513 3 (3+0) ^^^Internet Architecture & Protocols 70	CS-3548 3 (3+0) Web Systems and Technologies **** 72		

* Computing Core Courses
** Computing Supporting Area Elective Courses
***General Education Courses
^ University Elective Courses
^^ Computer Science – Core Courses
^^^Computer Science Supporting Courses
**** Specialization Elective Courses

Course Contents for BS Computer Science

Contents of Computing Core Courses

1st Semester -

Course Title: Programming Fundamentals

Course Code: CMP-2122
Course Structure: Lectures: 3 / Labs: 1
Credit Hours: 4
Prerequisites: None

Course Objectives:
The course is designed to familiarize students with the basic structured programming skills. It emphasizes upon problem analysis, algorithm designing, and program development and testing.

Course Syllabus:
Overview of Computer Programming.Principles of Structured and Modular Programming.Overview of Structured Programming Languages.Algorithms and Problem Solving. Program Development: Analyzing Problem, Designing Algorithm/Solution, Testing Designed Solution. Translating Algorithms into Programs.Fundamental Programming Constructs.Data Types.Basics of Input and Output.Selection and Decision (If, If-Else, Nested If-Else, Switch Statement and Condition Operator). Repetition (While and For Loop, Do-While Loops), Break Statement, Continues Statement. Control Structures. Functions.Arrays.Pointers.Records.Files. Testing & Debugging.

Course Outline:

1. Overview of Computer Programming: Machine Languages, Assembly Languages and High-Level Languages, History of C, C Standard Library, Typical C Program Development Environment, Memory Concepts, Arithmetic in C, Decision Making: Equality and Relational Operators. [Ch. 1,2]
2. Principles of Structured and Modular Programming: Algorithms, Pseudocode, Control Structures, The if Selection Statement, The if...else Selection Statement, The while Repetition Statement, Sentinel-Controlled Repetition, Nested Control Structures. Assignment Operators, Increment and Decrement Operators. [Ch. 3]
3. Program Control:Repetition Essentials, Counter-Controlled Repetition, for loop, switch Multiple-Selection Statement, do...while Repetition Statement, break and continue Statements, Logical Operators, Confusing Equality (==) and Assignment (=) Operators. [Ch. 4]
4. Functions:Function Definitions, Function Prototypes, Function Call Stack and Activation Records, Headers, Calling Functions By Value and By Reference, Scope Rules, Recursion, Fibonacci Series, Recursion vs. Iteration [Ch. 5]
5. Arrays:Defining Arrays, Array Examples, Passing Arrays to Functions, Sorting Arrays, Case Study: Computing Mean, Median and Mode Using Arrays, Searching Arrays, Multiple-Subscripted Arrays [Ch. 6]

6. Pointers:Pointer Variable Definitions and Initialization, Pointer Operators, Passing Arguments to Functions by Reference, Using the const Qualifier with Pointers, Bubble Sort Using Call-by-Reference, sizeof Operator, Pointer Expressions and Pointer Arithmetic, Relationship between Pointers and Arrays, Arrays of Pointers, Case Study: Card Shuffling and Dealing Simulation, Pointers to Functions. [Ch. 7]
7. Characters and Strings:Fundamentals of Strings and Characters, Character-Handling Library, String-Conversion Functions, Standard Input/Output Library Functions, String-Manipulation Functions of the String-Handling Library, Comparison Functions of the String-Handling Library, Search Functions of the String-Handling Library, Memory Functions of the String-Handling Library, Other Functions of the String-Handling Library [Ch. 8]
8. Formatted Input/Output:Streams, Formatting Output with printf, Printing Integers, Printing Floating-Point Numbers, Printing Strings and Characters, Other Conversion Specifiers, Printing with Field Widths and Precision, Using Flags in the printf Format Control String, Printing Literals and Escape Sequences, Reading Formatted Input with scanf. [Ch. 9]
9. Structures, Unions, Bit Manipulations and Enumerations:Structure Definitions, Initializing Structures, Accessing Structure Members, Using Structures with Functions, typedef, Example: High-Performance Card Shuffling and Dealing Simulation, Unions, Bitwise Operators, Bit Fields, Enumeration Constants. [Ch. 10]
10. File Processing: Data Hierarchy, Files and Streams, Creating a Sequential-Access File, Reading Data from a Sequential-Access File, Random-Access Files, Creating a Random-Access File, Writing Data Randomly to a Random-Access File, Reading Data from a Random-Access File. [Ch.-11]

Textbook(s):

- C How to Program by Paul Deitel and Harvey Deitel, Prentice Hall; 7th Edition (March 4, 2012)

Reference Material:

- Programming in C by Stephen G. Kochan, Addison-Wesley Professional; 4 edition (September 25, 2013). ISBN-10: 0321776410

Course Title: Object Oriented Programming

Course Code: CMP- 2124
Course Structure: Lectures: 3 / Labs: 1
2nd Semester
Credit Hours: 4
Prerequisites: CMP-2122(Programming Fundamentals)

Course Objectives:
The course aims to develop students' Object Oriented Programming skills.

Course Syllabus:
Evolution of Object Oriented (OO) Programming. OO Concepts and Principles.Problem Solving in OO Paradigm.OO Program & Design Process.Objects, Classes, Abstraction.Constructors and Destructors.Operator and Function Overloading.Virtual Functions.Derived Classes.Inheritance,

Encapsulation and Polymorphism.I/O and File Processing.Exception Handling.

Course Outline:

1. Introduction to Classes, Objects and Strings: Defining a Class with a Member Function, Defining a Member Function with a Parameter, Data Members, set Member Functions and get Member Functions, Initializing Objects with Constructors, Placing a Class in a Separate File for Reusability, Separating Interface from Implementation, Validating Data with set Functions [Ch. 3]
2. Class Templates array and vector; Catching Exceptions: Introduction, Arrays, Declaring arrays, Examples Using arrays, Range-Based for Statement, Sorting and Searching arrays, Multidimensional arrays. [Ch. 7]
3. Classes - Throwing Exceptions: Class Scope and Accessing Class Members, Access Functions and Utility Functions, Constructors with Default Arguments, Destructors, When Constructors and Destructors Are Called, Default Memberwise Assignment, const Objects and const Member Functions, Composition: Objects as Members of Classes, friend Functions and friend Classes, Using the this Pointer, static Class Members. [Ch. 9]
4. Operator Overloading; Class string: Introduction, Using the Overloaded Operators of Standard Library Class string, Fundamentals of Operator Overloading, Overloading Binary Operators, Overloading the Binary Stream Insertion and Stream Extraction Operators, Overloading Unary Operators, Overloading the Unary Prefix and Postfix ++ and – Operators, Dynamic Memory Management, Operators as Member vs. Non-Member Functions, Converting Between Types, explicit Constructors and Conversion Operators, Overloading the Function Call Operator ()[Ch. 10].
5. Inheritance: Introduction, Base Classes and Derived Classes, Relationship between Base and Derived Classes, Constructors and Destructors in Derived Classes, public, protected and private Inheritance, Software Engineering with Inheritance. [Ch. 11]]
6. Polymorphism: Introduction, Relationships Among Objects in an Inheritance Hierarchy, Type Fields and switch Statements, Abstract Classes and Pure virtual Functions, Polymorphism, Virtual Functions and Dynamic Binding "Under the Hood": [Ch. 12]
7. Stream Input/Output: Introduction, Streams, Stream Output, Stream Input, Unformatted I/O Using read, write and gcount, Introduction to Stream Manipulators, Stream Format States and Stream Manipulators, Stream Error States, Tying an Output Stream to an Input Prentice Hall File Processing: Introduction, Files and Streams, Creating a Sequential File, Reading Data from a Sequential File, Updating Sequential Files, Random-Access Files, Creating a Random-Access File, Writing Data Randomly to a Random-Access File, Reading from a Random-Access File Sequentially [Ch. 14]
8. Standard Library Containers and Iterators: Introduction to Containers, Introduction to Iterators, Introduction to Algorithms, Sequence Containers, Associative Containers, Container Adapters, Class bitset. [Ch. 15]
9. Exception Handling: Introduction, Rethrowing an Exception, Stack Unwinding, When to Use Exception Handling, Constructors, Destructors and Exception Handling, Exceptions and Inheritance, Processing new Failures, Class unique_ptr and Dynamic Memory Allocation, Standard Library Exception Hierarchy. [Ch. 17]

Textbook(s):

- C++ How to Program by Paul Deitel and Harvey Deitel, Prentice Hall, (February 12, 2013). ISBN-10: 0-13-337871-3

Reference Material:

- The C++ Programming Language (hardcover) (4th Edition) by Bjarne Stroustrup (Jul 29, 2013)
- The C++ Programming Language by Bjarne Stroustrup, Addison-Wesley Professional; 4 edition (July 29, 2013). ISBN-10: 0321958322
- Jumping into C++ by Alex Allain, Cprogramming.com (April 19, 2013). ISBN-10: 0988927802

Course Title: Discrete Structures

Course Code: CMP-2111
Course Structure: Lectures: 3 / Labs: 0
Credit Hours: 3
Prerequisites: None

2nd Semester

Course Objectives:

The course provides a solid theoretical foundation of discrete structures as they apply to Computer Science problems and structures. The students will learn how to use mathematical notation and solve problems using mathematical tools.

Course Syllabus:

Logic: Propositional Equivalences, Predicates and Quantifiers, Nested Quantifiers, Methods of Proof. Sets & Functions. Algorithms: the Growth of Functions, Complexity of Algorithms, the Integers and Division, Matrices. Number Theory and Cryptography. Mathematical Reasoning: Proof Strategy, Sequences and Summations, Mathematical Induction, Recursive Definitions and Structural Induction, Recursive Algorithms, Program Correctness. The Basics of Counting: The Pigeonhole Principle, Permutations and Combinations, Binomial Coefficients, Generalized Permutations and Combinations, Generating Permutations and Combinations. Advanced Counting Techniques: Recurrence Relations, Solving Recurrence Relations, Divide-and-Conquer Algorithms and Recurrence Relations, Generating Functions, Inclusion-Exclusion & its Application. Relations and Their Properties, n-ary Relations and Their Applications, Representing Relations, Closures of Relations, Equivalence Relations, Partial Orderings. Graph: Representing Graphs and Graph Isomorphism, Connectivity, Euler and Hamilton Paths, Shortest-Path Problems, Planar Graphs, Graph Coloring. Trees: Applications of Trees, Tree Traversal, Spanning Trees.

Course Outline:

1. Logic: Propositional Equivalences, Predicates and Quantifiers, Nested Quantifiers, Methods of Proof. [TB: Ch. 1]
2. Sets & Functions. [TB: Ch. 2]
3. Algorithms: the Growth of Functions, Complexity of Algorithms, the Integers and Division, Matrices. [TB: Ch. 3]
4. Number Theory and Cryptography. [TB: Ch. 4]

5. Mathematical Reasoning: Proof Strategy, Sequences and Summations, Mathematical Induction, Recursive Definitions and Structural Induction, Recursive Algorithms, Program Correctness. [TB: Ch. 5]
6. The Basics of Counting: The Pigeonhole Principle, Permutations and Combinations, Binomial Coefficients, Generalized Permutations and Combinations, Generating Permutations and Combinations. [TB: Ch. 6]
7. Advanced Counting Techniques: Recurrence Relations, Solving Recurrence Relations, Divide-and-Conquer Algorithms and Recurrence Relations, Generating Functions, Inclusion-Exclusion & its Application. [TB: Ch. 8]
8. Relations and Their Properties, n-ary Relations and Their Applications, Representing Relations, Closures of Relations, Equivalence Relations, Partial Orderings. [TB: Ch. 9]
9. Graph: Representing Graphs and Graph Isomorphism, Connectivity, Euler and Hamilton Paths, Shortest-Path Problems, Planar Graphs, Graph Coloring. [TB: Ch. 10]
10. Trees: Applications of Trees, Tree Traversal, Spanning Trees, Minimum Spanning Trees. [TB: Ch. 11]

Textbook(s):

- Discrete Mathematics and Its Applications by Kenneth H. Rosen, McGraw-Hill Science/Engineering/Math; 7th Edition (2011). ISBN-10: 0073383090

Reference Material:

- Discrete Mathematics by Richard Johnsonbaugh, Pearson; 7th Edition (January 8, 2008). ISBN-10: 0131593188
- Discrete Algorithmic Mathematics by Stephen B. Maurer and Anthony Ralston, A K Peters/CRC Press; 3rd Edition (August 2004). ISBN-10: 1568811667
- Discrete Mathematical Structures by Bernard Kolman, Robert Busby and Sharon C. Ross, Pearson; 6th Edition (2008). ISBN-10: 0132297515
- Discrete Mathematics with Ducks by sarah-marie Belcastro, A K Peters/CRC Press; 1st Edition (June 21, 2012). ISBN-10: 1466504994

Course Title: Data Structures& Algorithms

Course Code: CMP-3113
Course Structure: Lectures: 3 / Labs: 0 3rd Semester,
Credit Hours: 3
Prerequisites: CMP-2124 (Object Oriented Programming)

Course Objectives:
This course provides an introduction to the theory, practice and methods of data structures and algorithm design.

Course Syllabus:
Introduction to Data Structure & Algorithm.Complexity Analysis.Linked Lists: Singly Linked Lists, Doubly Linked Lists, Circular List.Stacks, Queues and Priority Queue. Recursion: Function call and Recursion Implementation, Tail Recursion, Non-tail Recursion, Indirect Recursion, Nested Recursion, Backtracking. Tree: Trees, Binary Trees, and Binary Search. Tree Traversal.Insertion.Deletion.Balancing a Tree.Heap.B-Tree, Spanning Tree, Splay Trees.Graphs:

Representation, Treversal, Shortest Path, Cycle Detection, Isomorphic Graphs. Graph Traversal Algorithms. Sorting: Insertion Sort, Selection Sort, Bubble Sort, Shell Sort, Heap Sort, Quick Sort, Merge Sort, Radix Sort, Bucket Sort. Hashing: Hash Functions, Collision Resolution, Deletion. Memory Management & Garbage Collection.

Course Outline:

1. Complexity Analysis [TB1: Ch. 1]
2. Linked Lists: Singly Linked Lists, Doubly Linked Lists, Circular List. [TB1: Ch. 3]
3. Stacks, Queues and Priority Queue. [TB1: Ch. 4]
4. Recursion: Function call and Recursion Implementation, Tail Recursion, Nontail Recursion, Indirect Recursion, Nested Recursion, Backtracking. [TB1: Ch. 5]
5. Binary Tree: Trees, Binary Trees, and Binary Search. Tree Traversal. Insertion. Deletion. Balancing a Tree. Heap. B-Tree. [TB1: Ch. 6]
6. Graphs: Representation,Traversal, Shortest Path, Cycle Detection, Spanning Tree. [Ch. 8]
7. Sorting: Insertion Sort, Selection Sort, Bubble Sort, Shell Sort, Heap Sort, Quick Sort, Merge Sort, Radix Sort. [TB1: Ch. 9]
8. Hashing: Hash Functions, Collision Resolution, Deletion. [TB1: Ch. 10]
9. Memory Management: Garbage Collection

Textbook(s):

1. Data Structures and Algorithm Analysis in C++ by Mark A. Weiss, Addison-Wesley; 3rd Edition (March 10, 2006). ISBN-10: 032144146X

Reference Material:

- Data Structures and Algorithms in C++ by Adam Drozdek, Course Technology; 4th Edition (August 27, 2012). ISBN-10: 1133608426
- Data Structures Using C++ by D. S. Malik, Course Technology; 2nd Edition (July 31, 2009). ISBN-10: 0324782012
- Data Structures and Other Objects Using C++ by Michael Main and Walter Savitch, Prentice Hall; 4th Edition (March 6, 2010). ISBN-10: 0132129485

Course Title: Digital Logic Design

Course Code: CMP-2210
Course Structure: Lectures: 3/Labs: 0
Credit Hours: 3
Prerequisites:None 2nd Smester.

Course Objectives:

The course introduces students with digital circuit of large complexity and how such circuits could be built in a methodological way, starting from Boolean logic and applying a set of rigorous techniques.

Course Syllabus:

Number Systems: Digital Systems, Number Systems and Codes. Unweighted Codes, Binary Storage and Registers, Binary Logic. Boolean Algebra and Logic Gates, Boolean Functions, Canonical and Standard Forms. Digital Logic Gates.Integrated Circuits. Gate-Level Minimization: The Map Method, Product of Sums Simplification, Don't-Care Conditions,

NAND and NOR Implementation, Exclusive-OR Function, Karnaugh Maps, Quine Mc-Cluskey Method. Combinational Logic: Combinational Circuits, Analysis Procedure, Design Procedure, Binary Adder-Subtractor, Decimal Adder, Binary Multiplier. Magnitude Comparator.Decoders.Encoders.Multiplexers. Synchronous Sequential Logic: Sequential Circuits, Latches, Flip-Flops, Registers and Counters. Memory and Programmable Logic: Random-Access Memory. Memory Decoding.Error Detection and Correction.Read-Only Memory.Programmable Logic Array.Programmable Array Logic.

Course Outline:

1. Number Systems, Operations, and Codes: Decimal Numbers, Binary Numbers, Decimal-to-Binary Conversion, Binary Arithmetic, I's and 2's Complements of Binary, Numbers, Signed Numbers, Arithmetic Operations with Signed Numbers, Hexadecimal Numbers, Octal Numbers, Binary Coded Decimal (BCD), Digital Codes, Error Detection and Correction Codes. [Ch. 2]
2. Logic Gates: The Inverter, The AND Gate, The OR Gate, The NAND Gate, The NOR Gate, The Exclusive-OR and Exclusive-NOR Gates. [Ch. 3]
3. Boolean Algebra and logic Simplification: Boolean Operations and Expressions, Laws and Rules of Boolean Algebra, DeMorgan's Theorem, Boolean Analysis of Logic Circuits, Simplification Using Boolean Algebra, Standard Forms of Boolean Expressions, Boolean Expressions and Truth Tables, The Kamaugh Map, Karnaugh Map SOP Minimization, Karnaugh Map POS Minimization, Five-Variable Karnaugh Maps. [Ch. 4]
4. Combinational logic Analysis: Basic Combinational Logic Circuits, Implementing Combinational Logic, The Universal Property of NAND and NOR Gates, Combinational Logic Using NAND and NOR Gates. [Ch. 5]
5. Functions of Combinational logic: Basic Adders, Parallel Binary Adders, Ripple Carry versus Look-Ahead Carry Adders, Comparators, Decoders, Encoders. Code Conveners: Multiplexers (Data Selectors), Demultiplexers, Parity Generators/Checkers.[Ch. 6]
6. latches, Flip-Flops, and Timers: Latches, Edge-Triggered Flip-Flops, Flip-Flop Operating Characteristics, Flip-Flop Applications. [Ch. 7]
7. Counters: Asynchronous Counter Operation, Synchronous Counter Operation, Up/Down Synchronous Counters, Design of Synchronous Counters. [Ch. 8]
8. Shift Registers: Basic Shift Register Functions, Serial In/Serial Out Shift Registers, Serial In/Parallel Out Shift Registers, Parallel In/Serial Out Shift Registers, Parallel In/Parallel Out Shift Registers, Bidirectional Shift Registers, Shift Register Counters. [Ch. 9]
9. Memory and Storage: Basics of Semiconductor Memory, Random-Access Memories (RAMs), Read-Only Memories (ROMs), Programmable ROMs (PROMs and EPROMs), Flash Memories. [Ch. 10]
10. Programmable Logic: FPGA [Ch. 11]

Textbook(s):

- Digital Fundamentals by Thomas L. Floyd, Prentice Hall; 9th edition (2007)

Reference Material:

- Digital Fundamentals: A Systems Approach by Thomas L. Floyd, Prentice Hall; 1 edition (July 13, 2012)

- Digital Design, by M. Morris Mano, Michael D. Ciletti, 4th Edition, Prentice Hall (2007). ISBN-10: 0131989243
- Digital Design by Franc Vahid, Wiley; 1st Edition (July 28, 2006). ISBN-10: 0470044373
- Fundamentals of Logic Design by Jr. Charles H. Roth and Larry L Kinney, CL Engineering; 6th Edition (March 13, 2009). ISBN-10: 0495471690

Course Title: Operating Systems

Course Code: CMP-3621
Course Structure: Lectures: 3/ Labs: 1
Credit Hours:4
Pre-requisites:None

5th Smester

Course Objectives:
To help students gain a general understanding of the principles and concepts governing the functions of operating systems and acquaint students with the layered approach that makes design, implementation and operation of the complex OS possible.

Course Syllabus:
Computing Environments.Types and Generation of Operating-System.Key Components. Virtual Machines, System Calls, System Boot, System Programs. Processes, Process Scheduling, Operations on Processes, Inter-process Communication, Communication in Client-Server Systems. Threads: Multithreading Models, Thread Libraries, Threading Issues. CPU Scheduling, Scheduling Criteria, Scheduling Algorithms. Thread Scheduling, Algorithm Evaluation. Process Synchronization, The Critical-Section Problem, Peterson's Solution, Synchronization Hardware, Semaphores, Classic Problems of Synchronization. Deadlocks Conditions & Handling.Main Memory Management.Virtual Memory Management.File-System and Implementation. I/O Systems: STREAMS, Hardware, Performance, Application I/O Interface, Kernel I/O Subsystem, Transforming I/O Requests to Bibliographical Notes, Hardware Operations. Case studies: Linux, Windows Operating Systems.
* Labs are preferred in this course. Lab assignments involving different single and multithreaded OS algorithms.

Course Outline:

1. Introduction: Over view of: Operating Systems, Operating-System Structure, Operating-System Operations, Process management, Memory Management, Storage Management, Protection and Security, Protection and Security, Distributed Systems, Special-Purpose Systems, Computing Environments. [TB: Ch1]
2. Operating-System Structures: Operating-System Services, Operating-System Structure, User Operating-System Interface, Virtual Machines, System Calls, Operating-System Generation, Types of System Calls, System Boot, System Programs. [TB:Ch2].
3. Processes: Process Concept, Process Scheduling, Operations on Processes, Inter-process Communication, Communication in Client- Server Systems. Threads: Multithreading Models, Thread Libraries, Threading Issues. [TB: Ch. 3, 4]
4. CPU Scheduling: Basic Concepts, Scheduling Criteria, Scheduling Algorithms, Multiple-Processor Scheduling, Thread Scheduling, Algorithm Evaluation. [TB: Ch. 5]
5. Process Synchronization: Background, Monitors, The Critical-Section Problem,

Peterson's Solution, Synchronization Hardware, Semaphores, Classic Problems of Synchronization. [TB: Ch. 6]

6. Deadlocks: System Model, Deadlock Characterization, Methods for Handling Deadlocks, Deadlock Prevention, Deadlock Avoidance, Deadlock Detection, Recovery from Deadlock. [TB: Ch. 7]
7. Main Memory: Swapping, Contiguous Memory Allocation, Paging, Structure of the Page Table, Segmentation, Example: The Intel Pentium. [TB: Ch.8]
8. Virtual Memory: Allocating Kernel Memory, Demand Paging, Copy-on-Write, Page Replacement, Allocation of Frames, Thrashing. [TB: Ch. 9]
9. File-System Implementation: File-System Structure, Log-Structured File Systems, File-System Implementation, Directory Implementation, Allocation Methods, Free-Space Management, Efficiency and Performance, Recovery. [TB: Ch. 11]
10. I/O Systems: STREAMS, Hardware, Performance, Application I/O Interface, Kernel I/O Subsystem, Transforming I/O Requests to Bibliographical Notes, Hardware Operations. [TB: Ch. 13]
11. Security:The Security Problem, Computer-Security, Program Threats, Classifications, System and Network Threats, Cryptography as a Security Tool, User Authentication, Implementing Security Defenses, Firewalling to Protect Systems and Networks. [TB: Ch. 15]
12. Case studies: Linux, Windows Operating Systems

Textbook(s):

- Operating System Concepts Essentials by Abraham Silberschatz, Peter B. Galvin and Greg Agne, Wiley; 8th Edition (July 5, 2008). ISBN-10: 0470128720

Reference Material:

- Applied Operating Systems Concepts by Silberschatz A., Peterson, J.L., & Galvin P.C. Wiley; 8th Edition (2011). ISBN-10: 1118112733
- Modern Operating Systems by Tanenmaum A.S., Prentice Hall; 3rd Edition (2007). ISBN-13: 978-0136006633

Course Title: Database Systems

Course Code: CMP-3450
Course Structure: Lectures: 3/ Labs: 1
Credit Hours: 4
Prerequisites: None

4th Semester

Course Objectives:

The course aims to introduce basic database concepts, different data models, data storage and retrieval techniques and database design techniques. The course primarily focuses on relational data model and DBMS concepts.

Course Syllabus:

Basic Concept: File Processing & Database Approach, Database Applications, Advantages of the DB, Components of the DB Environment, and Evolution of DBs. Database Architecture: DB Development Process, Three Schema Architecture, Data Modeling. Logical Design: E-R Modeling (Entities, Attributes, Relationships; Cardinality Constraints). RDBMS: Logical View

of Data, Relational Data Model, Constraints, Transforming ERD/EERD into Relations. The Relational Model: Types, Relations, Relational Algebra, Relational Calculus, Integrity. Normalization. EE-R Diagrams: Development & Constraints, DB Design Life Cycle. DB Development & Management: Introduction to SQL and Basic Commands, SQL Integrity Constraints. Physical DB Design, DB architecture, Query Optimization. SQL Commands: Saving, Listing, Editing, Restoring Table Contents; Logical Operators, Management Commands, Arithmetic Operators, Complex Queries and SQL Functions, Aggregate Function, Grouping Functions, Virtual Tables, Views, Indexes, Joins. Clint-Server & Distributed Environment, ODBC, Bridges, and Connectivity Issues. Concurrency Control with Locking, Serializability, Deadlocks, Database Recovery Management.Distributed Processing and Distributed Databases, DDBMS: Evolution, Architecture, Components, Advantages, Security and Authorization. Physical Design: Storage and File Structure, Efficiency and Tuning.

Course Outline:

1. Databases Overview: Basic Concept; File Processing & Database Approach, Database Applications, Advantages of the DB, Components of the DB Environment, Evolution of DBs.
2. Database Architecture: DB Development Process, Three Schema Architecture, Data Modelling, E-R Modelling (Basic Concepts)
3. Logical Design: E-R Modelling (Entities, Attributes, Relationships; Cardinality Constraints), RDBMS: Logical View of Data; The Relational Data Model
4. Logical Design:Constraints, Transforming ERD/EERD into Relations
5. The Relational Model: Types, Relations, Relational Algebra, Relational Calculus, Integrity
6. Normalization: First Normal Form, Second Normal Form
7. Normalization: Third Normal Form (3NF), Boyce Codd Normal Form (BCNF)
8. EE-R Diagrams: Development & Constraints, DB Design Life Cycle,
9. DB Development & Management: Introduction to SQL and Basic Commands. SQL Integrity Constraints.
10. Physical DB Design, DB architecture, Query Optimization
11. SQL Commands: Saving, Listing, Editing, Restoring Table Contents; Logical Operators, Management Commands
12. Arithmetic Operators, Complex Queries and SQL Functions, Aggregate Function, Grouping Functions
13. Virtual Tables, Views, Indexes, Joins
14. Clint-Server & Distributed Environment, ODBC, Bridges, and Connectivity Issues.
15. Concurrency Control with Locking, Serializability, Deadlocks, Database Recovery Management.
16. Distributed Processing and Distributed Databases,DDBMS: Evolution, Architecture, Components, Advantages, Security and Authorization. Physical Design: Storage and File Structure, Efficiency And Tuning

Textbook(s):

1. Modern Database Management by Fred McFadden, Jeffrey Hoofer, Mary Prescott, Prentice Hall; 11th Edition (July 26, 2012). ISBN-10: 0132662256
2. Database Systems A Practical Approach to Design, Implementation, and Management, 4th Edition, Thomas Connolly, Carolyn Begg, Addison Wesley, 2005.

3. Introduction to Oracle: SQL and PL/SQL ISBN-10: 0131453203

Reference Material:

- Database Design and Relational Theory: Normal Forms and All That Jazz by C. J. Date, O'Reilly Media; 1st Edition (April 24, 2012). ISBN-10: 1449328016
- Fundamentals of Database Systems by R. Elmasri and S. Navathe. 6th Edition, Addison-Wesley (2010). ISBN-10: 0136086209
- Database System Concepts by Abraham Silberschatz, Henry F. Korth and S. Sudarshan. McGraw-Hill; 6th Edition (2010). ASIN: B004Y3YXK2
- Database Systems: a Practical Approach to Design, Implementation and Management by T.Connolly and C.Begg, Addison-Wesley; 5th Edition (2009). ISBN-10: 0321523067
- Modern Database Management System by Fred, Jeffery A. Hoffer and Fred McFadden; Prentice Hall; 7th Edition (April 6, 2004). ISBN-10: 0131453203

Course Title: Software Engineering

Course Code: CMP-3310
Course Structure: Lectures: 3/ Labs: 0
Credit Hours: 3
Prerequisites: None

4th Sem

Course Objectives:

To study various software development models and software development life cycles. The concepts of project management, change control, process management, software development and testing are introduced through hands-on team Projects.

Course Syllabus:

The Nature of Software, Nature of WebApps, The Software Process, Software Engineering Practice. Generic Process Models.Specialized Process Models.Systems Analysis and Design.Business Information Systems.Introduction to SDLC, SDLC Phases, System Planning, Preliminary Investigation, SWOT Analysis.Strategic Planning.Information Systems Projects.Requirements Engineering.Data & Process Modeling. Design within the Context of Software Engineering. Design Models. System Architecture.Architectural Styles.User Interface Design.Software Quality Assurance.Validation Testing, System Testing, Internal and External View of Testing.Project Management Concepts.Project Scheduling. Risk Management. Maintenance and Reengineering.

Course Outline:

1. The Nature of Software, Unique Nature of WebApps, Software Engineering, The Software Process, Software Engineering Practice, Software Myths. [TB1: Ch. 1]
2. Generic Process Models: Framework Activity, Task Set, Process Patterns, Process Improvement, CMM, Prescriptive Process Models: Waterfall Model, Incremental Process Model, Evolutionary Process Model. [TB1: Ch. 2]
3. Specialized Process Models: Component Based Development, The Formal Methods Models, Agile Development. [TB1: Ch. 2-3]
4. Introduction to Systems Analysis and Design, Business Information Systems,

Information System Components, Types of Information Systems, Evaluating Software, Make or Buy Decision. [TB1: Ch. 1]

5. Introduction to SDLC, SDLC Phases, System Planning, Preliminary Investigation, SWOT Analysis. [TB1: Ch. 2]
6. The Importance of Strategic Planning, Information Systems Projects, Evaluation of Systems Requests, Preliminary Investigation, Systems Analysis, Requirements Modeling, Fact-Finding Techniques. [TB1: Ch. 2-3]
7. Requirements Engineering, Establishing the Groundwork, Eliciting Requirements, Developing Use Cases, Building the Requirements Model. [TB1: Ch. 5]
8. Requirements Modelling Strategies, Difference between Structured Analysis and Object Oriented Analysis; Difference between FDD Diagrams & UML Diagrams. [TB2:Ch. 3]
9. Data & Process Modelling, Diagrams: Data Flow, Context, Conventions, Detailed Level DFD's Diagram 0, Levelling, Balancing, Logical Versus Physical Models. [TB2: Ch. 4]
10. Design Within the Context of Software Engineering, The Design Process, Design Concepts, Design Models: Data Design Elements. [TB1: Ch. 8]
11. Architecture Design Elements, Interface Design Elements, Component-Level Design Elements, Deployments Design Elements. [TB: Ch. 8]
12. System Architecture, Architectural Styles, User Interface Design: The Golden Rules, User Interface Analysis and Design, WebApps Interface Design. [TB1: Ch. 9-11]
13. Software Quality Assurance: Background Issues, Elements of Software Quality Assurance, Software Testing Strategies, Strategic Issues, Test Strategies for Conventional Software. [TB1: Ch.16-17]
14. Validation Testing, System Testing, Internal and External View of Testing: White Box Testing and Black Box Testing Techniques. [TB1: Ch. 17-18)]
15. Introduction to Project Management, Project Scheduling: Gantt Chart, Risk Management: Proactive versus Reactive Risk Strategies, Software Risks, Maintenance and Reengineering: Software Maintenance, Software Reengineering. [TB1: Ch. 28-29]

Textbook(s):

- Software Engineering: A Practitioner's Approach by Roger S. Pressman, McGraw-Hill Science/Engineering/Math; 7th Edition (2009). ISBN-10: 0073375977
- Systems Analysis and Design by Gary B. Shelly, Thomas J. Cashman and Harry J. Rosenblatt, Course Technology; 7thEdition (2007). ISBN-10: 1423912225

Reference Material:

- Software Engineering 8E by Ian Sommerville, Addison Wesley; 8th Edition (2006). ISBN-10: 0321313798
- Systems Analysis and Design by Gary B. Shelly, Thomas J. Cashman and Harry J. Rosenblatt, Course Technology; 7thEdition (2007). ISBN-10: 1423912225

Course Title: Computer Communication and Networks

Course Code: CMP-2540
Course Structure: Lectures: 3/ Labs: 0
Credit Hours: 3
Prerequisites: None

3rd Semester

Course Objectives:
To introduce students with concepts related to computer communication, analogue & digital transmission, network layers, network models (OSI, TCP/IP) and protocol standards. Emphasis is given on the understanding of modern network concepts.

Course Syllabus:
Introduction to Data Communications, Communications Models, Data Networking, and the Internet.Protocol & Architecture.Protocol & Architecture.Data Transmission.Signal Encoding Techniques.Digital Data Communication Techniques.Data Link Control Protocols.Multiplexing.Circuit Switching and Packet Switching.Cellular Wireless Networks Technology & Protocols.Local Area Network Technology & Protocols.Ethernet Technology & Protocols. Wireless LANs: Wireless LAN Technology and Protocols.

Course Outline:
1. Introduction to Data Communications, Communications Models, Data Networking, and the Internet. [TB1: Ch. 1]
2. Protocol & Architecture: The OSI Model, Layered Architecture, Physical, Data Link and Network Layers, Transport, Session, Presentation and Application Layers. [TB1: Ch. 2]
3. Protocol & Architecture: TCP/IP, and Internet-Based Applications. [TB1: Ch. 2]
4. Data Transmission: Concepts and Terminology, Analog and Digital Data Transmission, Transmission Impairments and Channel Capacity, Transmission Media: Guided, Wireless, Line-of-Sight. [TB1: Ch. 3, 4]
5. Signal Encoding Techniques: Digital Data, Digital Signals; Digital Data, Analog Signals; Analog Data, Digital Signals; Analog Data, Analog Signals. [TB1: Ch. 5]
6. Digital Data Communication Techniques: Asynchronous and Synchronous, Types of Errors, Error Detection, Error Correction, Line Configurations. [TB1: Ch. 6]
7. Data Link Control Protocols: Flow Control, Error Control, High-Level Data Link Control (HDLC). [TB1: Ch. 7]
8. Multiplexing: Frequency-Division, Synchronous Time-Division, Statistical Time-Division, Asymmetric Digital Subscriber Line, xDSL. [TB1: Ch. 8]
9. Circuit Switching, Packet Switching Concepts, Principles and Architecture, Asynchronous Transfer: Role, Architecture and Services. [TB1: Ch. 9]
10. Circuit Switching and Packet Switching: Switched Communication Networks, Circuit-Switching, Circuit-Switching Concepts, Softswitch Architecture, Packet Switching Principles. [TB1: Ch. 11]
11. Cellular Wireless Networks: Principles of Cellular Networks, First-Generation Analog, Second-Generation CDMA, Third-Generation Systems, Fourth-Generation Systems. [TB1: Ch. 13]
12. Local Area Network: Topologies and Transmission Media, LAN Protocol Architecture, Bridges, Hubs and Switches, Virtual LANs. [TB1: Ch. 15]
13. Ethernet: Traditional Ethernet, High-Speed Ethernet, IEEE 802.1Q VLAN Standard. [TB1: Ch. 16]
14. Wireless LANs: Wireless LAN Technology, IEEE 802.11 Architecture and Services, IEEE 802.11 Medium Access Control, IEEE 802.11Physical Layer, IEEE 802.11 Security Considerations. [TB1: Ch. 17]

Textbook(s):

- Data and Computer Communications by William Stallings, Prentice Hall; 9th Edition (August 13, 2010). ISBN-10: 0131392050

Reference Material:

- Data Communications and Networking by Behrouz Forouzan, 4th Edition (2007). ISBN 978-007-125442-7
- Computer Networks by Andrew S. Tanenbaum and David J. Wetherall, Prentice Hall; 5th Edition (October 7, 2010). ISBN-10: 0132126958
- Computer Networks and Internets by Douglas E. Comer, Prentice Hall; 5th Edition (April 28, 2008). ISBN-10: 0136066984

Course Title: Human Computer Interaction

Course Code: CMP-3711
Course Structure: Lectures: 3/Labs: 0
Credit Hours: 3
Prerequisites: None

6th Semester

Course Objectives:

This course focuses on the basic concepts of how human perceives and interacts with computers. Through a set of exercises, students will acquire the ability to critique problems that exist in current interactive software and websites. Students will also learn several usability evaluation methods.

Course Syllabus:

The human.The computer.The interaction Models.Interaction design basics.HCI in the software process. Design rules. Implementation support.Evaluation techniques.Universal design.User support.Task analysis. Dialog notations and design. Models of the system.Modeling rich interaction.Groupware.Ubiquitous computing and augmented realities. Hypertext, multimedia and the world wide web.

Course Outline:

1. The human: Input–output channels, Human memory, Thinking, Emotion, Individual differences, Psychology and the design of interactive systems. [Ch. 1]
2. The computer: Text entry devices, Positioning, pointing and drawing, Display devices, Devices for virtual reality and 3D interaction, Physical controls, sensors and special devices, Paper: printing and scanning, Memory, Processing and networks. [Ch. 2]
3. The interaction: Models of interaction, Frameworks and HCI, Ergonomics, Interaction styles, Elements of the WIMP interface, Interactivity, The context of the interaction, Experience, engagement and fun. [Ch. 3]
4. Interaction design basics: What is design? The process of design, User focus, Scenarios, Navigation design, Screen design and layout, Iteration and prototyping. [Ch. 5]
5. HCI in the software process: The software life cycle, Usability engineering, Iterative design and prototyping, Design rationale. [Ch. 6]
6. Design rules: Principles to support usability, Standards, Guidelines, Golden rules and heuristics, HCI patterns. [Ch. 7]
7. Implementation support: Elements of windowing systems, Programming the application,

Using toolkits, User interface management systems.[Ch. 8]

8. Evaluation techniques: What is evaluation? Goals of evaluation, Evaluation through expert analysis, Evaluation through user participation, Choosing an evaluation method. [Ch. 9]
9. Universal design: Universal design principles, Multi-modal interaction, Designing for diversity.[Ch. 10]
10. User support: Requirements of user support, Approaches to user support, Adaptive help systems, Designing user support systems. [Ch. 11]
11. Task analysis: Differences between task analysis and other techniques, Task decomposition, Knowledge-based analysis, Entity–relationship-based techniques, Sources of information and data collection, Uses of task analysis [Ch. 15]
12. Dialog notations and design: What is dialog? Dialog design notations, Diagrammatic notations, Textual dialog notations, Dialog semantics, Dialog analysis and design. [Ch. 16]
13. Models of the system: Standard formalisms, Interaction models, Continuous behaviour.
14. Modelling rich interaction: Introduction, Status–event analysis, Rich contexts, Low intention and sensor-based interaction. [Ch. 18]
15. Groupware: Groupware systems, Computer-mediated communication, Meeting and decision support systems, Shared applications and artifacts, Frameworks for groupware, Implementing synchronous groupware. [Ch. 19]
16. Ubiquitous computing and augmented realities: Ubiquitous computing applications research, Virtual and augmented reality, Information and data visualization. [Ch. 20]
17. Hypertext, multimedia and the world wide web: Understanding hypertext, Finding things, Web technology and issues, Static web content, Dynamic web content. [Ch. 21]

Textbook(s):

- Human-Computer Interaction by Alan Dix, Janet E. Finlay, Gregory D. Abowd, Russell Beale, Prentice Hall; 3rd Edition (December 20, 2003). ISBN-10: 0130461091

Reference Material:

- Human-Computer Interaction: Concepts And Design by J. Preece, Y. Rogers, H. Sharp, D. Benyon, S. Holland, T. Carey, Addison Wesley; 1st Edition (April 30, 1994). ISBN-10: 0201627698.
- Human-Computer Interaction Handbook: Fundamentals, Evolving Technologies, and Emerging Applications by Julie A. Jacko, CRC Press; 3rdEdition (May 4, 2012). ISBN-10: 1439829438
- Interaction Design: Beyond Human - Computer Interaction by Yvonne Rogers, Helen Sharp, and Jenny Preece, Wiley; 3rdEdition (June 15, 2011). ISBN-10: 0470665769
- Designing with the Mind in Mind: Simple Guide to Understanding User Interface Design Rules by Jeff Johnson, Morgan Kaufmann; 1stEdition (June 3, 2010). ISBN-10: 012375030X

Course Title: Capstone Project
Course Code: CMP-4970
Course Structure: Lectures: 0/Labs: 6
Credit Hours: 6
Prerequisites:None

7th, & 8th Semester

Course Objectives:
The Capstone Project is an opportunity for participants to put their leadership competencies into practice. Capstone Project allows the student to identify and develop a project that puts into practice the leadership skills and competencies learned during the courses of study. Detailed guideline and documentation temples are available with the Department.

Contents of Computing Supporting Area Elective Courses

Course Title: Calculus and Analytical Geometry

1st Semester

Course Code: MATH-2213
Course Structure: Lectures: 3, Labs: 0
Credit Hours: 3
Prerequisites: None

Course Objectives:
To provide foundation and basic ground for calculus and analytical geometry background.

Course Syllabus:
Real Numbers and the Real Line. Functions. Shifting Graphs, Trigonometric Functions. Limits and Continuity. Tangent Lines. Derivatives. Differentiation Rules. Derivatives of Trigonometric Functions. The Chain Rule. Implicit Differentiation and Rational Exponents. Applications of Derivatives. Integration. Numerical Integration. Applications of Integrals. Transcendental Functions. Inverse Trigonomic Functions. Derivatives of Inverse Trigonometric Functions. Integrals. Hyperbolic Functions. Conic Sections, Parametrized Curves, and Polar Coordinates. Vectors and Analytic Geometry in Space.

Course Outline:

1. Real Numbers and the Real Line, Coordinates, Lines, and Increments, Functions, Shifting Graphs, Trigonometric Functions. [TB: Preliminaries]
2. Limits and Continuity: Rates of Change and Limits, Rules for Finding Limits, Target Values and Formal Definitions of Limits, Extensions of the Limit Concept, Continuity, Tangent Lines. [TB: Ch. 1]
3. Derivatives: The Derivative of a Function, Differentiation Rules, Rates of Change, Derivatives of Trigonometric Functions, The Chain Rule, Implicit Differentiation and Rational Exponents. [TB: Ch. 2]
4. Applications of Derivatives: Extreme Values of Functions, The Mean Value Theorem, The First Derivative Test for Local Extreme Values, Graphing with y' and y''. [TB: Ch. 3]
5. Integration: Indefinite Integrals, Integration by Substitution—Running the Chain Rule Backward, Estimating with Finite Sums, Riemann Sums and Definite Integrals, Properties, Area, and the Mean Value Theorem. Substitution in Definite Integrals. Numerical Integration. [TB: Ch. 4]
6. Applications of Integrals: Areas between Curves, Finding Volumes by Slicing, Volumes of Solids of Revolution—Disks and Washers. Cylindrical Shells. Lengths of Plan Curves, Areas of Surfaces of Revolution, Moments and Centers of Mass. [TB: Ch. 5]
7. Transcendental Functions: Inverse Functions and Their Derivatives, Natural Logarithms, The Exponential Function, a^x and $\log_a x$, Growth and Decay, L'Hôpital's Rule, Relative

Rates of Growth, Inverse Trigonometric Functions, Derivatives of Inverse Trigonometric Functions; Integrals. Hyperbolic Functions. [TB: Ch. 6]

8. Conic Sections, Parameterized Curves, and Polar Coordinates: Conic Sections and Quadratic Equations. Classifying Conic Sections by Eccentricity. Quadratic Equations and Rotations. Parameterizations of Plan Curves. Calculus with Parameterized Curves. Polar Coordinates. Graphing in Polar Coordinates. Polar Equations for Conic Sections. Integration in Polar Coordinates. [TB: Ch. 7, 9]
9. Vectors and Analytic Geometry in Space, Vectors in the Plane Dot Products, Vector-Valued Function Cartesian (Rectangular) Coordinates and Vectors in Space. Dot Products. Cross Products. Lines and Planes in Space. Cylinders and Quadric Surfaces. Cylindrical and Spherical Coordinates. [TB: Ch. 9, 10]

Textbook(s):

- Calculus and Analytic Geometry by George B. Thomas and Ross L. Finney, Addison Wesley; 10th Edition (1995) ISBN-10: 0201531747

Reference Material:

- Calculus and Analytical Geometry by Swokowski, Olinick and Pence, 6th Edition, (1994), Brooks/Cole Publishers.
- Calculus by Howard Anton, Irl C. Bivens, Stephen Davis, Wiley; 10th Edition (2012), ISBN-10: 0470647728
- Calculus with Analytic Geometry: Student Solution Manual by Howard Anton, Wiley; 5th Edition (1995). ISBN-10: 0471105899

Course Title: Probability and Statistics
Course Code: MATH-2110
Course Structure: Lectures: 3/ Labs: 0
Credit Hours: 3
Prerequisites: None

2nd Smith

Course Objectives:
To introduce the concepts of data analysis, presentation, counting techniques, probability and decision making.

Course Syllabus:
Statistics and Data Analysis.Collection of Data.Measures of Location.Measures of Variability.Discrete and Continuous Data.Statistical Modeling. Scientific Inspection, and Graphical, General Types of Statistical Studies. Probability.Random Variables and Probability Distributions.Mathematical Expectation.Discrete Probability Distributions.Continuous Probability Distributions.Fundamental Sampling Distributions and Data Descriptions.One- and Two-Sample Estimation Problems.Single Sample Estimating.One- and Two-Sample Tests of Hypotheses. Sample Tests. Simple Linear Regression and Correlation.Multiple Linear Regression and Certain.

Course Outline:

1. Introduction to Statistics and Data Analysis: Statistical Inference, Samples, Populations,

and the Role of Probability, Sampling Procedures; Collection of Data, Measures of Location: The Sample Mean and Median, Measures of Variability, Discrete and Continuous Data, Statistical Modeling, Scientific Inspection, and Graphical, General Types of Statistical Studies: Designed Experiment, Observational Study, and Retrospective Study. [TB: Ch. 1]

2. Probability: Sample Space, Events, Counting Sample Points, Probability of an Event, Additive Rules, Conditional Probability, Independence, and the Product Rule, Bayes' Rule. [TB: Ch. 2]
3. Random Variables and Probability Distributions: Concept of a Random Variable, Discrete Probability Distributions, Continuous Probability Distributions, Joint Probability Distributions. [TB: Ch. 3]
4. Mathematical Expectation: Mean of a Random Variable, Variance and Covariance of Random Variables, Means and Variances of Linear Combinations of Random Variables, Chebyshev's Theorem. [TB: Ch. 4]
5. Discrete Probability Distributions: Binomial and Multinomial Distributions, Hypergeometric Distribution, Negative Binomial and Geometric Distributions, Poisson Distribution and the Poisson Process. [TB: Ch. 5]
6. Continuous Probability Distributions: Continuous Uniform Distribution, Normal Distribution, Areas under the Normal Curve, Applications of the Normal Distribution, Normal Approximation to the Binomial, Gamma and Exponential Distributions, Chi-Squared Distribution, Beta Distribution. [TB: Ch. 6]
7. Fundamental Sampling Distributions and Data Descriptions: Random Sampling, Sampling Distributions, Sampling Distribution of Means and the Central Limit Theorem. Sampling Distribution of S2, t-Distribution, F-Quantile and Probability Plots. [TB: Ch. 8]
8. One- and Two-Sample Estimation Problems: Introduction, Statistical Inference, Classical Methods of Single Sample: Estimating the Mean, Standard Error of a Point, Prediction Intervals, Tolerance Limits, Estimating the Difference between Two Means. [TB: Ch. 9]
9. Single Sample: Estimating a Proportion, Estimating the Difference between Two Proportions, Single Sample: Estimating the Variance, Estimating the Ratio of Two Variances. [TB: Ch. 9]
10. One- and Two-Sample Tests of Hypotheses: Statistical Hypotheses: General Concepts, Testing a Statistical Hypothesis, The Use of P-Values for Decision Making in Testing Hypotheses. [TB: Ch. 10]
11. Single Sample: Tests Concerning a Single Mean, Two Samples: Tests on Two Means, Choice of Sample Size for Testing Means, Graphical Methods for Comparing Means, One Sample: Test on a Single Proportion, Two Samples: Tests on Two Proportions. [TB: Ch. 10]
12. One- and Two-Sample Tests Concerning Variances, Goodness-of-Fit Test, Test for Independence (Categorical Data), Test for Homogeneity [TB: Ch. 10]
13. Simple Linear Regression and Correlation: Introduction to Linear Regression, The Simple Linear Regression Model, Least Squares and the Fitted Model, Properties of the Least Squares Estimators. [TB: Ch. 11]
14. Multiple Linear Regression and Certain: Nonlinear Regression Models, Introduction, Estimating the Coefficients, Linear Regression Model Using Matrices, Properties of the Least Squares Estimators. [TB: Ch. 12]

Textbook(s):

- Probability and Statistics for Engineers and Scientists by Ronald E. Walpole, Raymond H. Myers, Sharon L. Myers and Keying E. Ye, Pearson; 9th Edition (January 6, 2011). ISBN-10: 0321629116

Reference Material:

- Probability and Statistics for Engineers and Scientists by Anthony J. Hayter, Duxbury Press; 3rd Edition (February 3, 2006), ISBN-10: 0495107573
- Schaum's Outline of Probability and Statistics, by John Schiller, R. AluSrinivasan and Murray Spiegel, McGraw-Hill; 3rd Edition (2008). ISBN-10: 0071544259
- Probability: A Very Short Introduction by John Haigh, Oxford University Press (2012). ISBN-10: 0199588481

Course Title: Linear Algebra

Course Code: MATH-3215
Course Structure: Lectures: 3, Labs: 0
Credit Hours: 3
Prerequisites: None

4th Semester

Course Objectives:

To provide fundamentals of solution for system of linear equations, operations on system of equations, matrix properties, solutions and study of their properties.

Course Syllabus:

Introduction to Vectors. Solving Linear Equations. Elimination = Factorization. Vector Spaces and Subspaces. Orthogonally. Determinants. Eigenvalues and Eigenvectors. Graphs and Networks, Markov Matrices, Population, and Economics. Linear Programming. Fourier series. Linear Algebra for Functions, Linear Algebra for Statistics and Probability, Computer Graphics. Numerical Linear Algebra. Complex Vectors and Matrices. Discrete Transforms and Simple Applications.

Course Outline:

1. Introduction to Vectors: Vectors and Linear Combinations, Lengths and Dot Products. Matrices. [TB1: Ch. 1]
2. Solving Linear Equations: Vectors and Linear Equations, the Idea of Elimination, Elimination Using Matrices, Rules for Matrix Operations, Inverse Matrices. [TB1: Ch. 2]
3. Elimination = Factorization; A = LU, Transposes and Permutations
4. Vector Spaces and Subspaces: Spaces of Vectors, The Null space of A: Solving Ax = 0, The Rank and the Row Reduced Form, the Complete Solution to Ax = B, Independence, Basis and Dimension, Dimensions of the Four Subspaces. [TB1: Ch. 3]
5. Orthogonally: Orthogonally of the Four Subspaces, Projections, Least Squares Approximations, Orthogonal Bases and Gram-Schmidt. [TB1: Ch. 4]
6. Determinants: The Properties of Determinants, Permutations and Cofactors, Cramer's Rule, Inverses, and Volumes. [TB1: Ch. 5]
7. Eigenvalues and Eigenvectors: Introduction to Eigenvalues, Diagonalizing a Matrix, Applications to Differential Equations, Symmetric Matrices, Positive Definite Matrices, Similar Matrices, Singular Value Decomposition (SVD). [TB1: Ch. 6]

8. Applications: Matrices in Engineering, Graphs and Networks, Markov Matrices, Population, and Economics; Linear Programming, Fourier series: Linear Algebra for Functions, Linear Algebra for Statistics and Probability, Computer Graphics.
9. Numerical Linear Algebra: Gaussian Elimination in Practice, Norms and Condition Numbers, Iterative Methods for Linear Algebra. [TB1: Ch. 9]
10. Complex Vectors and Matrices: Complex Numbers, Hermitian and Unitary Matrices, Matrix Factorizations. [TB1: Ch. 10]

Textbook(s):

- Introduction to Linear Algebra by Gilbert Strang, Wellesley Cambridge Press; 4th Edition (February 10, 2009). ISBN-10: 0980232716

Reference Material:

- Elementary Linear Algebra with Applications by Bernard Kolman, David Hill, 9th Edition, Prentice Hall PTR, 2007. ISBN-10: 0132296543
- Strang's Linear Algebra And Its Applications by Gilbert Strang, Strang, Brett Coonley, Andy Bulman-Fleming, Andrew Bulman-Fleming, 4th Edition, Brooks/Cole, 2005
- Elementary Linear Algebra: Applications Version by Howard Anton, Chris Rorres, 9th Edition, Wiley, 2005.
- Linear Algebra and Its Applications by David C. Lay, 2nd Edition, Addison-Wesley, 2000.
- Linear Algebra by Harold M. Edwards, Birkhäuser; 1st Edition (2004). ISBN-10: 0817643702
- Linear Algebra: A Modern Introduction by David Poole by Brooks Cole; 3rd Edition (May 25, 2010).ISBN-10: 0538735457

Course Title: Basic Electronics
Course Code: PHY-2210
Course Structure: Lectures: 3 / Labs: 0
Credit Hours: 3
Prerequisites: None

1st Semester

Course Syllabus:

Zero Reference Level, Chassis Ground, Ohm's Law, Linear Resistor, Non Linear Resistor, Cells in Series and Parallel. Resistive Circuits.Resistors, Inductors, Capacitors, Energy Sources.Magnetism and Electromagnetism.Theory of Solid State.P-N Junction. Forward Biased P-N Junction, Forward V/I Characteristics, Reverse Biased P-N Junction, Reverse Saturation Current, Reverse V/I Characteristics, Junction Breakdown, Junction Capacitance. Optoelectronics Devices. Spectral Response of Human Eye, Light Emitting Diode (LED), Photoemissive Devices, Photomultiplier Tube, Photovoltaic Devices, Bulk Type Photoconductive Cells, Photodiodes, P-N Junction Photodiode, PIN Photodiode, and Avalanche Photodiode. DC Power Supplies.Rectifiers. Filters, Voltage Multipliers, Silicon Controlled Rectifier SCR. The Basic Transistor.Transistor Biasing, Transistor Circuit Configuration.Modulation and Demodulation. Carrier Waves, Modulation, Demodulation Or Detection,.Integrated Circuits.Introduction to Operational Amplifier.Fiber Optics.

Course Outline:

1. Zero Reference Level, Chassis Ground, Ohm's Law, Formula Variations of Ohm's Law, Graphical Representation of Ohm's Law, Linear Resistor, Non Linear Resistor, Cells in Series and Parallel.[Ch 1]
2. Resistive Circuits. [Ch 2]
3. Resistors(5.1-15), Inductors(5.19-21) Capacitors(5.35-48) .[Ch 5]
4. Energy Sources. [Ch 6]
5. Magnetism and electromagnetism [Ch 7].
6. Solid State. Atomic structure, Electron distribution of different atoms, Energy bands in solids, Bonds in solids, Conduction in solids, Conductors, Semiconductors and types of semiconductors, Insulators, Majority and Minority charge carriers, Mobile charge carriers and immobile ions, Drift current in good conductors.[Ch 12]
7. P-N Junction. Formation of depletion layer, Junction or barrier voltage, Forward biased P-N Junction, Forward V/I Characteristics, Reverse biased P-N Junction, Reverse Saturation Current, Reverse V/I Characteristics, Junction breakdown, Junction Capacitance. [Ch 13]
8. Optoelectronics Devices. Spectral response of human eye, Light Emitting Diode (LED), Photoemissive Devices, Photomultiplier Tube, Photovoltaic Devices, Bulk type Photoconductive cells, Photodiodes, P-N junction Photodiode, PIN Photodiode, and Avalanche Photodiode. [Ch 16]
9. DC Power Supplies. Unregulated and Regulated Power Supply, Steady and Pulsating DC Voltages, Rectifiers (17.5-17.8), Filters (17.9-17.2), Voltage Multipliers (17.24-17.30), Silicon Controlled Rectifier SCR(17.33-17.37)[Ch 17]
10. The Basic Transistor. Transistor Biasing, Transistor Circuit Configuration. [Ch 18]
11. Modulation and Demodulation. Carrier Waves, Modulation, Demodulation or Detection, Comparison between Amplitude Modulation (AM) and Frequency Modulation (FM). [Ch 30]
12. Integrated Circuits. Advantages of ICs and Drawbacks of ICs, Scale of Integration, Classification of ICs by function, Linear and Digital Integrated Circuits, IC Terminology, Fabrication of IC Components, Popular Application of ICs, Operational Amplifier. [Ch 31]
13. Fibre Optics. Structure of Optical Fibres, Classification of Optical Fibres, Fibre Characteristics, Choice of Wavelength, Optical Fibre cable, Application of Fibre Optic Communication. [Ch 38]

Textbook(s):

- Basic Electronics Solid State by B. L. Theraja, S Chand & Co Ltd, 5th Edition, 2007, ISBN-13: 978-8121925563

Reference Material:

- Electronic Principles by Albert Paul Malvino, Sixth Edition, 1999, ISBN 0-07-115604-6

Contents of General Education Courses

Course Title: Functional English(English I)
Course Code: ENG-2411
Course Structure: Lectures: 3/ Labs: 0
Credit Hours: 3
Prerequisites: None

1st Semester

Course Objectives:
In today's employment market employers are looking for people who can articulate clearly, take and pass on messages, deal with customers effectively, read, understand and follow a wide range of documents and write fluently and accurately, using accepted business conventions of format, spelling, grammar and punctuation. Functional English course is developed to strengthen students' these skills which enable them to deal with the practical problems and challenges of life – at home, in education and at work.

Course Syllabus:
Punctuation.Writing Mechanics. Vocabulary: Frequently Confused Words, Frequently Misused Words, Phrases, Synonyms, Antonyms, Idioms, General Vocabulary. Use Of Articles and One, A Little/ A Few, This, That, Care, Like, Love, Hate, Prefer, Wish, All, Each, Every, Both, Neither, Either, Some, Any, No, None. Interrogatives.Kins of Nouns.Prepositions. Possessive, Personal, Reflexive, and Relative Pronouns and Clauses. Classes of Verbs. Usage of May, Can, Ought, Should, Must, Have To, Need for Obligation; Must, Have, Will and Should. The Auxiliaries Dare and Used. Present, Past, Future and Perfect Tenses. The Gerund &The Participles. Commands, Requests, Invitations, Advice, Suggestions.The Subjunctive. The Passive Voice; Indirect Speech, Conjunctions, Purpose. Clauses: Noun Clauses; Clauses of Reason, Result, Concession, Comparison, Time. Numerals, Dates, and Weights and Measures.Spelling Rules.Phrasal Verbs.Irregular Verbs.

Course Outline:
1. Punctuation: Periods, Question Marks, Exclamation Marks, Semicolons, Colons, Commas, Apostrophes, Quotation Marks.
2. Writing Mechanics: Capitals, Abbreviations; Vocabulary: Frequently Confused Words, Frequently Misused Words,
3. Vocabulary: Phrases, Synonyms, Antonyms, Idioms, General Vocabulary
4. Use Of Articles And One, A Little/ A Few, This, That, Care, Like, Love, Hate, Prefer, Wish, All, Each, Every, Both, Neither, Either, Some, Any, No, None; Interrogatives: Wh-? Words And How?
5. Kins of Nouns; Kinds of Adjectives; Adverbs: Kinds, Form, Position and Use
6. Prepositions; Possessive, Personal and Reflexive Pronouns; Relative Pronouns and Clauses
7. Classes of Verbs: Ordinary Verbs, Auxiliary Verbs (Be, Have, Do); May and Can for Permission and Possibility; Can and Be Able for Ability; Ought, Should, Must, Have To, Need for Obligation; Must, Have, Will and Should for Deduction and Assumption; The Auxiliaries Dare and Used
8. The Present Tenses
9. The Past and Perfect Tenses
10. The Future; The Infinitive
11. The Gerund & The Participles; Commands, Requests, Invitations, Advice, Suggestions;

The Subjunctive
12. The Passive Voice; Indirect Speech
13. Conjunctions, Purpose
14. Clauses: Noun Clauses; Clauses of Reason, Result, Concession, Comparison, Time
15. Numerals, Dates, and Weights And Measures; Spelling Rules;
16. Phrasal Verbs; List Of Irregular Verbs

Textbook(s):

- A Practical English Grammar by A. J. Thomson and A. V. Martinet,4th Edition Oxford University Press (1986).
- Basic English Usage by Michael Swan, Oxford UnivPr (Sd) (January 1986). ISBN-10: 0194311872

Reference Material:

- Functional English In Aglobal Society: Vocabulary Building and Communicative Grammar by Nicanor L. Guintomary Ann R. Sibal Brian D. Villaverde Dept. of Languages, Literature and Humanities College of Arts and Sciences Southern Luzon State University (2012).
- AQA Functional English Student Book: Pass Level 2 by Mr David Stone, Heinemann; 1st Edition (28 Jun 2010). ISBN-10: 0435151401
- English Composition and Grammar: Complete Course by John E. Warriner, Harcourt Brace Jovanovich; Complete Course Benchmark Edition (January 1988). ISBN-10: 0153117362
- Companion to English: Vocabulary (Learners Companion) by George Davidson, Prim-Ed Publishing (March 1, 2003). ISBN-10: 9814070904
- Word Power Made Easy by Norman and Lewis, Goyal Publishers (September 1, 2009). ISBN-10: 8183071007
- 1000 Most Important Words by Norman W. Schur, Ballantine Books (July 12, 1982). ISBN-10: 0345298632
- High School English Grammar and Composition by P.C Wren, Chand & Co (July 13, 2008). ISBN-10: 812192197X

Course Title: Communication Skills (English II)

Course Code: ENG-2412
Course Structure: Lectures: 3/ Labs: 0
Credit Hours: 3
Prerequisites: None

2nd Smester

Course Objectives:

- To sensitize students to their communicative behavior
- To enable them to reflect and improve on their communicative behavior/performance
- To build capacities for self criticism and facilitate growth
- To lead students to effective performances in communication

Course Syllabus:

Communication.The Communication Process.Perspectives in Communication.Internal

Representation.Elements of Communication.Listening.Expressing.Clarifying Language.Making Contact.Prejudgment.Influencing Others.Public Speaking. Preparing A Formal Oral Presentation. Delivering Presentation.Interviewing.Effective Written Communication.Building Rapport.

Course Outline:

1. Communication Skills: What Is Communication, The Importance of Communication, What Are Communication Skills? The Communication Process : Source, Message, Encoding, Channel , Decoding , Receiver, Feedback, Context . Perspectives in Communication: Introduction, Visual Perception, Language, Other Factors Affecting Communication Perspective, Past Experiences, Prejudices, Feelings, Mood, Relationship, Environment.
2. Internal Representation:Introduction, Internal Representation of Our World, Language as a Representational System, Verbal Clues, Visual Representation System, Auditory Representational System, Kinaesthetic Representational System, Auditory Digital Representational System, Eye Movements as an Indication, Visual Recall, Visual Construct, Auditory Recall, Auditory Construct, Kinaesthetic, Internal Auditory, Phrases for Use in Response to Each Representational System.
3. Elements of Communication:Introduction, Face to Face Communication, Tone of Voice, Body Language, Verbal Communication, Physical Communication. Communication Styles: Introduction, The Communication Styles Matrix, Direct Communication Style, Spirited Communication Style, Systematic Communication Style, Considerate Communication Style, Examples of Communication for Each Style, Direct Style, Spirited Style, Systematic Style Considerate Style.
4. Listening: Real Vs. Introduction, Self-Awareness, Pseudo Listening, Active Listening, Blocks to Listening, Assessing Your Listening, Four Steps to Effective Listening, Total Listing, Becoming an Active Listener.
5. Expressing: The Four Kinds of Expression, Whole Message, Contaminated Messages, Preparing Your Message, Practicing Whole Message, Rules of Effective Expression. Body Language: Body Movement, Spatial Relationships. Paralanguage and Meta-messages: The Element of Paralanguage, Changing Your Paralanguage, Meta-message, Coping with Meta-message. Hidden Agendas: The Eight Agendas, Purpose of the Agenda.
6. Clarifying Language: Understanding a Model, Challenging the Limits of a Model, Challenging Distortion in a Model. Assertiveness: Your Legitimate Right, Three Communication Styles, Identifying Communication Style, Your Assertive Goals, Assertive Expression and Listening, Combining Assertive Expression and Listening. Responding to Criticism, Special Assertive Strategies.
7. Making Contact: Fear of Stranger, Guidelines for Making Contact, The Art of Conversation, Putting It All Together. Negotiations: Four Stages of Negotiation, Dealing with Conflicts, Rules of Principles Negotiation, When The Going Get Tough.
8. Prejudgment: Prejudgment Traps, Stereotypes, Approval and Disapproval in Prejudgment, Parataxic Distortion, Perpetuating Illusion, Clarifying First Impression. Validation Strategies: What is validation, Why Does Validation Work? What Validation Is Not? Components of Validation, Successful Validation Strategies, The Power of Validation.
9. Influencing Others: What is Persuasion? Persuading Audience, Ineffective Strategies for Influencing Change, Effective Strategies, for Influencing Others, Your Plan for

Influencing Change, Lisa's Plan for Influencing Change Art of Persuasion.

10. Public Speaking: Defining Your Purpose, Outlining The Subject, Presentation, Organization, Audience Analysis, Style, Supporting Materials, The Outline, Delivery, Dealing with Stage Fright.
11. Preparing A Formal Oral Presentation:Presentation Design: Introduction, Consistency, Aspects of Consistency Language, Color, Fonts, Images, Contrast, Alignment, Simplicity, White Spaces, Charts, Graphics & Tables, How to Choose Which Type of Graph to Use? Graph Types, Multimedia Presentations, Adding Quotations.
12. Delivering Presentation: Introduction, Delivery,Managing Voice, Passion, Language, Movement, Facial Expressions, Body Language, Some Useful Tips: Active Listening, Inventing Stories, Feed back, Preliminary Preparations Proximity, Tension & Nerves, Questions, Tips to Handle Questions, Habits, Handling Tough Situations, Common Mistakes & Their Remedies, Dealing with Unexpected Disasters, Presentation for International Audience, Dealing People with Disabilities, Things to Remembers, Last Minute Tips.
13. Interviewing:Clarifying What You Want, If You are the Interviewer, If You Are the Interviewee.
14. Effective Written Communication: Introduction, When and When Not to Use Written Communication, Complexity of the Topic, Amount of 'Discussion' Required, Shades of Meaning Formal Communication, Writing Effectively, Subject Lines, Put the Main Point First, Know Your Audience, Organization of the Message.
15. Building Rapport:Introduction, Six Steps to Building Rapport, Match the Person's Sensory Modality, Mirror the Person's Physiology, Match the Person's Voice, Match the Person's Breathing, Match the Way the Person Deals with Information, Match Common Experiences, Calibration, Perceptual Positions.

Textbook(s):

- Effective Communication Skills, MTD Training &Ventus Publishing ApS.(2010) ISBN 978-87-7681-598-1 (TB1)
- Messages: The Communication Skills Book by Matthew McKay PhD , Martha Davis PhD, and Patrick Fanning, New Harbinger Publications; Third Edition (March 3, 2009). ISBN-10: 1572245921
- Secrets of Successful Presenters: A Guide for Successful Presenters by Dr. M. A. Pasha &Dr. S. Pasha, Lambert Academic Publishing (2012). ISBN-10:3659217557

Reference Material:

- Communication Skills in English by Prof P N Kharu, Dr.Varinder Gandhi Publisher: Laxmi. EAN: 9788131806920
- Essential Communication Skills: Teacher Edition with Talking Points by Patty Ann, Patty Ann; 1st Edition (July 5, 2012). ASIN: B008HYUDWQ
- Communication Skills Magic: Improve Your Relationships & Productivity through Better Understanding Your Personality Style and the Personality Styles of Those Around You by E.G. Sebastian, CreateSpace Independent Publishing Platform (January 5, 2010). ISBN-10: 1450513344
- People Skills: How to Assert Yourself, Listen to Others, and Resolve Conflicts by Robert Bolton,Touchstone (June 6, 1986). ISBN-10: 067162248X

- The Handbook of Communication Skills by Owen Hargie, Routledge; 4th Edition, Taylor & Francis, (12-Oct-2012).

Course Title: Technical and Business Writing (English III)
Course Code: ENG-2413
Course Structure: Lectures: 3/ Labs: 0
Credit Hours: 3
Prerequisites:None

3rd Semester

Course Objectives:
To effectively plan and structure technical reports and to recognize the various stages in writing a technical report.

Course Syllabus:
Writing for Readers.Academic, Public, and Work Communities.Analyzing Electronic Communities.Discovering and Planning. Purpose, Thesis, and Audience.Drafting. Revising, Editing, and Proofreading. Paragraphs.Clear and Emphatic Sentences.Reasoning Critically.Reading Critically.Arguing Persuasively.Designing Documents.Writing in Online Communities.Speaking Effectively. Academic Writing for Social and Natural Sciences. Public Writing. Researching and Writing.

Course Outline:
1. Writing for Readers: Academic, Public, and Work Communities; Analyzing Electronic Communities; c. Myths and Realities about Writing.
2. Discovering and Planning: Discovering Topics; Generating Ideas; Organizing Information; Planning in Digital Environments.
3. Purpose, Thesis, and Audience: Identifying Your Focus and Purpose; Creating a Thesis; Understanding Your Readers.
4. Drafting: Moving from Planning to Drafting, Drafting Collaboratively, Drafting in Digital Environments.
5. Revising, Editing, and Proofreading: Making Major Revisions; Making Minor Revisions; Revising Collaboratively; Revising in Digital Environments; Editing; Editing Collaboratively; Proofreading.
6. Paragraphs: Unfocused Paragraphs; Revising for Focus; Incoherent Paragraphs; Revising for Coherence; Poorly Developed Paragraphs; Revising for Development; Using Special-Purpose Paragraphs.
7. Clear and Emphatic Sentences: Unclear Sentences; Revising for Clear Sentences; Revising for Variety and Emphasis.
8. Reasoning Critically: Recognizing Critical Reasoning, Building a Chain of Reasoning, Representing Your Reasoning.
9. Reading Critically: Reading to Understand; Reading to Respond and Evaluate; Using Journals to Turn Reading into Writing.
10. Arguing Persuasively: Recognizing an Issue, Developing Your Stance, Creating an Argumentative Thesis, Developing Reasons and Evidence, Acknowledging Other Perspectives, Arguing Logically, Writing a Position Paper.
11. Designing Documents: Goals of Document Design, Format Choice, Layout, Type

Choice, Visuals, Sample Documents. Creating a Visual Argument: Presenting an Issue, Providing Evidence.

12. Writing in Online Communities: Online Expectations, E-mail Conventions, Online Communities, Web Pages, Avoiding Plagiarism and Behaving Ethically Online.
13. Speaking Effectively: Oral Presentations, Preparing an Oral Presentation, Managing Speech Anxiety, Fielding Questions.
14. Academic Writing: Social and Natural Sciences: Goals of Writing in the Social and Natural Sciences, Audiences in the Social and Natural Sciences, Writing Tasks in the Social and Natural Sciences, Types of Writing in the Social and Natural Sciences, Abstract, Informative Report, Lab Report, Research Report,
15. Public Writing: Goals of Public Writing, Public Audiences, Public Writing Tasks, Types of Public Writing, Public Flyer, Letter to the Editor, Oral Presentation.
16. Researching and Writing: Beginning Your Research, Types of Research Writing, Developing a Research Question, Developing a Preliminary Thesis, Creating a Research File and a Timeline, Reading and Notetaking, Summarizing, Paraphrasing, and Synthesizing.

Textbook(s):

- Writer's Companion – The Longman by Chris M. Anson, Robert A. Schwegler and Marcia F. Muth, Pearson Longman, 4th Edition (2007) . ISBN10: 0-20556-252-3

Reference Material:

- Technical English: Writing, Reading, and Speaking by Pickett and Laster. 8th Edition
- The Technical Writer's Companion byAlred, Gerald, Charles T. Brusaw and Walter E. Oliu, 3rd Edition. ISBN 0-312-25978-6.

Course Title: Islamic Studies

1st Semester

Course Code: SS-2311
Course Structure: Lectures: 2 / Labs: 0
Credit Hours: 2
Prerequisites: None

Course Objectives:

This course is aimed at:

- To provide Basic information about Islamic Studies
- To enhance understanding of the students regarding Islamic Civilization
- To improve Students skill to perform prayers and other worships
- To enhance the skill of the students for understanding of issues related to faith and religious life.

Course Syllabus:

Attached as Annexure A

Course Title: Pakistan Studies

Course Code: SS-2312
Course Structure: Lectures: 2/ Labs:0
Credit Hours: 2
Prerequisites: None

Course Objectives:

- Develop vision of historical perspective, government, politics, contemporary Pakistan, ideological background of Pakistan.
- Study the process of governance, national development, issues arising in the modern age and posing challenges to Pakistan.

Course Syllabus:
Attached as Annexure B

Course Title: Introduction to Information & Communication Technologies

Course Code: ICT-2021
Course Structure: Lectures: 3/Labs: 1
1st Semester
Credit Hours: 4
Prerequisites: None

Course Objectives:
The course introduces students to information and communication technologies and their application in the workplace. Students will get basic understanding of computer software, hardware, and associated technologies. They will also learn how computers are used in the workplace, how communications systems can help boost productivity, and how the Internet technologies can influence the workplace.

Course Syllabus:
Introduction to Computers, The Internet and World Wide Web, Application Software, The System Unit, Input Devices, Output Devices, Storage, System Software, Communications, Databases, Computer Security and Safety, Ethics, and Privacy.

Course Outline:

1. **Introduction to Computers:** Data and Information, Information Processing Cycle, the Components of a Computer, Advantages and Disadvantages of Using Computers. Networks and the Internet. Computer Software, Categories of Computers, Elements of an Information System, Examples of Computer Usage, Computer Applications in Society [Ch. 1].
2. **The Internet and World Wide Web**: Key Concepts of the Internet, Evolution of the Internet, The World Wide Web, E-Commerce, Other Internet Services, Netiquette [Ch. 2].
3. **Application Software:** Business Software, Graphics and Multimedia Software, Software for Home, Personal, and Educational Use, Web Applications, Application Software for Communications. [Ch. 3]

4. **The System Unit:** Processor, Data Representation, Memory, Expansion Slots and Adapter Cards, Ports and Connectors, Buses, Bays, Power Supply. [Ch. 4]
5. **Input Devices:** What Is Input? What Are Input Devices? The Keyboard, Pointing Devices, Mouse, Other Pointing Devices, Touch Screens And Touch-Sensitive Pads, Pen Input, Other Input For Smart Phones, Game Controllers, Digital Cameras, Voice Input, Video Input, Scanners And Reading Devices, Biometric Input, Terminals, Putting It All Together, Input Devices For Physically Challenged Users. [Ch. 5]
6. **Output Devices:** What is Output? Display Devices, Printers, Speakers, Headphones, and Earbuds, Other Output Devices. [Ch. 6]
7. **Storage:** Hard Disks, Flash Memory Storage, Cloud Storage, Optical Discs, Other Types of Storage. [Ch. 7]
8. **System Software:** Operating Systems, Operating System Functions, Types Of Operating Systems, Stand-Alone Operating Systems, Server Operating Systems, Embedded Operating Systems, Utility Programs [Ch. 8]
9. **Communications:** Uses of Computer Communications, Networks, Network Communications Standards, Communications Software, Communications over the Telephone Network, Communications Devices, Home Networks, Communications Channel, Physical Transmission Media, Wireless Transmission Media. [Ch. 9]
10. **Databases:** Data, and Information, The Hierarchy of Data, Maintaining Data, File Processing Versus Databases, Database Management Systems, Relational, Object-Oriented, and Multidimensional Databases, Web Databases, Database Administration
11. **Computer Security and Safety, Ethics, and Privacy:** Computer Security Risks, Internet And Network Attacks, Unauthorized Access And Use, Hardware Theft And Vandalism, Software Theft, Information Theft, System Failure, Backing Up, Wireless Security, Health Concerns Of Computer Use, Ethics And Society

Labs:
Lab work should be carried out to develop students' Computer Skills, Operating Systems and Utility Software Skills, E-Mail Skills, Word Processing Skills, Spreadsheet Skills, Electronic Presentation Skills, Web Surfing Skills.

Textbook(s):
- Discovering Computers by Gary B. Shelly & Misty E. Vermaat, Course Technology; 1st Edition (January 25, 2011).

Reference Material
- Computing Essentials 2012 by Timothy J. O'Leary and Linda I. O'Leary, McGraw Hill Higher Education; 22nd Revised Edition (February 1, 2011).
- Computers: Understanding Technology by Fuller, Floyd; Larson, Brian, Fourth Edition, ISBN: 978-0-76383-927-7 (OR Latest Edition.)
- The Concepts of Information Technology by Imran Saeed, Afsan Raza, Tariq Mahmood and Zafar Hussain, 6th Edition, IT Series Publications.

- The Essential Guide to Computing: The Story of Information Technology by by E Garrison Walters, Prentice Hall PTR (August 11, 2000). ISBN-10: 0130194697
- Computer Applications by Tasleem Mustafa, Tariq Mahmood, Imran Saeed and Zahid Javed, IT Publication Series

Course Title: Professional Practices

Course Code: SS-4910
Course Structure: Lectures:3/ Labs: 0
Credit Hours: 3
Prerequisites: None

8th Semester

Course Objectives:

A Computing graduate as professional has some responsibilities with respect to the society. This course develops student understanding about historical, social, economic, ethical, and professional issues related to the discipline of Computing. It identifies key sources for information and opinion about professionalism and ethics. Students analyze, evaluate, and assess ethical and professional computing case studies.

Course Outline:

The Engineering Profession, The Structure of Organizations, Finance and Accounting, Anatomy of a Software House, Computer Contracts, Intellectual Property Rights, The Framework of Employee Relations Law and Changing Management Practices, Human Resource Management and Software Engineering, Health and Safety at Work, Software Liability, Liability and Practice, Computer Misuse and the Criminal Law, Regulation and Control of Personal Information. Overview of the British Computer Society Code of Conduct, IEEE Code of Ethics, ACM Code of Ethics and Professional Conduct, ACM/IEEE Software Engineering Code of Ethics and Professional Practice.

Course Outline:

1. The Engineering Profession [TB: Ch. 1]
2. The Structure of Organizations [TB: Ch. 2]
3. Finance and Accounting [TB: Ch. 3]
4. Anatomy of a Software House [TB: Ch. 4]
5. Computer Contracts [TB: Ch. 5]
6. Intellectual Property Rights [TB: Ch. 6]
7. The Framework of Employee Relations Law and Changing Management Practices [TB: Ch. 7]
8. Human Resource Management and Software Engineering [TB: Ch. 8]
9. Health and Safety at Work [TB: Ch. 9]
10. Software Liability: Liability and Practice [TB: Ch. 10]
11. Computer Misuse and the Criminal Law [TB: Ch. 11]
12. Regulation and Control of Personal Information: Data Protection, Defamation and Related Issues [TB: Ch. 12]
13. The British Computer Society Code of Conduct [Online]
14. IEEE Code of Ethics [Online]
15. ACM Code of Ethics and Professional Conduct [Online]

16. ACM/IEEE Software Engineering Code of Ethics and Professional Practice [Online]

Textbook(s):

- Professional Issues in Software Engineering by Frank Bott, Allison Coleman, Jack Eaton and Diane Rowland, CRC Press; 3rd Edition (2000). ISBN-10: 0748409513
- Online Resources

Reference Material:

- A Gift of Fire: Social, Legal, and Ethical Issues for Computing and the Internet (3rd Edition) by Sara Baase, Prentice Hall; 3rd Edition (2008). ISBN-10: 0136008488
- Applied Professional Ethics by Gregory R. Beabout, University Press Of America (1993). ISBN-10: 0819193747.
- The Dark Side of Software Engineering: Evil on Computing Projects by Johann Rost and Robert L. Glass, Wiley-IEEE Computer Society Pr; 1st Edition (2011). ISBN-10: 0470597178
- Software Engineering Best Practices: Lessons from Successful Projects in the Top Companies by Capers Jones, McGraw-Hill Osborne Media; 1st Edition (2009). ISBN-10: 007162161X

Contents of University Elective Courses

Course Title: Financial Accounting
Course Code: MNG-2210
Course Structure: Lectures: 3/ Labs: 0
3rd Smester)
Credit Hours: 3
Prerequisites: None

Course Objectives:
This course intends to introduce students with knowledge of Financial Accounting required to help them to understand the process of financial management required to develop modern accounting information systems.

Course Syllabus:
Introduction to Accounting, Accounting Principles, Book Keeping, Basics of Financial Statements, Adjustments to Financial Statements, The Cash Book, Bank Reconciliation, Control Accounts, Property, Plant and Equipment (PPE), Accounting Errors, Accounting for Partnerships, Balance Sheet, Financial Asset, Accounting for inventories. Funds flow statement and simple cash flow activities.

Course Outline:

1. Introduction to Accounting: Nature, Purpose and Scope of Accounting, Objectives of Accounting, Users of Accounting Information and Their Respective Needs, Qualities of Useful Accounting Information, Accounting Principles: Going Concern, Accruals, Consistency, Prudence, Business Entity, Duality, Monetary Measurement, Substance Over Form, Realization.
2. Book Keeping: The Accounting Cycle, Double Entry Book-Keeping and Books of Original Entry, The Ledgers, Cash Book and the Trial Balance.
3. Basic Financial Statements: Structure of Financial Statements for a Sole Trader,

Statement of Financial Position (The Balance Sheet) for A Sole Trader.

4. Adjustments to Financial Statements: Carriage In and Carriage Out, Bad Debts, Bad and Doubtful Receivables, Bad Debts Recovered, Drawings, Discount Received and Allowed, Accrued and Prepaid Income and Expenses and Depreciation and Disposal of Property, Plant and Equipment.
5. The Cash Book: Two Column Cashbook, Three Column Cashbook, Analytical Cashbook and The Petty Cashbook.
6. Expected Learning Outcomes: Purpose of Bank Reconciliation, Causes of Differences Between Cash and Bank Balances, Bank Reconciliation Process, Bank Overdrafts, and DishonouredCheques.
7. Control Accounts: Uses of Control Accounts, Sales and Purchases Ledger Control Accounts.
8. Property, Plant and Equipment (PPE): Classification of Long-Term Assets, Accounting For PPE, Revenue and Capital Expenditure, Relevant Cost of PPE, Methods of Estimating Depreciation, Revaluation Method, Revaluation of PPE, Exchange of Assets, Disposal of Assets, Schedule of PPE and Presentation and Disclosure of PPE in the Financial Statements.
9. Accounting Errors: Types of Accounting Errors, Errors Not Affecting the Trial Balance and Errors Affecting the Trial Balance.Adjusted Trial Balance, Closing entries and post-closing Trial Balance.
10. Accounting for Partnerships: Introduction to Partnerships, Partnership Agreements, Appropriation of Profit, Personalaccounts, Partners Loan Accounts.

Textbook(s):

- Financial & Managerial Accounting by Jan Williams, Sue Haka, Mark Bettner and Joseph Carcello, McGraw-Hill/Irwin; 16th Edition (2011). ISBN-10: 0078111048

Reference Material:

- Fundamental Accounting Principles with Connect Plus by John Wild, Ken Shaw, and Barbara Chiappetta, McGraw-Hill/Irwin; 20th Edition (December 27, 2010). ISBN-10: 0077505980
- Principles of Managerial Finance by Lawrence J. Gitman and Chad J. Zutter, Prentice Hall; 13th Edition (2011). ISBN-10: 0136119468
- Accounting Principles by Jack L. Smith, Robert M. Keith and William L. Stephens, McGraw-Hill Companies, 3rd Edition (1993). ISBN-10: 0070430748
- Accounting: A Business Perspective (Irwin/Mcgraw-Hill Series in Principles of Accounting) by Roger H. Hermanson, James Don Edwards and Michael W. Maher (1998).ISBN-10: 0075615851

Course Title: Principles of Management
Course Code: MNG-2212
Course Structure: Lectures: 3 / Labs: 0
Credit Hours: 3
Prerequisites: None

6th Term

Course Objectives:

The course will cover topics fundamentals and principles of management, administrative police, objectives, and procedures and problems of organizational control and leadership.

Course Syllabus:

Introduction to Managers and Management.Organizational Culture and Environment. Decision Making - The Essence of Manager's Job. Planning.Organization Structure and Design.Motivation.Leadership.Communication. Controlling - Foundations of Control. The Personnel Function.Job Design and Analysis.Human Resource Planning.Recruitment and Selections/Testing and Interview.Union and Management, Compensation Administration, Health and Safety.

Course Outline:

1. Introduction to Managers and Management: What as Management and What Do Managers Do? Defining Management, Management Functions, Management Roles, Management Skills, History of Management.[TB2: Ch. 1]
2. Organizational Culture and Environment: The Manager: Omnipotent or Symbolic? The Organization's Culture, The Environment - Defining Environment, The Specific Environment, The General Environment, Influence on Management Practice. [TB1: Ch. 3]
3. Decision Making The Essence of Manager's Job: The Decision Making Process, The Rational Decision Maker, Decision Making Styles, Analyzing Decision Alternatives – Certainty, Risk, Uncertainty. [TB1: Ch. 6]
4. Planning: The Foundations of Planning, The Definition of Planning, Purposes of Planning, Types of Plans, Contingency Factors on Planning, Objectives: The Foundation for Planning, Multiplicity of Objectives, Real Versus Stated Objectives, Traditional Objective Setting, Management by Objectives. [TB2: Ch. 3]
5. Organization Structure and Design: Defining Organization Structure and Design, Building, The Vertical Dimension of Organizations, Building the Horizontal Dimension of Organizations, The Contingency Approach to Organization Design, Application of Organization Design.
6. Motivation: Motivating Employees, What is Motivation? Contemporary Approaches to Motivation, Contemporary Issues in Motivation, From Theory to Practice: Suggestions for Motivating Employees. [TB2: Ch. 10]
7. Leadership: Managers Verses Leaders, Trait Theories, Behavioral Theories, Contingency Theories, Emerging Approaches to Leadership, Contemporary Issues in Leadership. [TB2: Ch. 11]
8. Communication: Communication and Interpersonal Skills, Understanding Communication, Communication Styles of Men And Women, Feedback Skills, Delegation Skills', Conflict Management Skills, Negotiation Skills [TB2: Ch. 12]
9. Controlling - Foundations of Control: What is Control? The Importance of Control, The Control Process, Types of Control, Qualities of Effective Control, The Dysfunctional Side of Control, Ethical Issues in Control; Controlling Tools and Techniques: Information Controls, Financial Controls, Operations Controls, Behavioral Controls. [TB2: Ch. 13]
10. The Personnel Function: Terminology, Who Does Personnel Work? Staff Role of The Personnel Department Personnel (Human Resource) Functions. [TB3: Ch. 1 & 2]
11. Job Design and Analysis: Job Design, Job Information and Personnel Management,

Analyzing Jobs-Obtaining Job Information, Functional Job Analysis, Administration of The Job Analysis Program. [TB3: Ch. 6 & 7]

12. Human Resource Planning: Reasons for Human Resource Planning, The Planning Process. [TB3: Ch. 5]
13. Recruitment and Selections/Testing and Interview: Labor Market Considerations. Recruitment and Selection Policy Issues, The Employment Process, Sources of People, The Selection Process, The Selection Procedure, Testing: Interview. [TB3: Ch. 6 & 7]
14. Miscellaneous: Union and Management, Compensation Administration, Health And Safety [TB2: Ch. 15, 17 & 18]

Textbook(s)

1. Management by Robbins, S.P. & Coulter, Mary, Prentice Hall; 10th Edition (November 3, 2008). ISBN-10: 0132090716
2. Fundamentals of Management by Robbins, S.P. &DeCenzo, David A. Prentice Hall; 7th Edition (January 13, 2010). ISBN-13: 978-0132090711
3. Human Resource Management by David A. DeCenzo and Stephen P. Robbins. Wiley; 7th Edition (October 10, 2001). ISBN-10: 0471397857

Reference Material:

- Principles of Management by Charles W. L. Hill and Steven McShane, McGraw-Hill/Irwin; 1st Edition (2006). ISBN-10: 0073530123
- Principles of Management by Mason Carpenter, Flat World Knowledge, Inc. (2009). ISBN-10: 0982043074
- Management by Richard L. Daft, South-Western College Pub; 10th Edition (January 27, 2011). ISBN-10: 0538479531
- Fundamentals of Management by Stephen P. Robbins, David A. DeCenzo and Mary Coulter, Prentice Hall; 7th Edition (January 13, 2010). ISBN-10: 0136109829

Course Title: Principles of Philosophy
Course Code: SS-2511
Course Structure: Lectures: 3/Labs: 0
Credit Hours: **3**
Prerequisites: **None**

5th Term

Course Objectives:

The overall goal of this course is to provide students with the basic understanding required to conduct and critique epidemiological studies.

Course Syllabus:

The Nature of Philosophy. Philosophical Theories: History and Back Ground, Realism and Idealism, Monism and Dualism, Rationalism, Empiricism, Criticism, and Empiricism. The Start of Modern Philosophy.Perception and Reality.Knowledge, Belief and Logic.Space, Time, Causality and Substance.Mind & Body.Knowledge.Language.Science.Morality.Politics.Law.Metaphysics.

Course Outline:

1. The Nature of Philosophy. [TB1: 1]

2. Philosophical Theories: History and Back Ground, Realism and Idealism, Monism and Dualism, Rationalism, Empiricism, Criticism, and Empiricism [TB3: Ch. 12, 13, 14,15]
3. The Start of Modern Philosophy [TB1: 2]
4. Perception and Reality [TB1: 3]
5. Knowledge, Belief and Logic [TB1: 4]
6. Space, Time, Causality and Substance [TB1: 5]
7. Mind & Body [TB2: 1]
8. Knowledge [TB2: 2]
9. Language [TB2: 3]
10. Science [TB2: 4]
11. Morality [TB2: 5]
12. Politics [TB2: 6]
13. Law [TB2: 7]
14. Metaphysics [TB2: 8]

Textbook(s):

1. An Introduction to Philosophy by Jon Nuttall, Polity; 1st Edition (July 29, 2002). ISBN-10: 0745616631
2. Thinking It Through: An Introduction to Contemporary Philosophy by Kwame Anthony Appiah, Oxford University Press, USA (November 6, 2003). ISBN-10: 0195134583
3. An Introduction To Philosophy by George Stuart Fullerton, CreateSpace Independent Publishing Platform (July 18, 2011). ISBN-10: 1463688881

Reference Material:

- Philosophy: An Introduction to the Art of Wondering by James L. Christian, Wadsworth Publishing; 11th Edition (January 26, 2011). ISBN-10: 1111298084
- Pleasures of Philosophy by Durant, Touchstone; Revised Edition (December 31, 1999). ISBN-13: 978-0671581107
- Philosophy Basics: A Jargon-Free Guide for Beginners by Doug Erlandson, Doug Erlandson (September 15, 2011). ASIN: B005NJRTUW
- Introduction to Philosophy by William James Earle, McGraw-Hill; 1st Edition (October 1, 1991). ISBN-10: 0070187835

Course Title: Principles of Psychology

Course Code: SS-2410
Course Structure: Lectures: 3/Labs: 0
Credit Hours: 3
Prerequisites: None

Course Objectives:

The course provides an overview of the history and major issues of psychology, including learning and perception, personality theories, abnormal behavior, motivation and emotion, human development, social psychology.

Course Syllabus:
Attached as Annexure C

Course Title: Foreign/Regional Language (French, German, Sindhi, Punjabi etc.)

Course Code: SS-2XXX
Course Structure: Lectures: 3 / Labs: 0
Credit Hours: 3
Prerequisites: None

Course Objectives:
The course will develop students' functional skills of the offered language

Course Syllabus:
Follow UOS's Relevant Department's Syllabus

Course Title: Operations Research

Course Code: CS-4931
Course Structure: Lectures: 3 / Labs: 0
Credit Hours:3
Prerequisites: None

Course Objectives:
This course aims to introduce students to use quantitive methods and techniques for effective decisions–making; model formulation and applications that are used in solving business decision problems.

Course Syllabus:
Introduction to Model Building.Over view of Matrices and Vectors.Matrices and Systems of Linear Equations.The Gauss-Jordan Method for Solving Systems of Linear Equations.Linear Independence and Linear Dependence.The Inverse of a Matrix.Determinants. Linear Programming: The Graphical Solution of Two-Variable Linear Programming Problems. A Work-Scheduling Problem.A Capital Budgeting Problem. The Simplex Algorithm and Goal Programming: How to Convert an LP to Standard Form. The Simplex Algorithm.Using the Simplex Algorithm to Solve Minimization Problems.Solving LPs with Spreadsheets. Sensitivity Analysis: An Applied Approach: A Graphical Introduction to Sensitivity Analysis. The Computer and Sensitivity Analysis.Managerial Use of Shadow Prices. Sensitivity Analysis and Duality: A Graphical Introduction to Sensitivity Analysis. Some Important Formulas.Sensitivity Analysis.Economic Interpretation of the Dual Problem.The Dual Theorem and Its Consequences. Shadow Prices. Duality and Sensitivity Analysis. Transportation and Transshipment Problems: Formulating Transportation Problems. Finding Basic Feasible Solutions for Transportation Problems.The Transportation Simplex Method.Sensitivity Analysis for Transportation Problems. Network Models: Basic Definitions. Shortest Path Problems.Maximum Flow Problems.CPM and PERT. Minimum Cost Network Flow Problems. Minimum Spanning Tree Problems.The Network Simplex Method.

Course Outline:

1. Introduction to Model Building: An Introduction to Modeling. The Seven-Step Model-Building Process. Over view of Matrices and Vectors. Matrices and Systems of Linear Equations. The Gauss-Jordan Method for Solving Systems of Linear Equations. Linear Independence and Linear Dependence. The Inverse of a Matrix. Determinants. [TB1: Ch.1, 2]
2. Introduction to Linear Programming: The Graphical Solution of Two-Variable Linear Programming Problems. A Work-Scheduling Problem. A Capital Budgeting Problem. [TB1: Ch.3]
3. The Simplex Algorithm and Goal Programming: How to Convert an LP to Standard Form. The Simplex Algorithm. Using the Simplex Algorithm to Solve Minimization Problems. Solving LPs with Spreadsheets. [TB1: Ch.4]
4. Sensitivity Analysis: An Applied Approach: A Graphical Introduction to Sensitivity Analysis. The Computer and Sensitivity Analysis. Managerial Use of Shadow Prices. [TB1: Ch.5]
5. Sensitivity Analysis and Duality: A Graphical Introduction to Sensitivity Analysis. Some Important Formulas. Sensitivity Analysis. Sensitivity Analysis When More Than One Parameter is Changed. Duality and Sensitivity Analysis. [TB1: Ch.6]
6. Transportation and Transshipment Problems: Formulating Transportation Problems. Finding Basic Feasible Solutions for Transportation Problems. The Transportation Simplex Method. Sensitivity Analysis for Transportation Problems. [TB1: Ch.7]
7. Network Models: Basic Definitions. Shortest Path Problems. Maximum Flow Problems. CPM and PERT. Minimum Cost Network Flow Problems. Minimum Spanning Tree Problems. The Network Simplex Method. [TB1: Ch.8]

Textbook(s):

- Operations Research: Applications and Algorithms by Wayne L. Winston, Duxbury Press; 4th Edition (July 25, 2003). ISBN-10: 0534380581

Reference Material:

- Optimization in Operations Research by Ronald L. Rardin, Prentice Hall; 1 Edition (August 15, 1997). ISBN-10: 0023984155
- Operations Research: A Model-Based Approach by H. A. Eiselt and Carl-Louis Sandblom, Springer; 2nd Edition. (January 31, 2013). ISBN-10: 3642310532
- Operations Research: Principles and Practice A. Ravindran (Author), Don T. Phillips, and James J. Solberg, Wiley; 2nd Edition (January 16, 1987). ISBN-10: 0471086088

Course Title: Software Project Management

Course Code: SE-4349
Course Structure: Lectures: 3/ Labs: 0
Credit Hours: 3
Prerequisites:CMP-3310 (Software Engineering)

Course Objectives:

To develop students' ability to plan and manage software development projects successfully, maximizing the return from each stage of the software development life cycle.

Course Syllabus:

Introduction to Software Project Management, PM Tools, PMI's Knowledge Areas, PMI Framework, PMI Process Groups. Understanding Organizations.Project Planning.Project Evaluation.Selection of an Appropriate Approach in Project.Software Effort Estimation.Activity Planning. Risk Management. Evaluating the Risks to the Schedule. Risk Control, RMMM, Configuration Management & Maintenance, Environment for Configuration Control. Resource Allocation.Monitoring & Control.Review and Evaluation.Challenges of Outsourcing in Project Management, Presentations.

Course Outline:

1. Introduction: Software Project Versus Other Type of Projects Dimensions of a Software Project, Activities in SPM, Setting Goals & Objectives, Business Case, Significance of Processes, Project Vs. Program Management, [TB1: Ch. 1, Handouts]
2. Introduction of PM Tools, PMI's Knowledge Areas, Technical Fundamentals in SPM, Lifecycle Relationships, Classic Mistakes Product-Process-Peoples-Technology Mistakes [TB2, Hand-outs]
3. PMI Framework, PMI Process Groups: Process Initiating Process Group, Planning Process Group, Executing Process, Process Monitoring and controlling, Closing Process Group, Project Charter, Statement of Work.[TB2, Hand-outs]
4. Understanding Organizations, Organizational Structures, Functional -Project –Matrix, Organizational Impact on Projects, Identifying stakeholders: Define Responsibilities, Authority Relationships, Position Qualifications [TB2, Hand-outs]
5. Project Planning: Project Selection, Project Scope, Project Infrastructure, Analyse Project Characteristics, Identify Project & Product Activities, Work Break Down Structure [TB1: Ch. 3]
6. Project Evaluation: Strategic Assessment, Technical Assessment, Economic Assessment, Project Portfolio Management, Cost-Benefit Analysis, Cash Flow Forecasting, Cost-Benefit Evaluation Techniques, Procurement Management, Procurement Tools &Techniques, Types of Contracts [TB1: Ch. 2]
7. Selection of an Appropriate Approach in Project: Choosing Technologies, Technical Plan, Waterfall Model, V-Model, Spiral Model, Software Prototyping, Incremental Delivery, Agile Process Model: Dynamic Systems Development Method, Extreme Programming, Selection of Most Appropriate Process Model [TB1: Ch. 4]
8. Software Effort Estimation: Work Breakdown Structure (WBS) and Its Types, Estimation Problems, Software Estimation Techniques: Expert Judgment, Estimating By Analogy, LOC, Function Point Estimation, and COCOMO [TB1: Ch. 5]
9. Activity Planning: Project and Activities, Sequencings and Scheduling Activities, Network Planning Models, Formulation of Network Model, Adding the Time Dimensions, The Forward Pass, The Backward Pass, Identifying the Critical Path, Identifying the Critical Activities Project, AOA, GanttChart, (Installation & Configuration of Software Tools like MS-Project).[TB1: Ch. 6]
10. Risk Management: Categories of Risks, A Framework for Dealing with Risks, Evaluating the Risks to the Schedule: PERT, Importance of Risk, Types Of Risk, Risk Identification Techniques, Project Risk and Change Management [TB1: Ch. 7]
11. Risk Control, RMMM, Configuration Management & Maintenance, Environment for Configuration Control, Configuration Control vs. Version Control [TB1: Ch. 7, OLM]

12. Resource Allocation: Nature of Resources, Identifying Resource Requirements, Scheduling Resources, Resource Scheduling Techniques[TB1: Ch. 8]
13. Monitoring & Control: Creating Framework, Collecting Data, Visualizing Progress, Cost Monitoring, Earned Value, Change Control [TB1: Ch. 9]
14. Review and Evaluation: Determining Satisfaction of Requirements, Reviewing And Evaluating Performance, Project Closure: Project Documentation, Cutover/Migration, Quality Standards, Project Closing. [TB2]

Textbook(s):

- Software Project Management by Bob Hughes and Mike Cotterell, McGraw-Hill Education; 5th Edition (2009). ISBN-10: 0077122798
- A Guide to the Project Management Body of Knowledge, 3rd Edition (PMBOK Guides), ISBN-13: 978-1930699458

Reference Material:

- Applied Software Project Management by Andrew Stellman and Jennifer Greene, O'Reilly Media; 1st Edition (2005). ISBN-10: 0596009488
- Software Project Survival Guide (Pro -- Best Practices) by Steve McConnell, Microsoft Press; 1st Edition (1997), ISBN-10: 1572316217
- Mastering Software Project Management: Best Practices, Tools and Techniques by Murali K. Chemuturi and Thomas M. Cagley Jr., J. Ross Publishing (2010). ISBN-10: 1604270349
- Effective Project Management: Traditional, Agile, Extreme by Robert K. Wysocki, Wiley; 6th Edition (2011). ISBN-10: 111801619X
- The Software Project Manager's Handbook - Principles that work at work by Dwayne Phillips, 2nd Edition, IEEE Computer Society Press and Wiley Inter-science, 2004. ISBN 0-471-67420-6

Contents of Computer Science Core Courses

Course Title: Computer Organization and Assembly Language

Course Code: CS-3210
Course Structure: Lectures: 3/Labs: 0
Credit Hours: 3
Prerequisites: CMP-2210(Digital Logic & Design)

3rd Semester

Course Objectives:
This course covers the basics of computer organization with emphasis on the lower level abstraction of a computer system including digital logic, instruction set and assembly language programming.

Course Syllabus:
Introduction to Microprocessor Architecture: Microprocessor Bus Structure, Addressing, Data and Control, Introduction to Registers and Flags. Addressing Modes,, Introduction to Assembly Language, 80x86 families, Program layout, Data Definitions, Basic Instructions, Unsigned Arithmetic, Logic and Bit Operations, Modules, Separate Assembly, Argument Passing, Libraries, Combining Assembly and C Code, String Instructions, Arrays, Macros, Structures,

Floating Point Instructions, Bit MS-DOS, BIOS Disk Accessing, BIOS Keyboard/Video/Graphics, Interrupts; TSR Programs, Accessing I/O Ports; 8253 Timer.

Course Outline:

1. Introduction to Microprocessor Architecture: Microprocessor Bus Structure - Addressing, Data and Control, Registers and Flags. Addressing Modes.
2. Introduction to Assembly Language, 80x86 families; program layout. [TB: Ch. 1.1, 1.2; 2,3]
3. Data Definitions, Basic Instructions. [TB: Ch. 3, 4]
4. Unsigned Arithmetic; Logic and Bit Operations. [TB: Ch. 6, 7]
5. Modules; Separate Assembly; Argument Passing [TB: Ch. 5,8]
6. Libraries; Combining Assembly and C Code [TB: Ch. 13]
7. String Instructions; Arrays [TB: Ch. 9]
8. Macros; Structures [TB: Ch. 10]
9. Floating Point Instructions [TB: Ch. 12]
10. Bit MS-DOS. [TB: Ch. 14]
11. BIOS Disk Accessing [Ref]
12. BIOS Keyboard/Video/Graphics [Ref]
13. Interrupts; TSR Programs [Terminate And Stay Resident] [Ref]
14. Accessing I/O Ports; 8253 Timer [Ref]

Textbook(s):

- Assembly Language for x86 Processors by Kip R. Irvine, Prentice Hall; 6th Edition (March 7, 2010). ISBN-10: 013602212X

Reference Material:

- The 8088 and 8086 Microprocessors: Programming, Interfacing, Software, Hardware, and Applications by Walter A. Triebel & Avtar Singh, Prentice Hall; 4th Edition (September 8, 2002). ISBN-10: 0130930814.
- Lab Manual to Accompany - The 8088 and 8086 Microprocessors: Programming, Interfacing, Software, Hardware, and Applications by Walter A. Triebel & Avtar Singh, Pearson; 4th Edition (2003). ASIN: B000Q652KQ
- Principles of Computer Organization and Assembly Language by Patrick Juola, Prentice Hall; 1st Edition (January 11, 2011). ASIN: B009TGBI1Q
- The Art of Assembly Language by Randall Hyde, No Starch Press; 2nd Edition (March 22, 2010). ISBN-10: 1593272073

Course Title: Theory of Automata and Formal Languages

Course Code: CS-3131
Course Structure: Lectures: 3/ Labs: 0
Credit Hours: 3
Prerequisites: CMP-2111 (Discrete Structures)

Course Objectives:

The course introduces students with fundamental concepts of automata theory and formal languages to form basic models of computation which provide foundation of many branches of computer science, e.g. compilers, software engineering, concurrent systems, etc.

Course Syllabus:
Introduction to Automata.Finite Automata.Regular Expressions and Languages.Properties of Regular Languages.Context-Free Grammars and Languages.Pushdown Automata.Properties of Context-Free Languages.Turing Machines.Un-decidability.Intractable Problems.

Course Outline:

1. Introduction to Automata: The Methods and the Madness, Introduction to Formal Proof, Inductive Proofs, The Central Concepts of Automata Theory. [TB: Ch.1]
2. Finite Automata: Introduction of Finite Automata, Deterministic Finite Automata, Nondeterministic Finite Automata, Finite Automata With Epsilon Transitions. [TB: Ch.2]
3. Regular Expressions and Languages, Regular Expressions, Finite Automata and Regular Expressions, Applications of Regular Expressions, Algebraic Laws for Regular Expressions. [TB: Ch.3]
4. Properties of Regular Languages, Proving Languages Not to Be Regular, Closure Properties of Regular Languages, Decision Properties of Regular Languages, Equivalence and Minimization of Automata. [TB: Ch.4]
5. Context-Free Grammars and Languages: Context-Free Grammars, Parse Trees, Applications of Context-Free Grammars, Ambiguity in Grammars and Languages
6. Pushdown Automata: Definition of the Pushdown Automaton, The Languages of a PDA, Equivalence of PDAs and CFGs, Deterministic Pushdown Automata. [TB: Ch.6]
7. Properties of Context-Free Languages: Normal Forms for Context-Free Grammars, The Pumping Lemma for Context-Free Languages, Closure Properties of Context-Free Languages, Decision Properties of CFLs. [TB: Ch.7]
8. Introduction to Turing Machines: Problems That Computers Cannot Solve, The Turing Machine, Programming Techniques for Turing Machines, Extensions to the Basic Turing Machine, Restricted Turing Machines, Turing Machines and Computers. [TB: Ch.8]
9. Un-decidability: A Language That Is Not Recursively Enumerable, Un-decidable Problem That Is RE, Un-decidable Problems About Turing Machines, Posts Correspondence Problem, Other Un-decidable Problems. [TB: Ch.9]
10. Intractable Problems: The Classes P and NP, An NP-Complete Problem, A Restricted Satisfiability Problem. [TB: Ch.10]

Textbook(s):

- Introduction to Automata Theory, Languages, and Computation by J. Hopcroft, R. Motwani, and J. Ullman, 3rd Edition, 2006, Addison-Wesley.

Reference Material:

- An Introduction to Formal Language and Automata by Peter Linz, Jones & Bartlett Pub; 4th Edition (2006). ISBN-10: 0763737984
- Automata and Formal Languages: An Introduction by Dean Kelley, Prentice Hall (1995). ISBN-10: 0134977777

Course Title: Design and Analysis of Algorithms
Course Code: CS-3143
Course Structure: Lectures: 3 / Labs: 0
Credit Hours: 3
Prerequisites: CMP-2111 (Discrete Structure)

4th Smester

Course Objectives:
The course introduces students with the basic notions of the design of algorithms and the underlying data structures. Students will learn about several measures regarding the structure, complexity, and efficiency of algorithms.

Course Syllabus:
Algorithms in Computing, Divide-and-Conquer, Recurrences, Sorting and Order Statistics, Sorting in Linear Time, Binary Trees, Red-Black Trees, Dynamic Programming, Greedy Algorithms, Elementary Graph Algorithms, Single-Source Shortest Paths, All-Pairs Shortest Paths, Maximum Flow, String Matching.

Course Outline:

1. Role of Algorithms in Computing, Analysing Algorithms, Designing Algorithms, Growth of Functions, Asymptotic Notation, Standard Notations and Common Functions. [TB: Ch1,2,3]
2. Divide-and-Conquer, Strassen's Algorithm for Matrix Multiplication, Recursion. [TB: Ch. 4]
3. Recurrences: Substitution Method for Solving Recurrences, Recursion-Tree Method for Solving Recurrences, Master Method for Solving Recurrences. [TB: Ch. 4]
4. Sorting and Order Statistics: Heapsort Algorithm, Priority Ques, Quicksort Algorithm, Analysis of Quicksort. [TB: Ch. 6, 7]
5. Sorting in Linear Time: Lower Bounds for Sorting, Counting Sort, Radix Sort, Bucket Sort. [TB: Ch. 8]
6. Medians and Order Statistics, Binary Search Trees, Querying a Binary Search Tree, Insertion and Deletion. [TB: Ch. 9, 12]
7. Red-Black Trees: Properties of Red-Black Trees, Rotations, Insertion, Deletion; Minimum Spanning Trees: Introduction, Growing a Minimum Spanning Tree. [TB: Ch. 12]
8. Dynamic Programming: Elements of Dynamic Programming, Longest Common Subsequence, Optimal Binary Search Trees [TB: Ch. 15]
9. Greedy Algorithms: Elements of The Greedy Strategy, Huffman Codes, Matroids and Greedy Methods, Task-Scheduling Problem. [TB: Ch. 16]
10. Elementary Graph Algorithms, Representations of Graphs, Breadth-First Search, Depth-First Search, Topological Sort. [TB: Ch. 22]
11. Single-Source Shortest Paths: The Bellman-Ford Algorithm, Single-Source Shortest Paths in Directed Acyclic Graphs, Dijkstra's Algorithm. [TB: Ch. 24]
12. All-Pairs Shortest Paths: Floyd-Warshall Algorithm, Johnson's Algorithm for Sparse Graphs. [TB: Ch. 25]
13. Maximum Flow: Flow Networks, Ford-Fulkerson Method, Push-Relabel Algorithms, Relabel-to-Front Algorithm. [TB: Ch. 26]
14. String Matching: Naive String-Matching Algorithm, Rabin-Karp Algorithm, String

Matching with Finite Automata, Knuth-Morris-Pratt Algorithm. [TB: Ch. 32]

Text Book(s):

- Introduction to Algorithms by Thomas H. Cormen, Charles E. Leiserson, Ronald L. Rivest and Clifford Stein, The MIT Press; 3rdEdition (2009). ISBN-10: 0262033844

Reference Material:

- Introduction to the Design and Analysis of Algorithms by Anany Levitin, Addison Wesley; 2ndEdition (2006). ISBN-10: 0321358287
- Algorithms in C++ by Robert Sedgewick (1999). ASIN: B006UR4BJS
- Algorithms in Java by Robert Sedgewick, Addison-Wesley Professional; 3rdEdition(2002). ISBN-10: 0201361205

Course Title: Artificial Intelligence

Course Code: CS-3811
Course Structure: Lectures: 3/Labs: 0
Credit Hours: 3
Prerequisites: CMP-2111(Discrete Structures)

6th Term

Course Objectives:

This course will introduce the basic principles in artificial intelligence. It will cover simple representation schemes, problem solving paradigms, constraint propagation, and search strategies. Areas of application such as knowledge representation, natural language processing, expert systems, vision and robotics will be explored. The Prolog programming language will also be introduced.

Course Syllabus:

What is AI, Foundations of AI, History of AI. Weak AI, Strong AI.Intelligent Agents: Agents and Environments, The Nature of Environments, The Structure of Agents..Problem Solving by Searching.Breadth-First Search, Depth-First Search, Depth-limited Search, Iterative Deepening, Depth-first Search, Comparison of Uninformed Search Strategies. Informed Search and Exploration.Constraint Satisfaction Problems.Reasoning and Knowledge Representation.Inference in First-Order Logic.Introduction to Prolog Programming.Reasoning Systems for Categories.Reasoning with Uncertainty & Probabilistic Reasoning.Representing Knowledge in an Uncertain Domain.Learning from Observations.Knowledge in Learning. Statistical Learning, Neural Networks.

Course Outline:

1. Introduction: What is AI, Foundations of AI, History of AI. Intelligent Agents: Agents and Environments, The Nature of Environments, The Structure of Agents [TB: Ch. 1, 2]
2. Problem Solving by Searching: Problem Solving Agents, Searching for Solutions, Uninformed Search Strategies.
3. Breadth-First Search, Depth-First Search, Depth-limited Search, Iterative Deepening, Depth-first Search, Comparison of Uninformed Search Strategies. [TB: Ch. 3]
4. Informed Search and Exploration: Informed (Heuristic) Search Strategies: Greedy Best-first Search, A* Search, Heuristic Functions, Local Search Algorithms and Optimization Problems. [TB: Ch. 4]

5. Constraint Satisfaction Problems: Backtracking Search for CSPs, Local Search for CSPs. Adversarial Search: Games, Minimax Algorithm, Alpha-Beta Pruning. [TB: Ch. 5, 6]
6. Reasoning and Knowledge Representation: Introductions to Reasoning and Knowledge Representation, Propositional Logic, First Order Logic: Syntax and Semantics of First-Order Logic, Knowledge Engineering in First-Order Logic, [TB: Ch. 7, 8]
7. Inference in First-Order Logic: Inference rules for quantifiers, A first-order inference rule, Unification, Forward Chaining, Backward Chaining, A backward chaining algorithm, Logic programming, The resolution inference rule [TB: Ch. 9]
8. Introduction to Prolog Programming
9. Reasoning Systems for Categories, Semantic Nets and Description logics, Reasoning with Default Information: Open and closed worlds, Negation as failure and stable model semantic. Truth Maintenance Systems [TB: Ch. 10]
10. Reasoning with Uncertainty & Probabilistic Reasoning : Acting Under Uncertainty, Bayes' Rule and Its Use, [TB: Ch 13]
11. Representing Knowledge in an Uncertain Domain, The Semantics of Bayesian Networks. [TB: Ch. 14]
12. Learning from Observations: Forms of Learning , Inductive Learning,, Learning Decision Trees [TB: Ch. 18]
13. Knowledge in Learning, Explanation-Based Learning, Inductive Logic Programming. [TB: 19]
14. Statistical Learning, Neural Networks [TB: Ch. 20]

Textbook(s):

- Artificial Intelligence: A Modern Approach, by Russell and Norvig, Prentice Hall. 2nd Edition. ISBN-10: 0137903952

Reference Material:

- Artificial Intelligence: A Systems Approach by M. Tim Jones, Jones and Bartlett Publishers, Inc; 1st Edition (December 26, 2008). ISBN-10: 0763773379
- Artificial Intelligence in the 21st Century by Stephen Lucci , Danny Kopec, Mercury Learning and Information (May 18, 2012). ISBN-10: 1936420236

Course Title: Computer Architecture & Organization

Course Code: CS-4240
Course Structure: Lectures: 3/Labs: 0
Credit Hours: 3
Prerequisites: CS-3210 (Computer Organization and Assembly Language)

Course Objectives:

This course is concerned with the structure and behavior of the various functional modules of the computer; and how they interact to provide the processing needs of the user.

Course Syllabus:

Introduction to a Simple Computer, Architectures: Intel & MIPs Architecture, Instruction Set Architecture, Micro-architecture, Advanced Micro-architecture, Memory, Input/Output and

Storage System, Alternative Architectures, Embedded Systems, Performance Measurement and Analysis, Storage Systems and Interfaces.

Course Outline:

1. Introduction to a Simple Computer: CPU Basics and Organization, The Bus, Clock, The Input/Output Subsystem, Memory Organization and Addressing, Interrupts, MARIE, Instruction Processing, Hardware vs Micro-programmed Control, Real-World Examples of Computer . [TB2: Ch. 4]
2. Architectures: Intel & MIPs Architecture [TB1: Ch. 6]
3. Instruction Set Architecture: Instruction Format, Instruction Types, Addressing, Instruction Pipelining, ISAs – Intel, MIPS, Java Virtual Machine [TB2: Ch. 5]
4. Micro-architecture: Single-Cycle Processor, Multicycle Processor, Pipeline Processors, DDL Representation, Exceptions. [TB1: 7]
5. Advanced Micro-architecture: Deep Pipelines, Branch Prediction, Superscalar Processor, Out-of-Order Processor, Register Renaming, Single Instruction Multiple Data, Multithreading, Homogeneous Multiprocessing, Heterogeneous Multiprocessor. [TB1: 7]
6. Memory: Types of Memory, The Memory Hierarchy, Cache Memory, Virtual Memory, Memory Management [TB1: 8]
7. Input/Output and Storage System: I/O and Performance, Amdahl's Law, I/O architectures, Data Transmission Modes, Magnetic Disk Technology, Optical Disk Technology, Magnatic Tape, RAID, Future of Data Storage. [TB2: Ch. 7]
8. Alternative Architectures: RISC Machines, Flynn's Taxonomy, Parallel and Multiprocessor Architecture, Alternative Parallel Processing Approaches, Quantum Computing. [TB2: Ch. 9]
9. Embedded Systems: Embedded Hardware & Embedded Software. [TB2: Ch. 10]

Textbook(s):

- Digital Design and Computer Architecture & Organization by David Harris and Sarah Harris, Morgan Kaufmann; 2nd Edition (August 7, 2012). ISBN-10: 0123944244 .
- Essentials of Computer Organization and Architecture by Linda Null and Julia Lobur, Jones & Bartlett Learning; 3rd Edition (December 17, 2010)

Reference Material:

- Computer Architecture & Organization: A Quantitative Approach (Fifth Edition) by John L. Hennessy and David A. Patterson, Morgan Kaufmann; 5th Edition (September 30, 2011). ISBN-10: 012383872X
- Digital Design and Computer Architecture & Organization by D. M. Harris and S. L. Harris and Morgan Kaufmann, Morgan Kaufmann; 1st Edition (March 16, 2007). ISBN-10: 0123704979

Course Title: Compiler Construction
Course Code: CS-4141
Course Structure: Lectures: 3 / Labs: 0
Credit Hours: 3
Prerequisites: CS-3131 (Theory of Automata and Formal Languages)

Course Objectives:

At the end of the course students will understand the overall structure of a compiler, and will know significant details of a number of important techniques commonly used. They will be aware of the way in which language features raise challenges for compiler builders.

Course Syllabus:

Principles of Compilation, Compiler Structure, High-Level View of Translation, Desirable Properties of a Compiler.Scanners.Parsers.Context-Sensitive Analysis.Intermediate Representations.The Procedure Abstraction.Code Shape.Code Optimization.Data-Flow Analysis.Scalar Optimizations.Instruction Selection.Instruction Scheduling. Register Allocation. Implementation of a prototype compiler(Lab Assignment for the Semester)

Course Outline:

1. Overview of Compilation: Principles of Compilation, Compiler Structure, High-Level View of Translation, Desirable Properties of a Compiler. [TB: Ch.1]
2. Scanners: Recognizing Words, Regular Expressions, Implementing Scanners. [TB: Ch.2]
3. Parsers: Expressing Syntax, Top-Down Parsing, Bottom-Up Parsing. [TB: Ch.3]
4. Context-Sensitive Analysis: Type Systems, Attribute-Grammar Framework, Ad Hoc Syntax-Directed Translation. [TB: Ch.4]
5. Intermediate Representations: Graphical IRs, Linear IRs, Mapping Values to Names, Symbol Tables. [TB: Ch.5]
6. The Procedure Abstraction: Procedure Calls, Name Spaces, Communicating Values Between Procedures, Standardized Linkages. [TB: Ch.6]
7. Code Shape: Assigning Storage Locations, Arithmetic Operators, Boolean and Relational Operators, Storing and Accessing Arrays, Character Strings, Structure References, Control-Flow Constructs, Procedure Calls. [TB: Ch.7]
8. Code Optimization: Scope of Optimization, Local Optimization, Regional Optimization, Global Optimization, Interprocedural Optimization. [TB: Ch.8]
9. Data-Flow Analysis: Iterative Data-Flow Analysis, Static Single-Assignment Form, Inter-procedural Analysis. [TB: Ch.9]
10. Scalar Optimizations: Taxonomy for Transformations, Example Optimizations. [TB: Ch.10]
11. Instruction Selection: Code Generation, Extending the Simple Tree-Walk Scheme, Instruction Selection via Tree-Pattern Matching, Instruction Selection via Peephole Optimization. [TB: Ch.11]
12. Instruction Scheduling: The Instruction-Scheduling Problem, Local List Scheduling, Regional Scheduling. [TB: Ch.12]
13. Register Allocation: Background Issues, Local Register Allocation and Assignment, Moving Beyond Single Blocks, Global Register Allocation and Assignment.
14. Implementation of a prototype compiler **(Class Assignment for the Semester)**

Textbook(s):

- Engineering a Compiler, Second Edition by Keith Cooper and Linda Torczon, Morgan Kaufmann; 2nd Edition (February 21, 2011). ISBN-10: 012088478X

Reference Material:

- Compilers: Principles, Techniques, and Tools By Alfred V. Aho, Ravi Sethi, Jeffrey D. Ullman, Contributor Jeffrey D. Ullman , Prentice Hall; 2nd Edition (2006). ISBN-10:

0321486811

- Modern Compiler Design, By Dick Grune, Henri E. Bal, Ceriel J. H. Jacobs, Koen G. Langendoen, Springer; 2nd Edition. (2012). ISBN-10: 1461446988
- Modern Compiler Implementation in C, By Andrew W. Appel, Maia Ginsburg, Contributor Maia Ginsburg, Cambridge University Press, (2004). ISBN-10: 0521607655

Contents of Computer Science Supporting Courses

Course Title: Multivariable Calculus

Course Code: MATH-2214
Course Structure: Lectures: 3 / Labs: 0
Credit Hours: 3
Prerequisites: None

2nd Semester

Course Objectives:
The goals are to develop the skills to have ground knowledge of multivariate calculus and appreciation for their further computer science courses.

Course Syllabus:
Multivariable Functions and Partial Derivatives. Multiple Integrals. Laplace Transforms. Fourier analysis. Power Series, Taylor Series. Power Series. Functions Given by Power Series. Taylor and Maclaurin Series. Laurent Series. Residue Integration.

Course Outline:

1. Multivariable Functions and Partial Derivatives: Functions of Several Variables. Limits and Continuity. Partial Derivatives. Differentiability, Linearization, and Differentials. The Chain Rule. Partial Derivatives with Constrained Variables. Directional Derivatives, Gradient Vectors, and Tangent Planes. Extreme Values and Saddle Points. Lagrange Multipliers. Taylor's Formula. [TB1: Ch. 11]
2. Multiple Integrals: Double Integrals. Areas, Moments, and Centers of Mass. Double Integrals in Polar Form. Triple Integrals in Rectangular Coordinates. Masses and Moments in Three Dimensions. Triple Integrals in Cylindrical and Spherical Coordinates. Substitutions in Multiple Integrals. [TB1: Ch. 12]
3. Laplace Transforms: Laplace Transform. Inverse Transform. Linearity. First Shifting Theorem (s-Shifting). Transforms of Derivatives and Integrals. ODEs. Unit Step Function (Heaviside Function). Second Shifting Theorem (t-Shifting). Short Impulses. Dirac's Delta Function. Partial Fractions. Convolution. Integral Equations. Differentiation and Integration of Transform. Systems of ODEs. Laplace Transform: General Formulas. Table of Laplace Transforms. [TB2: Ch. 6]
4. Fourier Analysis: Fourier Series, Arbitrary Period. Even and Odd Function. Half-Rang Expansions. Forced Oscillations. Approximation by Trigonometric Polynomials. Sturm-Liouville Problems. Orthogonal Functions. Orthogonal Series. Generalized Fourier Series. Fourier Integral. Fourier Cosine and Sine Transforms. Fourier Transform. [TB2: Ch. 11]
5. Power Series, Taylor Series: Sequences, Series, Convergence Tests. Power Series.

Functions Given by Power Series. Taylor and Maclaurin Series. [TB2: Ch. 15]

6. Laurent Series. Residue Integration: Laurent Series. Singularities and Zeros. Infinity. Residue Integration Method. Residue Integration of Real Integrals. [TB2: Ch. 16]

Textbook(s):

- Calculus & Analytic Geometry by Thomas, Wiley; 10th Edition (August 16, 2011). ISBN-10: 0470458364
- Advanced Engineering Mathematics by Erwin Kreyszig, Wiley; 10th Edition (August 16, 2011). ISBN-10: 0470458364

Reference Material:

- Multivariable Calculus by James Stewart, Brooks Cole; 7th Edition (January 1, 2011). ISBN-10: 0538497874
- Multivariable Calculus by James Stewart 6th Edition, 2007, Cengage Learning publishers.
- Calculus and Analytical Geometry by Swokowski, Olinick and Pence, 6th Edition, 1994, Thomson Learning EMEA, Ltd.
- Elementary Multivariable Calculus by Bernard Kolman William F. Trench, 1971, Academic Press.
- Multivariable Calculus by Howard Anton, Albert Herr 5th Edition, 1995, John Wiley.

Course Title: Differential Equations
Course Code: MATH-2215
Course Structure: Lectures: 3 / Labs: 0
Credit Hours: 3
Prerequisites:None

3rd Semester

Course Objectives:

The course develops students' fundamental skills of solving ordinary differential equations, and developing differential equations for real-world problems.

Course Syllabus:

Introduction to Differential Equations. First-Order Differential Equations. Modeling With First-Order Differential Equations. Higher-Order Differential Equations. Undetermined Coefficients-Superposition Approach. Undetermined Coefficients- Annihilator Approach. Variation of Parameters. Cauchy-Euler Equation. Solving Systems of Linear Differential Equations by Elimination. Nonlinear Differential Equations. Modeling with Higher-Order Differential Equations: Linear Models: Initial-Value Problems, Boundary-Value Problems. Nonlinear Models. Series Solutions of Linear Equations. Systems of Linear First-Order Differential Equations. Homogeneous Linear Systems. Nonhomogeneous Linear Systems. Matrix Exponential. Numerical Solutions of Ordinary Differential Equations. Euler Methods. Runge-Kutta Methods. Multistep Methods. Higher-Order Equations and Systems. Second-Order Boundary-Value Problems.

Course Outline:

1. Introduction to Differential Equations: Definitions and Terminology. Initial-Value Problems. Differential Equations as Mathematical Models. [TB: Ch. 1]

2. First-Order Differential Equations: Solution Curves without a Solution. Separable Variables. Linear Equations. Exact Equations and Integrating Factors. Solutions by Substitutions. A Numerical Method. [TB: Ch. 2]
3. Modelling With First-Order Differential Equations: Linear Models. Nonlinear Models. Modelling with Systems of First-Order Differential Equations. [TB: Ch. 3]
4. Higher-Order Differential Equations: Preliminary Theory- Linear Equations. Reduction of Order. Homogeneous Linear Equations with Constant Coefficients. Undetermined Coefficients- Superposition Approach. Undetermined Coefficients- Annihilator Approach. Variation of Parameters. Cauchy-Euler Equation. Solving Systems of Linear Differential Equations by Elimination. Nonlinear Differential Equations. [TB: Ch. 4]
5. Modeling with Higher-Order Differential Equations: Linear Models: Initial-Value Problems. Linear Models: Boundary-Value Problems. Nonlinear Models. [TB: Ch. 5]
6. Series Solutions of Linear Equations: Solutions about Ordinary Points. Solutions about Singular Points. Special Functions. [TB: Ch. 6]
7. Systems of Linear First-Order Differential Equations: Preliminary Theory. Homogeneous Linear Systems. Non-homogeneous Linear Systems. Matrix Exponential.
8. Numerical Solutions of Ordinary Differential Equations: Euler Methods. Runge-Kutta Methods. Multistep Methods. Higher-Order Equations and Systems. Second-Order Boundary-Value Problems. [TB: Ch. 7].

Textbook(s):

- A First Course in Differential Equations by Dennis G. Zill, Brooks Cole; 10th Edition (March 15, 2012).ISBN-10: 1111827052

Reference Material:

- Advanced Engineering Mathematics by Erwin Kreyszig, Wiley; 10th Edition (August 16, 2011).ISBN-10: 0470458364
- Differential Equations with Boundary-Value Problems by Dennis G. Zill, Michael R. Cullen, Brooks Cole; 8th Edition (March 15, 2012). ISBN-10: 1111827060
- Elementary Differential Equations with Applications by C. H .Edwards, David E. Penney, Pearson; 3rd Edition (October 20, 2008). ISBN-10: 0136054250

5TH Tested

Course Title: Numerical Computing

Course Code: CS-3941
Course Structure: Lectures: 3 / Labs: 0
Credit Hours: 3
Prerequisites: None

Course Objectives:

On completion of this course, students will be able to demonstrate programming proficiency using structured programming techniques to implement numerical methods for solutions using computer-based programming techniques using Mat Lab for all methods. The course must serve the purpose of scientific software development for science and engineering problems.

Course Syllabus:

Mathematical Preliminaries and Error Analysis. Solutions of Equations in One Variable.

Interpolation and Polynomial Approximation. Numerical Differentiation and Integration. Gaussian Quadrature. Multiple Integrals. Improper Integrals. Intial-Value Problems for Ordinary Differential Equations. Euler's Method. Higher-Order Taylor Methods. Runge-Kutta Methods. Error Control and the Runge-Kutta-Fehlberg Method. Multistep Methods. Variable Step-Size Multistep Methods. Extrapolation Methods. Higher-Order Equations and Systems of Differential Equations. Stability. Stiff Differential Equations. Direct Methods for Solving Linear Systems. Iterative Techniques in Matrix Algebra. Approximation Theory. Approximating Eigenvalues. Numerical Solutions of Nonlinear Systems of Equations. Boundary-Value Problems for Ordinary Differential Equations. Numerical Solutions to Partial Differential Equations.

Course Outline:

1. Mathematical Preliminaries and Error Analysis: Round-off Errors and Computer Arithmetic. Algorithms and Convergence. [TB1: Ch. 1]
2. Solutions of Equations in One Variable: The Bisection Method. Fixed-Point Iteration. Newton's Method and its Extensions. Error Analysis for Iterative Methods. Accelerating Convergence. Zeros of Polynomials and Müller's Method. [TB1: Ch. 2]
3. Interpolation and Polynomial Approximation: Interpolation and the Lagrange Polynomial. Data Approximation and Neville's Method. Divided Differences. Hermite Interpolation. Cubic Spline Interpolation. Parametric Curves. [TB1: Ch. 3]
4. Numerical Differentiation and Integration: Numerical Differentiation. Richardson's Extrapolation. Elements of Numerical Integration. Composite Numerical Integration. Romberg Integration. Adaptive Quadrature Methods. Gaussian Quadrature. Multiple Integrals. Improper Integrals. [TB1: Ch. 4]
5. Intial-Value Problems for Ordinary Differential Equations: Elementary Theory of Initial-Value Problems. Euler's Method. Higher-Order Taylor Methods. Runge-Kutta Methods. Error Control and the Runge-Kutta-Fehlberg Method. Multistep Methods. Variable Step-Size Multistep Methods. Extrapolation Methods. Higher-Order Equations and Systems of Differential Equations. Stability. Stiff Differential Equations. [TB1: Ch. 5]
6. Direct Methods for Solving Linear Systems: Linear Systems of Equations. Pivoting Strategies. Linear Algebra and Matrix Inversion. The Determinant of a Matrix. Matrix Factorization. Special Types of Matrices. [TB1: Ch. 6]
7. Iterative Techniques in Matrix Algebra: Norms of Vectors and Matrices. Eigenvalues and Eigenvectors. The Jacobi and Gauss-Siedel Iterative Techniques. Iterative Techniques for Solving Linear Systems. The Conjugate Gradient Method. [TB1: Ch. 7]
8. Approximation Theory: Discrete Least Squares Approximation. Orthogonal Polynomials and Least Squares Approximation. Rational Function Approximation. Trigonometric Polynomial Approximation. [TB1: Ch. 8]
9. Approximating Eigenvalues: Linear Algebra and Eigenvalues. Orthogonal Matrices and Similarity Transformations. The Power Method. Householder's Method. The QR Algorithm. [TB1: Ch. 9]
10. Numerical Solutions of Nonlinear Systems of Equations: Fixed Points for Functions of Several Variables. Newton's Method. Quasi-Newton Methods. Homotopy and Continuation Methods. [TB1: Ch. 10]
11. Boundary-Value Problems for Ordinary Differential Equations: The Linear Shooting Method. The Shooting Method for Nonlinear Problems. Finite-Difference Methods for Linear Problems. Finite-Difference Methods for Nonlinear Problems. [TB1: Ch. 11]
12. Numerical Solutions to Partial Differential Equations: Elliptic Partial Differential

Equations. Parabolic Partial Differential Equations. Hyperbolic Partial Differential Equations. [TB1: Ch. 12]

Textbook(s):

- Numerical Analysis by Richard L. Burden and J. Douglas Faires, 9th Edition, Cengage Learning (2011). ISBN-10: 0538733519
- Numerical Methods: Design, Analysis, and Computer Implementation of Algorithms by Anne Greenbaum & Timothy P. Chartier, Princeton University Press (April 1, 2012). ISBN-10: 0691151229 [For MatLab implementation]

Reference Material:

- A First Course in Numerical Analysis by Anthony and Philip Rabinowitz , Dover Publications; 2nd Edition (February 6, 2001). ISBN-10: 048641454X
- Numerical Methods in Scientific Computing by Germund Dahlquist and Åke Björck, Society for Industrial and Applied Mathematics (2008). ISBN-10: 0898716446
- Numerical Methods for Scientific Computing by J.H. Heinbockel, Create Space Independent Publishing Platform (2006). ISBN-10: 1412031532
- Numerical Methods for Scientists and Engineers (Dover Books on Mathematics) by R. W. Hamming, Dover Publications; 2nd Edition (1987). ISBN-10: 0486652416

Course Title: Object Oriented Analysis and Design

Course Code: SE-3311
Course Structure: Lectures: 3/Labs: 0
Credit Hours: 3
Prerequisites:CMP-2124 (Object Oriented Programming)

Course Objectives:

In this course, the students will learn how to produce detailed object models and designs from system requirements; use the modeling concepts provided by UML; identify use cases and expand into full behavioral designs; expand the analysis into a design ready for implementation and construct designs that are reliable.

Course Syllabus:

Principles of Object Technology. UML Unification, UML Diagrams, Unified Process & Rational Unified Process, RUP Disciplines, Requirements Types, Use Case Modeling. EBP Guidelines.System Use Case Diagram, Use Case Table, Activity Diagram, Supplementary Specifications, Vision Document, Glossary, Rational Rose Overview.Elaboration Phase of RUP; Configuration Management; System Sequence Diagram, Domain Model.Implementation of System Sequence & Domain Model. Use Case Dependencies. Analysis Use Case Diagram, Implementation of Sequence, Collaboration, Analysis Use Case Diagram.State Chart Diagrams and Implementation. Design Patterns. Use Case Realization Using GRASP Patterns, Design Model. Modeling Generalization, Creating Design Class Diagram, Mapping Data Model to Domain Model.Implementation of Design Class Diagram, Coding patterns, Mapping Design to Code.Patterns for Assigning Responsibilities, Polymorphism, Pure Fabrication, Indirection, Protected Variation.GoF Design Patterns. [Students must be introduced with Object Diagram,

Component Diagram, Package Diagram, Deployment Diagram, Network Diagram.]

Course Outline:

1. Principles of Object Technology: Introduction to Object Technology, Principles of Modeling, and Principles of Object Orientation [TB: Ch. 1.1-5]
2. Introduction to UML, Unification, UML Diagrams, Unified Process & Rational Unified Process, RUP Disciplines, Case Study Analysis and Basics, Case Study, About Inception, Feasibility and Risk Analysis [TB: Ch. 1.6, 2.1-6, 3.1-2,4.1-3]
3. Understanding Requirements, Requirements Types, Use Case Modeling: Use Case Writing Styles, EBP Guidelines [TB: Ch. 5.1, 6.1-8]
4. System Use Case Diagram, Use Case Table, Activity Diagram, Supplementary Specifications, Vision Document, Glossary, Rational Rose Overview, Use Case & Activity Diagram Modeling in Rational Rose [TB: Ch. 6.9, 6.12-17, 7.2-4 & 7]
5. Elaboration Phase of RUP; Configuration Management; System Sequence Diagram, Domain Model : Identifying Business Classes, Associations, Attributes [TB: Ch.8.2-5,9.2-4,10.1-4,11.1-7,12.1-4]
6. Implementation of System Sequence & Domain Model: Use Case Operational Contracts, Business Sequence, Analysis Sequence & Collaboration Diagrams [TB: Ch. 11.10, 12.9, 13.1-2, 13.9, 15.1-7]
7. Use Case Dependencies. Analysis Use Case Diagram, Implementation of Sequence, Collaboration, Analysis Use Case Diagram [TB: Ch. 25.1-5, 15.6-7]
8. State Chart Diagrams and Implementation [TB: Ch. 29.1-5, 29.8, Ch. 1-13, 25, 29]
9. Design Patterns: GRASP: Information Expert, Creator, Cohesion & Coupling, Controller [Ch. 16.1-10]
10. Use Case Realization Using GRASP Patterns, Design Model: Determining Visibility [TB: Ch. 17.1-9, 18.1-3]
11. Modeling Generalization, Creating Design Class Diagram, Mapping Data Model to Domain Model [TB: Ch. 26.1-7, 27.1-10, 19.1-6, 34.5-9]
12. Implementation of Design Class Diagram, Coding patterns, Mapping Design to Code [TB: Ch. 19.6, 20.1-11]
13. More Patterns for Assigning Responsibilities, Polymorphism, Pure Fabrication, Indirection, Protected Variation. GoF Design Patterns: Adapter, Factory [TB: Ch. 22.1-4, 23.1-2]
14. Gof: Singleton, Strategy, Composition, Façade and Discuss Remaining Patterns [TB: Ch. 23.4-8]

Note: [Students must also be introduced with Object Diagram, Component Diagram, Package Diagram, Deployment Diagram, Network Diagram.]

Textbook(s):

- Applying UML and patterns: An introduction to Object-Oriented Analysis and Design and Iterative Development by Craig Larman, Prentice Hall; 3rd Edition (October 30, 2004). ISBN-10: 0131489062

Reference Material:

- The Unified Modeling Language User Guide by G. Booch, J. Rambaugh and I. Jakobson, Addison-Wesley Professional; 2nd Edition (2005). ISBN-10: 0321267974.
- The Unified Modeling Language Reference Manual by James Rumbaugh, Ivar Jacobson

and Grady Booch, Addison-Wesley Professional; 2nd Edition (2004). ISBN-10: 032171895X.

- The Unified Modeling Language User Guide by Grady Booch, James Rumbaugh and Ivar Jacobson, Addison-Wesley Professional; (2005). ISBN-10: 0321267974.
- Visual Modeling with Rational Rose 2000 and UML by Terry Quatrani, Addison Wesley, (2000). ISBN: 0201699613.
- The Rational Unified Process Made Easy: A Practitioner's Guide to the RUP: A Practitioner's Guide to the RUP by Per Kroll, Philippe Kruchten and Grady Booch, Addison-Wesley Professional (2003). ISBN-10: 0321166094.

Course Title: Internet Architecture and Protocols
Course Code: CS-3513
Course Structure: Lectures: 3 / Labs: 0
Credit Hours: 3
Prerequisites: CMP-2540 (Computer Communications and Networks)

Course Objectives:
This course investigates the design principals of Internet. Students will learn the structure of the Internet and related protocols.

Course Syllabus:
Terms and Concepts.Functioning of the Internet. Review of The TCP/IP Model. Network Layer Addresses (IP Addresses). DHCP.DNS Servers& Configuration.Error Recovery Operations.Internet Local Area Networks (LANs).IEEE Standards. (CSMA/CD) LANs.CSMA/CD Protocol Stacks.Review of Ethernet.CSMA/CD Frames. Subnetwork Access Protocol (SNAP). CSMA/CD.Ethernet Layers.CSMA/CD Standards.The Token Ring Network.The Ring Configuration.FDDI.FDDI Configuration.The FDDI Layers.FDDI Backbones.Switched LANs.Fast Ethernet.Fast Ethernet and the Layered Model.Auto-Negotiation.Gigabit Ethernet. Internet Wide Area Networks (WANs). Message Switching and Packet Switching. Frame Relay. Cell Relay.Comparing WAN Technologies.X.25, Frame Relay, and ATM Virtual Circuits. Mapping IP Addresses to "Labels": Label or Tag Switching. IP and ICMP.ICMP.Time-to-Live.Destination Unreachable.Redirect.Router Discovery. Pings. IPv6. TCP and UDP. Round Trip Time (RTT). Nagle's Algorithm ReExamined. The Slow Start.Congestion Window and Threshold Size. The User Datagram Protocol (UDP). The Point-to-Point Protocol (PPP) and The Layer 2 Tunneling Protocol (L2TP). Routing Protocols.

Course Outline:
1. Introduction. Terms and Concepts. Functioning of the Internet. Review of The TCP/IP Model. Network Layer Addresses (IP Addresses). The IP Address Format. Special Rules for Addresses. IP Address Space. Address Resolution (Mapping). The Address Resolution Protocols. ARP. Proxy ARP. Reverse ARP. Bootstrap Protocol (BOOTP). DHCP. Introduction to Subnets and Subnet Addressing. Introduction to the Domain Name System (DNS). DNS Servers. The DNS Configuration. [TB: Ch. 1]
2. Error Recovery Operations: Introduction. Data Transfer across Links. The Basic Operations. Relationship of the Link Layer to the OSI Model. Link Layer Primitives (Service Definitions). [TB: Ch. 2]
3. The Link Timers. State Variables and Sequence Numbers. Transmit and Receive

Windows. The High Level Data Link Control (HDLC). The HDLC Frame. The FCS Check. Error. Checking. End-to-End Error Recovery by TCP. [TB: Ch. 2]

4. Internet Local Area Networks (LANs): Introduction to LAN, Notations and Topologies. IEEE Standards. Carrier Sense Multiple Access/Collision Detection (CSMA/CD) LANs. CSMA/CD Protocol Stacks. Review of Ethernet. CSMA/CD Frames. [TB: Ch. 3]
5. Subnetwork Access Protocol (SNAP). CSMA/CD in Action. Ethernet Layers. The Various CSMA/CD Standards. The Token Ring Network. The Ring Configuration. FDDI. FDDI Configuration. The FDDI Layers. FDDI Backbones. Switched LANs. Fast Ethernet. Comparing Ethernet and Fast Ethernet. Fast Ethernet and the Layered Model. Auto-Negotiation. Gigabit Ethernet. [TB: Ch. 3]
6. Internet Wide Area Networks (WANs): Typical Functions of a WAN Network Layer. WAN Interfaces. Placement of Functions. Connection-Oriented and Connectionless Networks. Relaying Data through the WAN. [TB: Ch. 4]
7. Review of Circuit Switching, Message Switching and Packet Switching. Frame Relay. Cell Relay. Comparing WAN Technologies. X.25, Frame Relay, and ATM Virtual Circuits. Mapping IP Addresses to "Labels": Label or Tag Switching. [TB: Ch. 4]
8. IP and ICMP: Attributes of IP. Processing the Datagram. Routing Table. Secondary Addresses in the Table. The IP Header. The IP Addresses Options Field. Subnetting. Address Aggregation. CIDR. Variable Length Submasks (VLSMs). Address Processing Overhead. Fragmentation. [TB: Ch. 5]
9. ICMP. Time-to-Live. Destination Unreachable. Redirect. Router Discovery. Pings. IPv6. Design Intent for IPv6. Hierarchical Address. Format of IPv6 Datagram. Extension Headers. ICMP and IPv6. Transition to IPv6. [TB: Ch. 5]
10. TCP and UDP:Protocol Placement of TCP and UDP. TCP: End-to-End Communications. Internet Traffic Characteristics. Arrival of Traffic. Bulk and Interactive Traffic. Internet Ports. Internet Ports. Port Operations. Sockets. TCP and Interactive Traffic. TCP and Bulk Traffic. The TCP Header (Segment). The TCP Open. TCP Data Transfer Operations. TCP Close. TCP Traffic Management. TCP Timer. [TB: Ch. 6]
11. Round Trip Time (RTT). Nagle's Algorithm ReExamined. The Slow Start. Congestion Window and Threshold Size. The User Datagram Protocol (UDP). The UDP Header. Interfaces to TCP and UDP. Socket Calls. [TB: Ch. 6]
12. The Point-to-Point Protocol (PPP) and The Layer 2 Tunneling Protocol (L2TP): Introduction to PPP. PPP and Associated Protocols. Major Functions of LCP. HDLC Formats. Key Terms. PPP Frame Format. Auto-Detect Operations. The PPP Phases. Link Dead (physical layer not ready). Link Establishment Phase. Authentication Phase. Network Layer Protocol Phase. Link Termination Phase. The PPP Protocol Data Unit. [TB: Ch. 7]
13. The LCP Packets. LCP Options. IPCP for IP Support. PPP Authentication. PAP. CHAP. IPv6CP. L2TP. L2TP Terms and Concepts. L2TP Configuration. L2TP Tunnels. L2TP Protocol Stack. L2TP Operations. [TB: Ch. 7]
14. Routing Protocols: Introduction. The Routing Domain. Multiple Routing Domains. Routing and Forwarding. Protocol Stacks. Gateway. Types of Routing Protocols. Distance Vector. Link State Metric. Design Goals. Static, Stub, and Default Routes. Distance Vector Protocols. Link State Metric Protocols. Shortest Path First Operations. [TB: Ch. 8]

Textbook(s):

- Internet Architecture: An Introduction to IP Protocols by Uyless D. Black, Prentice Hall PTR; 1st Edition (2000). ISBN-10: 0130199060

Reference Material:

- Internet Routing Architectures by Sam Halabi, Cisco Press; 2nd Edition (2000). ISBN-10: 157870233X
- TCP/IP Protocol Suite by Behrouz A. Forouzan, McGraw-Hill Science/Engineering/Math; 4th Edition (2009). ISBN-10: 0073376043
- Next-Generation Internet: Architectures and Protocols, by Andrei Gurtov, Cambridge University Press (2011). ISBN-10: 0521113687

Contents of Computer Science Elective Courses

Course Title: Multimedia Systems and Design

Course Code:CS-3743
Course Structure: Lectures: 3/ Lab: 0
Credit Hours: 3
Prerequisites: None

Course Objectives:
The course introduces students with the complete process of multimedia system specifications, formats, design, testing, and prototyping, including the tools and techniques for integrating multimedia content into a product.

Course Syllabus:
What is Multimedia? Text, Multimedia Authoring and Tools, Multimedia Authoring, Multimedia Production, Multimedia Presentation, Automatic Authoring; Editing and Authoring Tools- (Adobe Premiere, Macromedia Director, Macromedia Flash, Dreamweaver), VRML, Handling Images, Sound, Making Animation and Video, Making Multimedia, Multimedia Skills, Planning and Costing, Designing and Producing, Content and Talent, The Internet and Multimedia, Designing for the World Wide Web, Delivering Multimedia Product.

Course Outline:

1. What is Multimedia? Text [TB1. Ch. 1, 2]
2. Multimedia Authoring and Tools: Multimedia Authoring, Multimedia Production, Multimedia Presentation, Automatic Authoring; Editing and Authoring Tools- Adobe Premiere, Macromedia Director, Macromedia Flash, Dreamweaver; VRML. [TB2: Ch. 2]
3. Handling Images. [TB1. Ch. 3]
4. Handling Sound. [TB1. Ch. 4]
5. Handling Animation. [TB1. Ch. 5]
6. Handling Video. [TB1. Ch. 6]
7. Making Multimedia. [TB1. Ch. 7]
8. Multimedia Skills. [TB1. Ch. 8]
9. Planning and Costing. [TB. Ch. 9]
10. Designing and Producing [TB1. Ch. 10]

11. Content and Talent. [TB1. Ch. 11]
12. The Internet and Multimedia [TB1. Ch. 12]
13. Designing for the World Wide Web; [TB1. Ch. 13]
14. Delivering. [TB1. Ch. 14]

[Instructors need to devise a content delivery and Lab work plan using a multimedia Authoring tool in line with the contents of the textbook]

Textbook(s):

- Multimedia Making It Work Eighth Edition by Tay Vaughan, McGraw-Hill Osborne Media; 8th Edition (October 29, 2010). ISBN-10: 0071748466
- Fundamentals of Multimedia by Z. M. Li and M. S. Drew, Prentice Hall (2004), ISBN: 0-13-127256-X

Reference Material:

- Digital Multimedia by N. Chapman and J. Chapman. 2nd Edition, Wiley (2004). ISBN: 0-470-85890-7
- The Technology of Video and Audio Streaming by David Austerberry, Focal Press; 2nd Edition (2004). ISBN-10: 0240805801
- Multimedia Security: Watermarking, Steganography, and Forensics by Frank Y. Shih, CRC Press; 1st Edition (2012). ISBN-10: 1439873313
- Multimedia Computing by Daniel Cunliffe and Geoff Elliott, Lexden Publishing Ltd. (2005). ISBN-10: 1904995055
- Multimedia Foundations: Core Concepts for Digital Design by Vic Costello, Ed Youngblood and Susan Youngblood, Focal Press; 1st Edition (2012). ISBN-10: 0240813944

Course Title: Web Systems and Technologies

Course Code: CS-3548
Course Structure: Lectures: 3 / Labs: 0
Credit Hours: 3
Prerequisites: CMP-2122 (Programming Fundamentals)
Course Objectives:
To introduce students with Web Systems and Technologies.

Course Syllabus:
Overview of WWW, Web Pages, Web Sites, Web Applications, TCP/IP, TCP/IP Application, Services, Web Servers, WAMP Configuration. Introduction to HTTP, HTML & HTML5 Tags, and Dynamic Web Content.CSS and CSS3. Client Side Programming: JavaScript: Basics, Expressions and Control Flow, Functions, Objects, and Arrays, Accessing CSS from JavaScript. Form Handling. Server Side Programing: Programing in PHP.Introduction MySQL, MySQL Functions, Accessing MySQL via phpMyAdmin. Cookies, Sessions, and Authentication.Introduction to XML, Ajax, JQuery, Browsers and the DOM. Designing a Social Networking Site.

Course Outline:
1 Overview of WWW, Web Pages, Web Sites, Web Applications, TCP/IP, TCP/IP Application, Services, Web Servers, WAMP Configuration.

2 Introduction to HTTP, HTML & HTML5 Tags, and Dynamic Web Content.[Ch. 1]
3 CSS and CSS3 [Ch. 18,19]
4 Client Side Programming: Programing in JavaScript: Basics, Expressions and Control Flow, Functions, Objects, and Arrays, Accessing CSS from JavaScript [Ch. 13, 14, 15, 20]
5 Form Handling [Ch. 11]
6 Server Side Programing: Programing in PHP, [Ch. 3, 4,5,6]
7 Introduction MySQL, MySQL Functions, Accessing MySQL via phpMyAdmin,
8 Cookies, Sessions, and Authentication [Ch. 12]
9 Introduction to Ajax, JQuery,Browsers and the DOM [W3 Schools Tutorial]
10 Designing a Social Networking Site [Ch. 21]

Textbook(s):

- Learning PHP, MySQL, JavaScript, and CSS, A Step-by-Step Guide to Creating Dynamic Websites By Robin Nixon, O'Reilly Media; Second Edition edition (September 3, 2012). ISBN-10: 1449319262

Reference Material:

- Web Technologies: A Computer Science Perspective by Jeffrey C. Jackson, Prentice Hall; 1st Edition (August 27, 2006). ISBN-10: 0131856030
- Web Technologies by Uttam Kumar Roy, Oxford University Press, USA (June 13, 2011). ISBN-10: 0198066228
- Web Application Architecture: Principles, protocols and practices by Leon Shklar and Richard Rosen, Wiley; 2nd Edition (May 5, 2009). ISBN-10: 047051860X

Course Title: Enterprise Application Development

Course Code: CS-4745
Course Structure: Lectures: 3/ Labs: 0
Credit Hours: 3
Prerequisites: CS-3548 (Web Systems and Technologies)

Course Objectives:
This course explores advanced application development techniques in a large enterprise wide setting using Microsoft technologies.

Course Syllabus:
Object-Oriented Programming Review, Software Architectures Overview, Application and Page Framework, Asp. Net Server Control and Client Side Scripts, Manipulating Pages and Server Control With JavaScript, Client-Side callback, Web Server Control, Validation Server Control, Master Pages, Theme and Skins, Data Binding & Data Management with ADO.Net, Basic Of XML, XML Reader and XML Writer, Xml Document and Xpath Document, HTML and CSS Design with Asp.Net, ASP.Net AJAX Control, Building and Consuming Services, XML Services, Protocol for Web Services, ADO. Net Data Services, Security and Configuration, Application Deployment and Distribution.

Course Outline:

1. Object-Oriented Programming Review, Software Architectures Overview: Desktop, File/Server, 2-Tier Client/Server, Multi-Tier Client/Server
2. Application and Page Framework, Page Directives, Page Events, Compilation and Build Providers
3. Asp. Net Server Control and Client Side Scripts, Applying Style to Server Control, HTML Server Control
4. Manipulating Pages and Server Control With JavaScript, Client-Side callback
5. Web Server Control (label, literal, textbox, table, XML etc.)
6. Validation Server Control
7. Master Pages, Coding Master Pages, Coding Content Pages, Nesting Master Pages
8. Theme and Skins: Creating Own Theme, Multiple Skin Theme, Programmatically Working with Themes,
9. Data Binding & Data Management with ADO.Net, Data List Server Control, List View Server Control
10. Basic Of XML, XML Reader and XML Writer, Xml Document And Xpath Document
11. HTML and CSS Design with Asp.Net
12. ASP.Net AJAX Control, ASP .Net AJAX Application Control, Server Side Control, Update Panel Control
13. Building and Consuming Services, XML Services, Protocol for Web Services
14. ADO. Net Data Services

Textbook(s):

- Professional ASP.NET 4 in C# and VB by Bill Evjen, Scott Hanselman and Devin Rader, Wrox; 1st Edition (March 9, 2010). ISBN-10: 0470502207

Reference Material:

- Beginning ASP.NET 4.5 in C# by Matthew MacDonald, Apress; 1st Edition (August 29, 2012). ISBN-10: 1430242515
- Beginning ASP.NET 4: in C# and VB by Imar Spaanjaars, Wrox; 1st Edition (March 22, 2010). ISBN-10: 0470502215
- Patterns of Enterprise Application Architecture by Martin Fowler, Addison-Wesley Professional; 1st Edition (November 15, 2002). ISBN-10: 0321127420

Course Title: Mobile Application Development

Course Code: CS-4548
Course Structure: Lectures: 3 / Labs: 0
Credit Hours: 3
Prerequisites: CMP-2124 (Object Oriented Programming)

Course Syllabus:

Introduction to .NET Compact Framework. Building a Microsoft Windows Forms GUI. Using SQL Server and Other Data Stores.Catching Errors, Testing, and Debugging.Application Packaging and Deployment.Exchanging Data with Backend Servers.Networking.Getting Connected.Security Programming for Mobile Applications.Threading.Graphics Programming.Direct3D Mobile.Interoperating with the Platform. Building Custom Controls. Internationalization.Developing Applications with Windows Mobile.

Course Outline:

1. Building a Microsoft Windows Forms GUI. [TB: Ch. 1]
2. Using SQL Server 2005 Compact Edition and Other Data Stores. [TB: Ch. 2]
3. Catching Errors, Testing, and Debugging. [TB: Ch. 3]
4. Completing the Application: Packaging and Deployment. [TB: Ch. 4]
5. Exchanging Data with Backend Servers. [TB: Ch. 5]
6. Networking. [TB: Ch. 6]
7. Getting Connected. [TB: Ch. 7]
8. Security Programming for Mobile Applications. [TB: Ch. 8]
9. Threading. [TB: Ch. 9]
10. Graphics Programming. [TB: Ch. 10]
11. Direct3D Mobile. [TB: Ch. 11]
12. Interoperating with the Platform. [TB: Ch. 12]
13. Building Custom Controls. [TB: Ch. 13]
14. Internationalization. [TB: Ch. 14]
15. Developing with Windows Mobile. [TB: Ch. 15]

Textbook(s):

- Microsoft® Mobile Development Handbook By Andy Wigley, Daniel Moth, Peter Foot, Microsoft Press (May 30, 2007). ISBN-10: 0735623589

Reference Material:

- Building Microsoft ASP.NET Applications for Mobile Devices by Andy Wigley and Peter Roxburgh, Microsoft Press; 2nd Edition (May 14, 2003). ISBN-10: 073561914X
- Professional Mobile Application Development by Jeff McWherter and Scott Gowell, Wrox; 1st Edition (September 4, 2012). ISBN-10: 1118203909

Course Title: E-Commerce Applications Development

Course Code: CS-4746
Course Structure: Lectures: 3/Labs: 0
Credit Hours: 3
Prerequisites: CMP-3310 (Software Engineering)

Course Objectives:

This course focuses on electronic commerce applications, technologies, and tools which are used to conduct business on the World Wide Web.

Course Syllabus:

An overview of e-Commerce & Models, Planning an e-Commerce Framework, Managing Products and Categories, Product Variations and User Uploads, Enhancing the User Experience, The Shopping Basket, The Checkout and Order Process, Shipping and Tax, Discounts, Vouchers, and Referrals, Checkout, Taking Payment for Orders, User Account Management, Administration: Dashboard, Managing Products and Categories, Managing Orders, Customers, Refunds, Voucher Codes, Shipping, Deploying, Security, and Maintenance, SEO.

Course Outline:

1. e-Commerce: An overview of e-Commerce, Brick 'N Mortar stores vs Service-based

companies , e-Commerce Models, e-Commerce popular sites: iStockphoto, WooThemes, eBay, Amazon, Play.com. [TB: Ch.1]

2. Planning an e-Commerce Framework: Designing a framework, Patterns, Model-View-Controller, Registry , Singleton, Structure, Building a framework, Routing requests. [TB: Ch.2]
3. Products and Categories: Product information, Category information, Structuring Content, Versioning, Building products, categories, and content functionality, Routing products and categories. [TB: Ch.3]
4. Product Variations and User Uploads: Giving users choice, Giving users control, Shopping. [TB: Ch.4]
5. Enhancing the User Experience: The importance of user experience, Search, Providing wish lists, Making Recommendations, Stock Checking, Customer's Feed Back, Processing reviews/comments. [TB: Ch.5]
6. The Shopping Basket: Creating A Basket, Basket Contents, Managing the Basket, Cleaning the Basket. [TB: Ch.6]
7. The Checkout and Order Process: The Process, Authentication, Payment Method, Order Processed. [TB: Ch.7]
8. Shipping and Tax: Shipping Methods, Shipping Costs, Shipping Rules, Tracking, Tax Calculation. [TB: Ch.8]
9. Discounts, Vouchers, and Referrals: Discount codes, Purchasable Voucher Codes, Referrals. [TB: Ch.9]
10. Checkout: Checkout process consideration, Order process review, Authentication & Confirmation. [TB: Ch.10]
11. Taking Payment for Orders: Taking payment, Payment System, Payment gateway, Taking Payment Online, Taking payment offline. [TB: Ch.11]
12. User Account Features: User Account Area, Changing Details, Viewing & Managing Orders. [TB: Ch.12]
13. Administration: Dashboard, Managing Products and Categories, Managing Orders, Customers, Refunds, Voucher Codes, Shipping , etc. [TB: Ch.3]
14. Deploying, Security, and Maintenance, SEO. [TB: Ch.14, 15]

Textbook(s):

- PHP 5 E-commerce Development by Michael Peacock, Packt Publishing (January 20, 2010). ISBN-10: 184719964X

Reference Material:

- Introduction to E-Commerce by Jeffrey F. Rayport, McGraw-Hill, 2nd Edition (2007). ISBN-10: 0071232664
- E-Commerce 2012 (8th Edition) by Kenneth Laudon and Carol Guercio Traver, Prentice Hall; 8th Edition (2011). ISBN-10: 0138018812
- The Legal Environment of Business: Text and Cases - Ethical, Regulatory, Global, and Corporate Issues by Frank B. Cross and Roger .LeRoy Miller, South-Western College/West; 8th Edition (2011). ISBN-10: 0538453990
- e-Business and e-Commerce How to Program by Harvey M. Deitel, Paul J. Deitel and Tem R. Nieto, Prentice Hall; 1st Edition (2000). ISBN-10: 013028419X
- The Complete E-Commerce Book:Design, Build & Maintain a Successful Web-based Business by Janice Reynolds, Cmp Books (2000). ISBN-10: 157820061X

- Effortless E-Commerce with PHP and MySQL by Larry E. Ullman, New Riders; 1st Edition (2010). ISBN-10: 0321656229

Course Title: Cloud Computing
Course Code: CS-4544
Course Structure: Lectures: 3/Labs: 0
Credit Hours: 3
Prerequisites: CMP-3621(Operating Systems)

Course Objectives:
This course gives an introduction to cloud computing and related techniques, issues, ecosystem and case studies. Students will become familiar with cloud services and their techniques through labs and the term project.

Course Syllabus:
Overview of Distributed Computing, Emergence of Cloud Computing, Global Nature of the Cloud, Cloud-Based Service Offerings, Grid Computing , Reliability of Cloud Model, Benefits of Cloud Model, Legal Issues, Key Characteristics of Cloud Computing, Challenges for the Cloud. The Evolution of Cloud Computing. Web Services Delivered from the Cloud: Communication-as-a-Service (CaaS), Infrastructure-as-a-Service, Monitoring-as-a-Service (MaaS), Platform-as-a-Service (PaaS), Software-as-a-Service (SaaS), Infrastructure as a Service (IaaS), Platform as a Service (PaaS), Software as a Service (SaaS). Building Cloud Networks.Virtualization.Federation, Presence, Identity, and Privacy in the Cloud.Security in the Cloud. Common Standards in Cloud Computing. End-User Access to Cloud Computing. Mobile Internet Devices and the Cloud.

Course Outline:
1. Overview of Distributed Computing, Emergence of Cloud Computing, Global Nature of the Cloud, Cloud-Based Service Offerings, Grid Computing , Reliability of Cloud Model, Benefits of Cloud Model, Legal Issues, Key Characteristics of Cloud Computing, Challenges for the Cloud. [TB1]
2. The Evolution of Cloud Computing: Computer Hardware Evolution, Internet Software Evolution, Server Virtualization. [TB1: Ch. 1]
3. Web Services Delivered from the Cloud: Communication-as-a-Service (CaaS), Infrastructure-as-a-Service, Monitoring-as-a-Service (MaaS), Platform-as-a-Service (PaaS), Software-as-a-Service (SaaS), Infrastructure as a Service (IaaS), Platform as a Service (PaaS), Software as a Service (SaaS). [TB1: Ch. 2]
4. Building Cloud Networks: Evolution from the MSP Model to Cloud, The Cloud Data Center, Collaboration, Service-Oriented Architectures, Basic Approach to a Data Center-Based SOA, The Role of Open Source Software in Data Centers. [TB1: Ch. 3]
5. Virtualization: Sun xVMVirtualBox, FreeDOS, 7-Zip Archive Tool. [TB1: Ch. 4]
6. Federation, Presence, Identity, and Privacy in the Cloud: Federation in the Cloud, Presence in the Cloud, Privacy and Its Relation to Cloud-Based Information Systems. [TB1: Ch. 5]
7. Security in the Cloud, Cloud Security Challenges, Software-as-a-Service Security, Is Security-as-a-Service the New NSSP? [TB1: Ch. 6]
8. Common Standards in Cloud Computing: The Open Cloud Consortium, The Distributed

Management Task Force, Standards of Application Development, Standards for Messaging, Standards for Security. [TB1: Ch. 7]

9. End-User Access to Cloud Computing: YouTube, YouTube API Overview, Zimbra, Facebook, Zoho, DimDim Collaboration. [TB1: Ch. 8]
10. Mobile Internet Devices and the Cloud: Smartphones, Mobile Operating Systems for Smartphones, Mobile Platform Virtualization, Collaboration Applications for Mobile Platforms. [TB1: Ch. 9]

Textbook(s):

- Cloud Computing Implementation, Management, and Security by John W. Rittinghouse and James F. Ransome, Taylor and Francis Group, LLC (2010). ISBN 978-1-4398-0680-7.

Reference Material:

- Cloud Computing Explained: Implementation Handbook for Enterprises by John Rhoton. Recursive Press (2009). ISBN-10: 0956355609.
- Cloud Computing and SOA Convergence in Your Enterprise: A Step-by-Step Guide by David S. Linthicum, Addison-Wesley Professional; 1st Edition (2009). ISBN-10: 0136009220.
- Cloud Computing Bible by Barrie Sosinsky, Wiley; 1st Edition (2011). ISBN-10: 0470903562.
- Cloud Application Architectures: Building Applications and Infrastructure in the Cloud (Theory in Practice (O'Reilly)) by George Reese, O'Reilly Media; 1st Edition (2009). ISBN-10: 0596156367.
- Securing the Cloud: Cloud Computer Security Techniques and Tactics by Vic (J.R.) Winkler, Syngress; 1st Edition (2011). ISBN-10: 1597495921.
- Private Cloud Computing: Consolidation, Virtualization, and Service-Oriented Infrastructure by Stephen R Smoot and Nam K Tan, Morgan Kaufmann; 1 Edition (2011). ISBN-10: 0123849195.

Course Title: Principles of Soft Computing

Course Code: CS-4863
Course Structure: Lectures: 3 / Labs: 0
Credit Hours: 3
Prerequisites: CS-3143 (Design and Analysis of Algorithms)

Course Objectives:

Soft Computing refers to a collection of computational techniques in computer science, artificial intelligence and engineering disciplines which attempt to study, model and analyze complex problems - those for which more conventional methods have not yielded low cost, analytic and complete solutions. Unlike conventional computing, soft computing techniques are tolerant of imprecision, uncertainty and approximations. This course introduces students with soft computing techniques.

Course Syllabus:

Introduction to Soft Computing: Soft-Computing, Intelligent Systems and Soft Computing, Importance, Decision Support Systems, Soft Computing for Smart Machine Design. Fuzzy Set

Theory: Fuzzy Systems, Fuzzy Sets, Fuzzy Logic, Fuzzy Rules/Relations, Membership Functions, Fuzzification And Defuzzification, Fuzzy System Design, Fuzzy Arithmetics. Decision Making With Fuzzy Information, Fuzzy Classification and Clustering. Neural Networks: Single-Layer Networks, The Multi-Layer Perceptron, Radial Basis Functions, Error Functions, Parameter Optimization Algorithms, Learning and Generalization, Bayesian Nets: Symmetric Matrices, Dynamic Neural Networks and their Applications, Neuro-Fuzzy Systems. Evolutionary Computation and Genetic Fuzzy Systems: Introduction GA For Problem Solving, Theoretical Foundations. Machine Learning: Concept Learning and the General-to-Specific Ordering, Decision Tree Learning, Evaluating Hypotheses, Computational Learning Theory, Instance-Based Learning, Learning Sets Of Rules, Analytical Learning, Combining Inductive And Analytical Learning.

Course Outline:

1. Introduction to Soft Computing [TB1: Ch1]
2. Soft-Computing: Introduction to Intelligent Systems and Soft Computing, Importance, Decision Support Systems [TB1: Ch1], Soft Computing for Smart Machine Design [TB1: Ch9].
3. Fuzzy Set Theory - Fuzzy Systems: Fuzzy Sets [TB2:Ch 2], Fuzzy Logic, Fuzzy Rules/Relations[TB2:Ch 3], Membership Functions, Fuzzification and Defuzzification [TB2:Ch 4], Fuzzy System Design [TB2:Ch 8], Fuzzy Arithmetics [TB2:Ch 12], Decision Making with Fuzzy Information[TB1:Ch 2], Fuzzy Classification and Clustering[TB2:Ch 10]
4. Neural Networks: Single-Layer Networks[TB3: Ch. 3], The Multi-Layer Perceptron [TB3:Ch4], Radial Basis Functions [TB3:Ch 5], Error Functions[TB3: Ch6], Parameter Optimization Algorithms[TB3:Ch7], Learning and Generalization[TB3:Ch 9], Bayesian Nets(Symmetric Matrices [TB3:Ch10], Dynamic Neural Networks and Their Applications[TB1: Ch6], Neuro-Fuzzy Systems [TB1: Ch7]
5. Evolutionary Computation And Genetic Fuzzy Systems: Introduction[TB4:Ch1, TB1:Ch8], GA for Problem Solving[TB4:Ch2], Theoretical Foundations[TB4:Ch4]
6. Machine Learning: Concept Learning and the General-To-Specific Ordering [TB5:Ch2], Decision Tree Learning[TB5:Ch3], Evaluating Hypotheses[TB5:Ch5], Computational Learning Theory[TB5:Ch7], Instance-Based Learning[TB5:Ch8], Learning Sets of Rules[TB5:Ch10], Analytical Learning[TB5:Ch11], Combining Inductive and Analytical Learning[TB5:Ch12]

Textbook(s):

1. Soft Computing and Intelligent Systems Design: Theory, Tools, and Applications by F. Karray, C. De Silva, Addison-Wesley; 1st Edition (June 4, 2004). ISBN-10: 0321116178
2. Fuzzy Logic with Engineering Applications by T. Ross, Third Edition, Wiley; 3rd Edition (March 1, 2010). ISBN-10: 047074376X
3. Neural Networks and Pattern Recognition by C. Bishop, Oxford University Press, (1996). ISBN-10: 0198538642
4. An Introduction to Genetic Algorithms by M. Mitchell. A Bradford Book; Third Printing Edition (February 6, 1998). ISBN-10: 0262631857
5. Machine Learning by T. Mitchell, McGraw-Hill Science/Engineering/Math; 1st Edition (March 1, 1997). ISBN-10: 0070428077

Reference Material:

- An Introduction to Genetic Algorithms by M. Mitchell, A Bradford Book (February 6, 1998). ISBN-10: 0262631857
- Genetic Algorithms in Search, Optimization, and Machine Learning by D. E. Goldberg , Addison-Wesley Professional; 1st Edition (January 11, 1989). ISBN-10: 0201157675
- Understanding Neural Networks and Fuzzy Logic: Basic Concepts and Applicationsby S. V. Kartalopoulos, IEEE Press - PHI, (2004).
- Neural Networks, Fuzzy Logic and Genetic Algorithms: Synthesis & Applications by S. Rajasekaran & G. A. Vijayalakshmi Pai, PHI, (2003).
- Principles of Soft Computing by S. N. Sivanandam & S. N. Deepa , Wiley - India, (2007).

Course Title: Theory of Programming Languages

Course Code: CS-4140
Course Structure: Lectures: 3/Labs: 0
Credit Hours: 3
Prerequisites: CS-3131 (Theory of Automata & Formal Languages)

6th Term

Course Syllabus:

The Programming Language Spectrum, Compilation and Interpretation, Programming Environments.Programming Language Syntax.Names, Scopes, and Bindings.Semantic Analysis. Target Machine Architecture. Control Flow. Data Types.Subroutines and Control Abstraction.Data Abstraction and Object-Orientation.Functional Languages.Logic Languages.Concurrency.Scripting Languages.

Course Outline:

1. The Programming Language Spectrum, Compilation and Interpretation, Programming Environments. [TB1: Ch. 1]
2. Programming Language Syntax: Specifying Syntax, Scanning, Parsing, Finite & Push-Down Automata, Grammar and Language Classes. [TB1: Ch. 2]
3. Names, Scopes, And Bindings: The Notion Of Binding Time , Object Lifetime and Storage Management, Scope Rules, Implementing Scope, The Meaning of Names Within a Scope, The Binding of Referencing Environments, Macro Expansion, Separate Compilation. [TB1: Ch. 3]
4. Semantic Analysis: The Role of The Semantic Analyzer, Attribute Grammars, Evaluating Attributes, Action Routines, Space Management for Attributes, Decorating a Syntax Tree. [TB1: Ch. 4]
5. Target Machine Architecture: The Memory Hierarchy, Data Representation, Instruction Set Architecture, Architecture and Implementation, Compiling for Modern Processors.
6. Control Flow: Expression Evaluation, Structured and Unstructured Flow, Sequencing, Selection, Iteration, Recursion, Non-Determinacy. [TB1: Ch. 6]
7. Data Types: Type Systems, Type Checking, Records (Structures) and Variants (Unions), Arrays, Strings, Sets, Pointers and Recursive Types, Lists, Files and Input/Output, Equality Testing and Assignment. [TB1: Ch. 7]
8. Subroutines and Control Abstraction: Review of Stack Layout, Calling Sequences, Parameter Passing, Generic Subroutines And Modules, Exception Handling, Coroutines, Events. [TB1: Ch. 8]
9. Data Abstraction and Object Orientation: Object-Oriented Programming, Encapsulation

and Inheritance, Initialization and Finalization, Dynamic Method Binding, Multiple Inheritance, Object-Oriented Programming Revisited. [TB1: Ch. 9]

10. Functional Languages: Historical Origins, Functional Programming Concepts, A Review/Overview of Scheme, Evaluation Order Revisited, Higher-Order Function. Theoretical Foundations, Functional Programming In Perspective. [TB1: Ch. 10]
11. Logic Languages: Logic Programming Concepts, Prolog, Logic Programming in Perspective. [TB1: Ch. 11]
12. Concurrency: Background and Motivation, Concurrent Programming Fundamentals, Implementing Synchronization, Language-Level Mechanisms, Message Passing. [TB1: Ch. 12]
13. Scripting Languages: What is a Scripting Language? Problem Domains, Scripting The World Wide Web, Innovative Features. [TB1: Ch. 13]

Textbook(s):

- Programming Language Pragmatics by Michael L. Scott, Morgan Kaufmann; 3rd Edition (April 6, 2009). ISBN-10: 0123745144

Reference Material:

- Theories of Programming Languages by John C. Reynolds, Cambridge University Press; 1st Edition (April 2, 2009). ISBN-10: 0521106974
- Introduction to the Theory of Programming Languages (Undergraduate Topics in Computer Science) by Gilles Dowek and Jean-Jacques Lévy, Springer; 1st Edition, (December 15, 2010). ISBN-10: 0857290754
- Seven Languages in Seven Weeks: A Pragmatic Guide to Learning Programming Languages (Pragmatic Programmers) by Bruce A. Tate, Pragmatic Bookshelf; 1st Edition (November 17, 2010). ISBN-10: 193435659X
- Concepts in Programming Languages by John C. Mitchell, Cambridge University Press; 1st Edition (October 14, 2002). ISBN-10: 0521780985
- Advanced Programming Language Design by Raphael A. Finkel, Addison-Wesley; 1st Edition (December 31, 1995). ISBN-10: 0805311912

Course Title: Computer Graphics

Course Code: CS-4711
Course Structure: Lectures: 3 / Labs: 0
Credit Hours: 3
Prerequisites: CS-3143 (Design and Analysis of Algorithms)

Course Syllabus:

Overview of computer Graphics & Systems.Geometry and Lines.Graphics Primitives.Polygons.Transformation.Segmentation.Windowing and Clipping.Three Dimensions Geometry, 3D Primitives, 3D Transformations.Digital Geometry Processing.Classification, Partitioning, and Clipping.Visibility.

Course Outline:

1. A Survey of Computer Graphics, Overview of Graphics Systems. [TB3:Ch 1, 2]
2. Geometry and Line Generation Introduction, Lines, Line Segments, Perpendicular Lines, Distance between a Point and a Line, Vectors, Pixels and Frame Buffers, Vector

Generation, Bresenham's Algorithm, Antialiasing of Lines, Thick Line Segments, Character Generation, Displaying the Frame Buffer. [TB1:Ch 1]

3. Graphics Primitives Introduction, Display Devices, Primitive Operations, The Display-File Interpreter, Normalized Device Coordinates, Display-File Structure, Display-File Algorithms, Display Control, Text, The Line-Style Primitive. [TB1:Ch 2]
4. Polygons Introduction, Polygons, Polygon Representation, Entering Polygons, An Inside Test, Polygon Interfacing Algorithms, Filling Polygons, Filling with a Pattern, Initialization, Antialiasing. [TB1:Ch 3]
5. Transformation Introduction, Matrices, Scaling Transformations, Sin and Cos, Rotation, Homogeneous Coordinates and Translation, Coordinate Transformations, Rotation about an Arbitrary Point, Other Transformations, Inverse Transformations, Transformation Routines, Transformations and Patterns, Initialization, Display Procedures. [TB1:Ch 4]
6. Segments Introduction, The Segment Table, Segment Creation, Closing a Segment, Deleting a Segment, Renaming a Segments, Visibility, Image Transformation Revising Previous Transformation Routines, Saving and Showing Segments, Other Display-File Structures, Some Raster Techniques. [TB1:Ch 5]
7. Windowing and Clipping Introduction, The Viewing Transformation, Viewing Transformation, Implementation, Clipping, The Cohen-Sutherland Outcode Algorithm, The Clipping of Polygons, Adding Clipping to the System, Generalized Clipping, Position Relative to an Arbitrary Line, Multiple Windowing. [TB1:Ch 6]
8. Three Dimensions Introduction, 3D Geometry, 3D Primitives, 3D Transformations, Rotation about an Arbitrary Axis, Parallel Projection, Perspective Projection, Viewing Parameters, Special Projections, Conversion to View Plane Coordinates, Clipping in Three Dimensions, Clipping Planes, The 3D Viewing Transformation. [TB1:Ch 8]
9. Digital Geometry Processing, Spatial Curves, Surfaces, Volumetric Objects, Triangulations and Polyhedral Surfaces, Representation of implicit Surfaces, Representation of Volumetric Objects. [TB2:Ch 8]
10. Classification, Partitioning, and Clipping, Clipping Applications, Clipping Acceleration, Clipping Methodology, 2D Clipping, Clipping a Segment against the Virtual Screen, Polygon Clipping, 3D Clipping Clipping and Viewing. [TB2:Ch 12]
11. Visibility Foundations, (XYZ) Algorithms: Visibility with Rasterization, (XY)Z Algorithms: Visibility after Rasterization, Z(XY) Algorithms: Visibility before Rasterization. [TB2:Ch 13]

Textbook(s):

- Computer Graphics: A Programming Approach by Steven Harrington, Mcgraw-Hill College; 2nd Edition, (1987). ISBN-10: 0070267537
- Computer Graphics: Theory and Practice by Jones Gomes, CRC Press, (2012). ISBN-10: 1568815808

Reference Material:

- Computer Graphics with OpenGL by Donald D. Hearn and M. Pauline Baker, Pearson, 3 Edition, 2002, ISBN-10: 0131202383
- Computer Graphics with Open GL (4th Edition) by Donald D. Hearn, Prentice Hall, 4 Edition, (2010). ISBN-10: 0136053580
- Introduction to Computer Graphics: Using Java 2D and 3D, Springer, 2nd Edition, (2012). ISBN-10: 1447127323

Course Title: Artificial Neural Networks
Course Code: CS-4812
Course Structure: Lectures: 3/ Labs:0
Credit Hours: 3
Prerequisites: None

Course Objectives:
On completion of this course, the student should be able to understand neural network architectures and learning algorithms and also be able to apply neural networks to real classification problems.

Course Syllabus:
Introduction,: Humans And Computers. The Structure of the Brain.Pattern Recognition.The Basic Neuron & Learning Algorithm. The Multilayer Backpropagation Network (BPN). The Multilayer Perceptron Algorithm.Kohonen Self-Organising Networks.The BAM (Bidirectional Auto-Associative Memory) Network.The Hopfield Memory Networks.Simulated Annealing. Mean Field Theory, Spin Glasses, Constraint Satisfaction, The Travelling Salesman Problem. The Elastic Net. The Counter Propagation Network (CNP). CNP Data Processing.Adoptive Resonance Memory. The Initialization Phase, The Recognition Phase, The Comparison Phase, Vigilance Threshold, The Search Phase. ART Algorithm, Training Art Network, Scaling The Feedforward Weights, The Training Cycle, Classification.

Course Outlines

1. Introduction: Humans And Computers, The Structure of The Brain, Learning in Machines, The Differences .[TB1: Ch1]
2. Pattern Recognition: Feature Vectors And Feature Space, Discriminant Functions, Classification Techniques, Linear Classifiers.[TB1: Ch2]
3. The Basic Neuron: Modeling the Single Neuron, The Perceptron Learning Algorithm (Hebbian Learning), Widrow-Hoff Delta Rule, Limitations of Perceptrons, The End of the Line? [TB1: Ch 3]
4. The Multilayer Backpropagation Network (BPN), The Generalized Delta Rule, Updates of Output-Layer Weights, Updates of Hidden Layer Weights [TB2: Ch3, TB1: Ch4]
5. The Multilayer Perceptron Algorithm(Summary), The XOR Problem Revisited, Multilayer Perceptron as Classifier, Learning Difficulties [TB1: Ch4, TB2: Ch3]
6. Kohonen Self-Organising Networks: Introduction, The Self-Organisation Concept, The Kohonen Algorithm, Weights Training, Initialising The Weights, Reducing The Neighbourhood [TB1: Ch5]
7. The BAM (Bidirectional Auto-Associative Memory) Network: Associative-Memory Definitions, BAM Architecture, BAM Processing, BAM Mathematics, BAM Energy Function [TB2: Ch4]
8. The Hopfield Memory Networks: Introduction, The Hopfield Network Algorithm, The Energy Landscape, Storing Patterns, Recall The Stored Patterns [TB1: Ch6]
9. Simulated Annealing: Statistical-Mechanics Concepts, Real And Simulated Annealing, The Boltzman Machine, Basic Architecture and Processing Algorithm, Learning in Boltzman Machines [TB2: Ch5]
10. Mean Field Theory, Spin Glasses, Constraint Satisfaction, The Travelling Salesman

Problem, The Elastic Net [TB1: Ch6]

11. The Counter Propagation Network (CNP): CNP Building Blocks, The Input Layer, The Instar and Its Learning Algorithm, Competitive Networks, The Outstar. [TB2: Ch6]
12. CNP Data Processing, Forward Mapping, Training Algorithm of the CNP , Adoptive Resonance Memory: Adoptive Resonance Theory (ART), The ART Architecture, ART-1 Operation CNP [TB2: Ch6, TB1: Ch7]
13. The Initialization Phase, The Recognition Phase, The Comparison Phase, Vigilance Threshold, The Search Phase. [TB1: Ch7]
14. ART Algorithm, Training Art Network, Scaling The Feedforward Weights, The Training Cycle, Classification. [TB1: Ch7]

Textbooks:

1. Neural Computing (an introduction); by R Beal and T Jackson; Institute of Physics Publishing, Techno House, Redcliffe Way, Bristol BS1 6NX, UK; (1994).
2. Neural Networks (Algorithms, Applications, and Programming Techniques) by James A. Freeman and David M. Skapura; Published by Pearson Education (Singapure) Pte. Ltd., Indian Branch, 482 F.I.E. Patpargannj, Delhi 110 092, India; (2004).

Reference Material:

- Neural Networks and Pattern Recognition by C. Bishop, Oxford University Press, (1996). ISBN-10: 0198538642
- Neural Networks and Learning Machines by Simon O. Haykin, Prentice Hall; 3rd Edition (November 28, 2008). ISBN-10: 0131471392

Course Title: System Programming

Course Code: CS-3641
Course Structure: Lectures: 3 / Labs: 0
Credit Hours: 3
Prerequisites: CMP-2122(Programming Fundamentals)

Course Objectives:

This course has three goals. First, it teaches the tools available in a Windows operating system for program development. These tools include standard libraries, system calls, system programs, and the basic Windows file system structure. Second, it is intended to rigorously develop the System programming skills of students. Third, it is intended to introduce students to system level code reading and the principles of code management.

Course Syllabus:

Operating System Essentials, Windows, Standards, and Open Systems, 32-bit and 64-bit Source Code Portability. Using the Windows File System and Character I/O. Advanced File and Directory Processing, and the Registry. Exception Handling.Memory Management, Memory-Mapped Files, and DLLs. Process Management.Threads and Scheduling. Thread Synchronization. Advanced Thread Synchronization.Interprocess Communication.Network Programming with Windows Sockets.Windows Services.Asynchronous Input/Output and Completion Ports. Overlapped I/O, I/O Completion Ports. Securing Windows Objects.

4th Edition (February 26, 2010). ISBN-10: 0321657748

Reference Material:

- Programming Windows® by Charles Petzold, Microsoft Press; 5th Edition (December 2, 1998). ISBN-10: 157231995X
- Programming Windows with MFC by Jeff Prosise, Microsoft Press; 2nd Edition (May 13, 1999). ISBN-10: 1572316950
- Windows 8 Bible by Jim Boyce and Rob Tidrow, Wiley; 4th Edition (October 23, 2012). ISBN-10: 1118203887
- Programming Windows Security by Keith Brown, Addison-Wesley Professional; 1st Edition (July 15, 2000). ISBN-10: 0201604426

Course Title: 3D Modeling & Animation

Course Code: CS-4742
Course Structure:Lectures: 3/ Labs: 0
Credit Hours: 3
Prerequisites: None

Course Objectives:

This course utilizes concepts and tools that professionals apply to create games and illustrations as well as storytelling with 3d animation. This course will cover all related techniques needed to created 3D scenes including lighting, texturing and rendering.

Course Syllabus:

Introduction to 3D Modeling & Animation, History Of Computer Graphics and Special Effects. Polygons, Polygon Meshes, Extruding, Controlling Edges and Edges Loop, Subdividing and Simplifying, Combining Meshes, Polygon Count, Normals, UV Coordinates.NURBS, Advantages and Disadvantages of NURBS.Subdivision Surfaces.Deforming, Sculpting and Special Selections, Morph Targets, Lattices and Curves, Specialized Deformers, Managing Soft and Rigid Bodies.Managing Animation. Coloring, Shaders, Ray Tracing, Photon Mapping. Working with Textures, Shading, UV Mapping, Paining in 3D, Changing Geometry, Seamless Reporting Pattern, Multiple Maps. Light Effect. Virtual Camera, Faking Camera Effects, Matching Virtual Cameras to Real One, Cameras and Image Planes, Animating the Camera, Camera Views, Camera Movements. Environments, Rendering.Animation Tools.

Course Outline:

1. Introduction to 3D Modeling & Animation, History Of Computer Graphics and Special Effects. [TB: Ch. 1, 2]
2. Polygons: From 2D To 3D, Understanding Polygon, Polygon Meshes, Extruding, Controlling Edges and Edges Loop, Subdividing and Simplifying, Combining Meshes, Polygon Count, Normals, UV Coordinates. [TB: Ch. 3]
3. NURBS: From Straight to Curve, Crafting and Modifying Curves, NURBS Surface, Advantages and Disadvantages of NURBS. Subdivision Surfaces: The Marriage of Polygon and NURBS. [TB: Ch. 4, 5]
4. Deforming, Sculpting and Special Selections, Morph Targets, Lattices and Curves, Specialized Deformers, Soft Bodies, Constrains, Skeletons and Muscles, Rigid Bodies.

Course Outline:

1. Operating System Essentials, Windows, Standards, and Open Systems, 32-bit and 64-bit Source Code Portability, The Standard C Library. [TB: Ch. 1]
2. Using the Windows File System and Character I/O:The Windows File Systems, File Naming; Opening, Reading, Writing, and Closing Files; Unicode Strategies, Standard Devices, File and Directory Management, Console I/O. [TB: Ch.2]
3. Advanced File and Directory Processing, and the Registry: The 64-Bit File System, File Pointers, File Attributes and Directory Processing, File Locking, Registry Management. [TB: Ch. 3]
4. Exception Handling: Exceptions and Their Handlers, Floating-Point Exceptions, Errors and Exceptions, Termination Handlers, Console Control Handlers, Vectored Exception Handling. [TB: Ch. 4]
5. Memory Management, Memory-Mapped Files, and DLLs: Windows Memory Management Architecture, Managing Heap Memory, Memory-Mapped Files, Dynamic Link Libraries, The DLL Entry Point, DLL Version Management. [TB: Ch. 5]
6. Process Management: Windows Processes and Threads, Process Creation, Process Identities, Duplicating Handles, Exiting and Terminating a Process, Waiting for a Process to Terminate, Environment Blocks and Strings, Processes in a Multiprocessor Environment, Process Execution Times, Generating Console Control Events. [TB: Ch. 6]
7. Threads and Scheduling: Thread Basics, Thread Management, Using the C Library in Threads, Performance Impact, Introduction to Program Parallelism, Thread Local Storage, Process and Thread Priority and Scheduling, Thread States, Timed Waits, Fibers. [TB: Ch 7]
8. Thread Synchronization: Thread Synchronization Objects, CRITICAL_SECTION Objects, A CRITICAL_SECTION for Protecting Shared Variables, Mutexes, Semaphores, Events. [TB: Ch. 8]
9. Advanced Thread Synchronization: The Condition Variable Model and Safety Properties, Using SignalObjectAndWait, A Queue Object, Windows NT6 Condition Variables, Asynchronous Procedure Calls, Queuing Asynchronous Procedure Calls, Alertable Wait States, Thread Stacks and the Number of Threads. [TB: Ch. 10]
10. Interprocess Communication: Anonymous Pipes, Named Pipes, Named Pipe Transaction Functions, Mailslots, Pipe and Mailslot Creation, Connection, and Naming. [TB: Ch. 11]
11. Network Programming with Windows Sockets: Windows Sockets, Socket Server Functions, Socket Client Functions, Comparing Named Pipes and Sockets, In-Process Servers, Line-Oriented Messages, DLL Entry Points, and TLS, Datagrams. [TB: Ch. 12]
12. Windows Services: Writing Windows Services–Overview, The main() Function, ServiceMain() Functions, The Service Control Handler, Event Logging, Managing Windows Services.
13. Asynchronous Input/Output and Completion Ports: Overview of Windows Asynchronous I/O,
14. Overlapped I/O, I/O Completion Ports. [TB: Ch. 14]

Textbook(s):

- Windows System Programming by Johnson M. Hart, Addison-Wesley Professional;

[TB: Ch. 6]

5. Rigging, Parent Child, Bones and Joints, Skeletons, Creating a Skeleton Rig, Joint Limiting, Kinematics, Skinning, Rigid Building, Smooth Binding, Muscles, Other Uses for Joint. [TB: Ch. 7]
6. Animation, Basic Principles, Key Framing, Animation with Graphics, Motion Capture, Facial Animation, Automation, Fence-Post Errors, Animation Workflow. [TB: Ch. 8]
7. Dynamics, Physics, Collision Detection, Particles, Hairs, Fluid Dynamics, Crowds and Population, Quality. [TB: Ch. 9]
8. Coloring, Shaders, Ray Tracing, Photon Mapping. [TB: Ch. 10]
9. Working with Textures, Shading, UV Mapping, Paining in 3d, Changing Geometry, Seamless Reporting Pattern, Multiple Maps. [TB: Ch. 11]
10. Light Effect, Reflection, Refraction, Caustics, Translucency, Shadows. Lighting the Way, Light Properties, Types of Light, Objects as Light Source. [TB: Ch. 12, 13]
11. Working with Camera, Virtual Camera, Faking Camera Effects, Matching Virtual Cameras to Real One, Cameras and Image Planes, Animating the Camera, Camera Views, Camera Movements. [TB: Ch. 14]
12. Environments, Rendering [TB: Ch. 15, 16]
13. Animation Tools

Textbook(s):

- 3D Art Essentials: The Fundamentals of 3D Modeling, Texturing, and Animation by Ami Chopine, Focal Press; 1st Edition (March 23, 2011). ISBN-10: 0240814711

Reference Material:

- Blender (latest Version)
- GIMP (latest), Photoshop (any)
- 3D Modeling, Animation, and Rendering: An Illustrated Lexicon, Color Edition by Michael E. Mortenson, CreateSpace Independent Publishing Platform (2010). ISBN-10: 1453728481
- The Complete Guide to Blender Graphics: Computer Modeling and Animation by John M. Blain, A K Peters/CRC Press; 1st Edition (2012). ISBN-10: 1466517034
- Digital Modeling by William Vaughan, New Riders; 1st Edition (2012). ISBN-10: 0321700899
- Blender Game Engine: Beginner's Guide by bacone Victor kuller, Packt Publishing (2012). ISBN-10: 1849517029

Course Title: Computer Game Development

Course Code: CS-4741
Course Structure: Lectures: 3, Labs: 0
Credit Hours: 3
Prerequisites: CMP-3113 (Data Structures & Algorithms)

Course Objectives:

The course is design to teaching how to create a complete computer / video game from start to finish? What are the different elements to a game? What makes a great game?

Course Syllabus:

Introduction to Game Development, Platform and Player Modes, What Is The Framework? Goals And Genres? What Are The Possibilities? Player Elements, Player Motivation, Geographic, Psychographics.Demographics, Gender, Generation, Rating, Applying Player Market to Platform. Story and Character Development: Classic Charters, Traditional Story Structure, Story Element. Plot, Game Story Devices, Game Characters. Character Development Element, Point-of-view, Visual Character Development, Verbal Character Development, Movement.Visual Character Development, Verbal Character Development, Movements, Chracter Description, Game Storytelling and Documentation. Gameplay: Rules to Play, Interactivity Modes, Game theory, Challenges, Balance. Levels: Level Design, Structure, Time, Space. Interface: Playe-Centerd Design, Interface & Game Feature, Interface Types, Usability. Audio: Importance of Game Audio, Sound Effect, Voiceover, Music. Company Role, Team Roles, Tools, Business Side of Game Development. Production and Management, Development Phases, Game Documentation.

Course Outline:

1. Building The Foundation, Historical Elements How Did We Get Here
2. Platform And Player Modes, What Is The Framework? [TB: Ch. 2]
3. Goals And Genres? What Are The Possibilities? [TB: Ch. 3]
4. Player Elements, Player Motivation, Geographic, Psychographics. [TB: Ch. 4]
5. Demographics, Gender, Generation, Rating, Applying Player Market to Platform. [TB: Ch. 4]
6. Story and Character Development: Classic Charters, Traditional Story Structure, Story Element. [TB: Ch. 5]
7. Plot, Game Story Devices, Game Characters [TB: Ch. 5]
8. Character Development Element, Point-of-view, Visual Character Development, Verbal Character Development, Movement, [TB: Ch. 5]
9. Visual Character Development, Verbal Character Development, Movements, Chracter Description, Game Storytelling and Documentation [TB: Ch. 5]
10. Gameplay: Rules to Play, Interactivity Modes, Game theory, Challenges, balance [TB: Ch. 6]
11. Levels: Level Design, Structure, Time, Space. [TB: Ch. 7]
12. Interface: Playe-Centerd Design, Interface & Game Feature, Interface Types, Usability. [TB: Ch. 8]
13. Audio: The Importance of Game Audio, Sound Effect, Voiceover, Music. [TB: Ch. 9]
14. Role & Responsibilities: Company Role, Team Roles, Tools, Business Side of Game Development. [TB: Ch. 10]
15. Production and Management, Development Phases, Game Documentation [TB: Ch. 11]

Textbook(s):

- Game Development Essentials by Jeannie Novak, Delmar Cengage Learning; 3rd Edition (August 17, 2011). ISBN-10: 1111307652

Reference Material:

- Game Development Essentials: An Introduction by Jeannie Novak, Delmar Cengage Learning; 3rd Edition (2011). ISBN-10: 1111307652
- Game Development Essentials: Mobile Game Development by Kimberly Unger and

Jeannie Novak, Delmar Cengage Learning; 1st Edition (2011). ISBN-10: 1418052655

- Game Development Essentials: Game Interface Design by Kevin Saunders and Jeannie Novak, Delmar Cengage Learning; 2nd Edition (2012). ISBN-10: 1111642885
- Game Development Essentials: Online Game Development by Rick Hall and Jeannie Novak, Delmar Cengage Learning; 1 Edition (2008). ISBN-10: 1418052671
- Beginning 3D Game Development with Unity: All-in-one, multi-platform game development by Sue Blackman, Apress; 1st Edition (2011). ISBN-10: 1430234229
- Game Coding Complete by Mike McShaffry and David Graham, Course Technology PTR, 4th Edition, (2012). ISBN-10: 1133776574
- The Essential Guide to Flash Games: Building Interactive Entertainment with Action Script by Jeff Fulton and Steve Fulton, friends of ED; 1st Edition (2010). ISBN-10: 1430226145

Course Title: Web Engineering

Course Code: CS-4513
Course Structure: Lectures: 3/Labs: 0
Credit Hours: 3
Prerequisites: CS-3548 (Web Systems and Technologies)

Course Objectives:
The course is aimed to provide students with conceptual understanding required to develop web applications and web services according to international standards.

Course Syllabus:
An Introduction to Web Engineering.Requirements Engineering for Web Applications.Web Applications Modeling.Web Application Architectures. Technology-away Web Application Design. Technologies for Web Applications.Testing Web Applications.Operation and Maintenance of Web Application.Web Project Management.Web Application Development Process.Usability of Web Applications.Performance of Web Applications.Security for Web Applications.The Semantic Web.

Course Outline:

1. An Introduction to Web Engineering: Categories of Web Applications, Characteristics of Web Applications.
2. Requirements Engineering for Web Applications: Fundamentals of RE, RE Specifics in Web Engineering, Principles for RE of Web Applications, Adapting RE Methods to Web Application Development. [TB: Ch. 2]
3. Web Applications Modeling: Fundamentals of WAM, Modeling Specifics in Web Engineering, Modeling Requirements, Content Modeling, Hypertext Modeling, Presentation Modeling, Customization Modeling, Methods and Tools. [TB: Ch. 3]
4. Web Application Architectures:Fundamentals of WAA, Specifics of WAA, Components of a Generic AA, Layered Architecture, Data-aspect Architectures. [TB: Ch. 4]
5. Technology-away Web Application Design: Web Design from an Evolutionary Perspective, Presentation Design, Interaction Design, Functional Design, Outlook. [TB: Ch. 5]
6. Technologies for Web Applications: Fundamentals, Client/Server Communication on the Web, Client-side Technologies, Document-specific Technologies, Server-side

Technologies. [TB: Ch. 6]

7. Testing Web Applications: Test Web Applications: Fundamentals, Test Specifics in Web Engineering, Test Approaches, Test Scheme, Test Methods and Techniques, Test Automation. [TB: Ch. 7]
8. Operation and Maintenance of Web Application: Introduction, Challenges Following the Launch of A Web Application, Promoting a Web Application, Content Management, Usage Analysis. [TB: Ch. 8]
9. Web Project Management: Project Management to Web Project Management, Challenges in WPM, Managing Web Team, Managing the Development Process. [TB: Ch. 9]
10. Web Application Development Process: Fundamentals, Requirements for a Web Application Development Process, Analysis of the Rational Unified Development Process, Analysis of Extreme Programming. [TB: Ch. 10]
11. Usability of Web Applications: What is Usability, Characteristics of Web Application Usability, Design Guidelines, Web Usability Engineering Methods, Web Usability standards, Web Usability Engineering Trends. [TB: Ch. 11]
12. Performance of Web Applications: What is Performance, Characteristics of Web Applications Performance, System Definition and Indicators, Characterizing the Workload, Analytical Techniques, Representing and Interpreting Results, Performance Optimization Methods. [TB: Ch. 12]
13. Security for Web Applications: Introduction, Aspects of Security, Encryption, Digital Signatures and Certificates, Secure Clients/Server-Interaction, Client Security Issue, Service Provider Security Issues. [TB: Ch. 13]
14. The Semantic Web: Fundamentals, Technological Concepts, Specifics of Semantics Web Applications, Tools. [TB: Ch. 14]

Textbook(s):

- Web Engineering: The Discipline of Systematic Development of Web Applications by Gerti Kappel, Birgit Pr ¨ oll, Siegfried Reich, Werner Retschitzegger, Springer; Softcover reprint of hardcover 1st Edition. 2008 Edition (December 10, 2010). ISBN-10: 184996677X

Reference Material:

- Web Engineering by Emilia Mendes and Nile Mosley, Springer; Softcover reprint of hardcover 1st Edition. 2006 Edition (November 9, 2010). ISBN-10: 3642066453
- Web Engineering: A Practioner's Approach by Roger Pressman and David Lowe, McGraw-Hill Science/Engineering/Math; 1st Edition (January 22, 2008). ISBN-10: 0073523291
- Web Application Architecture: Principles, Protocols and Practices by Leon Shklar and Rich Rosen, Wiley; 2nd Edition (May 5, 2009). ISBN-10: 047051860X
- Web Engineering by Emilia Mendes and Nile Mosley, Springer; Softcover reprint of hardcover 1st Ed. 2006 Edition (November 9, 2010). ISBN-10: 3642066453
- Web Engineering: Modelling and Implementing Web Applications by Gustavo Rossi, Oscar Pastor, Daniel Schwabe, and Luis Olsina, Springer; Softcover reprint of hardcover 1st Edition. 2008 Edition (December 10, 2010). ISBN-10: 184996677X
- W3C Online Resources

Course Title: Database Administration & Management

Course Code: CS-3441
Course Structure: Lectures: 3/Labs: 0
Credit Hours: 3
Prerequisites: CMP-3450 (Database Systems)

Course Objectives:

- Make Students fully understand the concepts and technical issues of Database Administration.
- Make Students to have good understanding of internal functionality of Database Management System and can Administrator Huge Database implemented in a DBMS.
- They Should Perform Database Administration tasks i.e. Backup and Recovery and Performance Tuning of Databases.

Course Syllabus:

Installation; SQL* Plus; Oracle Enterprise Manager; DBA Tools. Oracle Architectural Components: Oracle Server. Oracle Instance.Physical Structure.SGA.Shared Pool.Library Cache.Data Dictionary Cache.Large Pool.Processes.Managing Oracle Instances.Startup and Shutdown Database.Managing Files.Creating Database and Data dictionary.Managing Tablespaces.Operations with Tablespaces. Data File Management, Segments, Block. Managing Undo Data, Undo Data Statistics: Managing Tables and Users. Indexes Management, Maintaining Data Integrity, Constraints.Managing Privileges.Basic Oracle Net Architecture.Server Side Configuration.Client Side Configuration. Usage and Configuration of Oracle Shared Server. Backup and Recovery. Sizing Shared Pool, Sizing Buffer Cache, I/O Issues. Tuning Rollback Segments. Tuning Shared Servers, Types of Locks, Block Efficiency, Storage hierarchy, Avoiding Dynamic allocation, Statistics, PCTFREE and PCTUSED. Monitoring Index Usage.

Course Outline:

1. Installation; SQL* Plus; Oracle Enterprise Manager; DBA Tools. Oracle Architectural Components: Oracle Server; Oracle Instance.
2. Physical Structure; SGA; Shared Pool; Library Cache; Data Dictionary Cache; Large Pool; User Process; Server Process; Background Processes.
3. Managing an Oracle Instance: Parameter File; Creating SPFILE; Oracle Managed Files; Startup and Shutdown Database; Alert Log File; Background Trace File; User Trace File.
4. Creating Database and Data dictionary.
5. Managing Control Files and Redo Log Files.
6. Managing Tablespaces, Operations with Tablespaces.
7. Data File Management, Segments, Block.
8. Managing Undo Data, Undo Data Statistics: Managing Tables and Users:
9. Indexes Management, Maintaining Data Integrity, Constraints. Managing Privileges.
10. Basic Oracle Net Architecture: Types of Networks, Oracle Net Services, Oracle Shared Server, Connection Manager, Oracle Net Connections.
11. Server Side Configuration: The Listener Process; Configuring Listener, Sessions, Creating and Managing Listener.
12. Client Side Configuration: Host Naming Method, Local Naming Method, Net Assistant, Configurations. Usage and Configuration of Oracle Shared Server.

13. Backup and Recovery, Instance and Media Recovery, Configuration of Archive log mode, User Managed Complete Recovery, Loading Data into Database, Tuning Tools, Sizing Shared Pool, Sizing Buffer Cache, I/O Issues.
14. Tuning Rollback Segments, Latches, Rollback Segment Tuning Shared Servers, Types of Locks, Block Efficiency, Storage hierarchy, Avoiding Dynamic allocation, Statistics, PCTFREE and PCTUSED, Monitoring Index Usage.

Textbook(s):

- Oracle Database 11g DBA Handbook by Bob Bryla and Kevin Loney, McGraw-Hill Osborne Media; 1st Edition (December 6, 2007). ISBN-10: 0071496637
- Database Administration: The Complete Guide to DBA Practices and Procedures by Craig S. Mullins, Addison-Wesley Professional; 2nd Edition (October 21, 2012). ISBN-10: 0321822943

Reference Material:

- Database Systems: A Practical Approach to Design, Implementation and Management by Thomas M. Connolly and Carolyn E. Begg, Addison-Wesley; 5th Edition (2009). ISBN-10: 0321523067
- Oracle Database 11g The Complete Reference by Kevin Loney, McGraw-Hill Osborne Media; 1st Edition (2008). ISBN-10: 0071598758
- Oracle Database 11g Release 2 Performance Tuning Tips & Techniques (Oracle Press) by Rich Niemiec, McGraw-Hill Osborne Media; 1st Edition (2012). ISBN-10: 0071780262
- Online Material URL http://otn.oracle.com

Course Title: Data Warehousing

Course Code: CS-4441
Course Structure: Lectures: 3 / Labs: 0
Credit Hours: 3
Prerequisites: CMP-3450 (Database Systems)

Course Syllabus:

Introduction to Data Warehousing, Data Warehouse System Lifecycle, Analysis and Reconciliation of Data Sources, User Requirement Analysis, Conceptual Modeling, Conceptual Design, Workload and Data Volume, Logical Modeling, Logical Design, Data-staging Design, Indexes for the Data Warehouse, Physical Design, Data Warehouse Project Documentation, Case Studies, Tools for Data Warehousing: MS SQL and Teradata.

Course Outline:

1. Introduction to Data Warehousing: Brief History, Characteristics, Architecture, Data Staging and ETL, Multi-dimentional Model, Meta-data, Accessing Data Warehouse, ROLAP, MOLAP, and HOLAP. [TB1: Ch. 1]
2. Data Warehouse System Lifecycle: Risk Factors, Top-Down vs Bottom-Up, Data Mart Design Phases, Methodological Framework – Data-Driven, Requirement-Driven; Testing Data Marts. [TB1: Ch. 2]
3. Analysis and Reconciliation of Data Sources: Inspecting and Normalization Schemata,

Integration Problems, Integration Phases, Defining Mapping. [TB: Ch. 3]

4. User Requirement Analysis: Interviews, Glossary-based Requirement Analysis. Additional Requirements. [TB: Ch. 4]
5. Conceptual Modeling: Dimensional Fact Model, Events and Aggregation, Temporal Aspects, Overlapping Fact Shcemata, Formalizing the Dimensional Fact Model. [TB: Ch. 6]
6. Conceptual Design: ER Schema-based Design, Relational Schema-based Design, XML Schema-based Design, Mixed-approach Design. Requirement-driven Approach Design. [TB: Ch. 6]
7. Workload and Data Volume [TB1: Ch. 7]
8. Logical Modeling: MOLAP and HOLAP Systems, ROLAP Systems, Views, Temporal Scenarios. [TB1: Ch. 8]
9. Logical Design: From Fact Schemata to Start Schemata, View Materialization, View Fragmentation. [TB1: Ch. 9]
10. Data-staging Design: Population Reconciled Databases, Cleansing Data, Populating Dimensional Tables, Populating Fact Tables, Populating Materialized View
11. Indexes for the Data Warehouse: B*-Tree Indexes, Bitmap Indexes, Projection Indexes, Join & Star Indexes, Spatial Indexes, Join-Algorithm. [TB1: Ch. 11]
12. Physical Design: Optimizers, Index Selection, Splitting a Database into Tablespaces, Allocating Data Files, Disk Block Size. [TB1: Ch. 12]
13. Data Warehouse Project Documentation: Data Warehouse Levels, Data Mart Level, Fact Level
14. Case Studies, Tools for Data Warehousing: MS SQL and Teradata

Textbook(s):

- Data Warehouse Design: Modern Principles and Methodologies by Matteo Golfarelli and Stefano Rizzi, McGraw-Hill Osborne Media; 1st Edition (May 26, 2009). ISBN-10: 0071610391

Reference Material:

- Building the Data Warehouse by William H. Inmon, Wiley; 4th Edition (2005). ISBN-10: 0764599445
- The Data Warehouse Lifecycle Toolkit : Expert Methods for Designing, Developing, and Deploying Data Warehouses by Ralph Kimball, Laura Reeves, Margy Ross and Warren Thornthwaite, Wiley (August 13, 1998). ISBN-10: 0471255475
- Data Warehousing Fundamentals for IT Professionals by Paulraj Ponniah, Wiley; 2nd Edition (2010). ISBN-10: 0470462078
- Data Mining and Data Warehousing: Practical Machine Learning Tools Techniques by Ram Kumar Singh and Amit Asthana, LAP LAMBERT Academic Publishing (2012). ISBN-10: 3659118419

Course Title: Data Mining
Course Code: CS-4442
Course Structure: Lectures: 3 / Labs: 0
Credit Hours: 3
Prerequisites: CMP-3450(Database Systems)

Course Objectives:
The course introduces students with basic applications, concepts, and techniques of data mining and to develop their skills for using recent data mining software to solve practical problems in a variety of disciplines.

Course Syllabus:
Data-Mining Concepts, Preparing the Data, Data Reduction, Learning From Data, Statistical Methods, Decision Trees and Decision Rules, Artificial Neural Networks, Ensemble Learning, Cluster Analysis, Association Rules, Web Mining and Text Mining, Visualization Methods, Data Mining Tools: Weka, CBA and Yale, etc.

Course Outline:
1. Data-Mining Concepts: Introduction, Data-Mining Process, Large Data Sets, Data Warehouses for Data Mining, Business Aspects Data Mining. [TB1: Ch. 1]
2. Preparing the Data: Raw Data- Representation, Characteristics, Transformation; Missing Data, Time-Dependent Data, Outlier Analysis. [TB1: Ch. 2]
3. Data Reduction: Dimensions of Large Data Sets, Feature Reduction, Relief Algorithm, Entropy Measure for Ranking Features, PCA, Value Reduction, Feature Discretization: ChiMerge Technique, Case Reduction. [TB1: Ch. 3]
4. Learning From Data: Learning Machine, SLT, Types of Learning Methods, Common Learning Tasks, SVMs, kNN: Nearest Neighbor Classifier, Model Selection versus Generalization, Model Estimation. [TB1: Ch. 4]
5. Statistical Methods: Statistical Inference, Assessing Differences in Data Sets, Bayesian Inference, Predictive Regression, ANOVA, Logistic Regression, Log-Linear Models, LDA. [TB1: Ch. 5]
6. Decision Trees and Decision Rules: Decision Trees, Generating & Pruning Decision Tree, CART Algorithm & Gini Index, Limitations of Decision Trees and Decision Rules. TB1: Ch. 6]
7. Artificial Neural Networks: Model of an Artificial Neuron, Architectures of ANNs, Learning Process, Learning Tasks Using ANNs, Multilayer Perceptrons, Competitive Networks and Competitive Learning, SOMs. [TB1: Ch.7]
8. Ensemble Learning: Ensemble-Learning Methodologies, Combination Schemes for Multiple Learners, Bagging and Boosting, AdaBoost. [TB: Ch. 8]
9. Cluster Analysis: Clustering, Similarity Measures, Agglomerative Hierarchical Clustering, Partitional Clustering, Incremental Clustering, DBSCAN Algorithm. BIRCH Algorithm, Agglomerative Hierarchal and Partition Clustering Algorithms, Clustering Validation. [TB: Ch. 9]
10. Association Rules: Market-Basket Analysis, Algorithm Apriori, From Frequent Itemsets to Association Rules, Improving the Efficiency of the Apriori Algorithm, FP Growth Method, Associative-Classification Method, Multidimensional Association–Rules Mining. [TB: Ch. 10]

11. Web Mining and Text Mining: Web Mining, Web Content, Structure, and Usage Mining, HITS and LOGSOM Algorithms, Mining Path–Traversal Patterns, PageRank Algorithm, Text Mining, Latent Semantic Analysis. [TB: Ch. 11]
12. Visualization Methods: Perception and Visualization, Scientific Visualization and Information Visualization, Parallel Coordinates, Radial Visualization, Visualization Using Self-Organizing Maps, Visualization Systems for Data Mining
13. Data Mining Tools: Weka, CBA and Yale, etc.

Textbook(s):

- Data Mining: Concepts, Models, Methods, and Algorithms by Mehmed Kantardzic. Wiley-IEEE Press; 2nd Edition (August 16, 2011). ISBN-10: 0470890452

Reference Material:

- Data Mining: Concepts and Techniques, Third Edition (The Morgan Kaufmann Series in Data Management Systems) by Jiawei Han, Micheline Kamber and Jian Pei, Morgan Kaufmann; 3rd Edition (2011). ISBN-10: 0123814790
- Principles of Data Mining (Adaptive Computation and Machine Learning) by David J. Hand, Heikki Mannila and Padhraic Smyth, A Bradford Book (August 1, 2001). ISBN-10: 026208290X
- Data Mining and Data Warehousing: Practical Machine Learning Tools Techniques by Ram Kumar Singh and Amit Asthana, LAP LAMBERT Academic Publishing (2012). ISBN-10: 3659118419
- Information-Statistical Data Mining: Warehouse Integration with Examples of Oracle Basics (The Springer International Series in Engineering and Computer Science) by Bon K. Sy and Arjun K., Springer; 1st Edition (2003). ISBN-10: 1402076509
- Building the Data Warehouse by William H. Inmon, Wiley; 4th Edition (2005). ISBN-10: 0764599445

Course Title: Enterprise Resource Planning Systems

Course Code: CS-4461
Course Structure: Lectures: 3/Labs: 0
Credit Hours: 3
Prerequisites: CMP-3450 (Database Systems)

Course Objectives:

An ERP system is software that runs all areas of an organization including accounting and finance, HR, sales and distribution, production, purchasing and inventory.This course covers ERP theory and practice. Course content includes evolution of ERP systems, business process reengineering, process mapping, ERP life cycle, ERP functionality, ERP bolt-ons and security and risk issues.

Course Syllabus:

Introduction to Enterprise Resource Planning Systems.ERP Technology.ERP and Business Process Reengineering.Systems Diagramming and the Process Map. ERP Life Cycle: Planning and Package Selection. ERP Life Cycle: Implementation and Operation and Maintenance. ERP Sales, CRM and Knowledge Management.ERP Financials.Human Capital Management, Self-Service and Outsourcing.Manufacturing Systems and Supply Chain.Auditing ERP.Business

Intelligence and Performance Management.

Course Outline:

1. Introduction to Enterprise Resource Planning Systems. [TB. Ch. 1]
2. ERP Technology. [TB. Ch. 2]
3. ERP and Business Process Reengineering. [TB. Ch. 3
4. Systems Diagramming and the Process Map. [TB. Ch. 41]
5. ERP Life Cycle: Planning and Package Selection. [TB. Ch. 5]
6. ERP Life Cycle: Implementation and Operation and Maintenance. [TB. Ch. 6]
7. ERP Sales, CRM and Knowledge Management. [TB. Ch. 7
8. ERP Financials. [TB. Ch. 8]
9. Human Capital Management, Self-Service and Outsourcing. [TB. Ch. 9]
10. Manufacturing Systems and Supply Chain. [TB. Ch. 10]
11. Auditing ERP . [TB. Ch. 11]
12. Business Intelligence and Performance Management. [TB. Ch. 12]

Textbook(s):

- Modern ERP: Select, Implement & Use Today's Advanced Business Systems by Marianne Bradford, lulu.com (October 19, 2009). ISBN-10: 0557012910.

Reference Materials:

- Managerial Issues of Enterprise Resource Planning Systems by David Olson, McGraw-Hill/Irwin; 1st Edition (September 10, 2003). ISBN-10: 0072861126
- Enterprise Resource Planning by Bret Wagner by Ellen Monk, Course Technology; 3rd Edition (February 4, 2008). ISBN-10: 1423901797
- ERP Systems by Dimpi Srivastava by Aarti Batra, I K International Publishing House (February 15, 2010). ISBN-10: 9380578148

Course Title: Business Intelligence and Analytics

Course Code: CS-4443
Course Structure: Lectures: 3 / Labs: 0
Credit Hours: 3
Prerequisites: CS-4441 (Data Warehouse)

Course Objectives:

The course will enhance students' understanding regarding the evolution, need and benefits of business intelligence. Students will also learn about various technical aspects of BI and understand the processes involving in planning, designing, building and maintaining BI environment.

Course Syllabus:

Business Intelligence Introduction, BI Environment, Business Process and Information Flow, Data Requirements Analysis, Data Warehouses and the Technical BI Architecture, Data Profiling, Business Rules, Data Quality, Data Integration, Deriving Insight from Data, Knowledge Discovery & Delivery, BI User Types and Reports, Installations, Configuring and Maintaining the BI Server, Creating Repositories from Relational Sources, Creating Repositories from OLAP Data Sources, Creating Reports Using Answers and Dashboards.

Course Outline:

1. Business Intelligence - An Introduction, Value Drivers, Performance Metrics and Key Performance Indicators, Use Cases for BI. [TB: Ch. 1, 2]
2. BI Success Factors. Strategic Versus Tactical Planning, BI Strategy and Plan. [TB: Ch. 3,4]
3. BI Environment, BI and Analytics Platform and Strategy, Organizational BI Framework, Services & Systems Evaluation. [TB: Ch. 5]
4. Business Process and Information Flow: Information Need & Flow, Information Processing & Information Flow, Information Flow Model, Modeling Frameworks. [TB: Ch. 6]
5. Data Requirements Analysis: Business Uses of Information, Metrics: Facts, Qualifiers, and Models, Defining Business Rules, Data Requirement Analysis, Assessing Suitability. [TB: Ch. 7]
6. Data Warehouses and the Technical BI Architecture: Data Modeling and Analytics, Analytical Platforms, Operational Data Stores. Business Metadata: What is Metadata? Types of Metadata, Semantics Metadata Processes for Business Analytics. [TB: Ch. 8, 9]
7. Data Profiling: Data Sources, Data Profiling Activities, Data Model Inference, Attribute Analysis, Relationship Analysis, Management Issues. [TB: Ch. 10]
8. Business Rules: The Value of Proposition of Business Rules, The Business Rules Approach, Defining Business Rules, Business Rule Systems, Sources of Business Rules, Management Issues. [TB: Ch. 11]
9. Data Quality: Virtuous Cycle of Data Quality, Types of Data Flow, Business Impacts of Data Flow, Dimensions of Data Quality, Data Quality Assessment, Data Quality Rules, Data Quality Monitoring and Improvement, Data Quality for Business Analytics, Data Cleansing. [TB: Ch. 13]
10. Data Integration: Improving Data Accessibility, Extracting/ Transformation/Loading, Data Latency and Data Synchrony, Data Replication and Change Data Capture, Data Integration and Cloud Computing, Information protection, Merge/Purge and Record Consolidation. [TB: Ch. 13]
11. Deriving Insight from Data: Customer Profiles, Behavior, and Lifetime Value; Demographics, Psychographics, Geographic; Geographic Data, Behavior Analysis. [TB: Ch. 15, 16]
12. Knowledge Discovery & Delivery: Business Drivers, KD Virtuous Cycle, Direct Versus Unidirectional Knowledge Discovery, Data Mining Activities, Data Mining Techniques. [TB: Ch. 17]
13. BI User Types, Standards Reports, Interactive Analysis and Ad Hoc Querying, Parameterized Reports and Self-Service Reporting, Dimensional Analysis, Alerts/ Notifications, Visualizations, Scorcards and Dashboards, Geographical Visualizations, Integrated Analysis. [TB: Ch. 18]

Textbook(s):

- Business Intelligence by David Loshi, Morgan Kaufmann; 2nd Edition (October 31, 2012). ISBN-10: 0123858895

Reference Material:

- Oracle Business Intelligence 11g Developers Guide by Mark Rittman, McGraw-Hill Osborne Media; 1st Edition (September 18, 2012). ISBN-10: 0071798749
- Delivering Business Intelligence with Microsoft SQL Server 2012 3/E by Brian Larson, McGraw-Hill Osborne Media; 3rd Edition (March 16, 2012). ISBN-10: 0071759387
- Business Intelligence by Elizabeth Vitt, Michael Luckevich, and Stacia Misner, Microsoft Press (December 22, 2008). ISBN-10: 073562660X
- The Data Warehouse Mentor: Practical Data Warehouse and Business Intelligence Insights, by Robert Laberge, 1st Edition, McGraw-Hill Companies, (2012). ASIN: B008UYJJ8C
- Business Intelligence: A Managerial Approach by Turban, Sharda, Delen, King, 2nd Edition, Prentice Hall (2011). ISBN: 13-978-0-136-10066-9
- Business Intelligence in Plain Language: A practical guide to Data Mining and Business Analytics by Jeremy Kolb, Applied Data Labs Inc. (2012). ASIN: B009K7INOY

Course Title: Advance Database Management

Course Code: CS-4444
Course Structure: Lectures: 3 / Labs: 0
Credit Hours: 3
Prerequisite: CS-3450 (Database Systems)
Course Objectives:
The students will learn about the salient features of various types of databases, transaction management, data warehousing and data mining
Course Syllabus:
PL/SQL Basics.Programmatic SQL – Embedded SQL, Dynamic SQL, and ODBC Standard. Transaction processing and concurrency control. Object-based databases and XML Object-based databases.Data warehousing.Data Warehousing Design.OLAP and Data Mining On-line Analytical Processing.Database Security.PL/SQL Security.
Course Outline:

1. PL/SQL – Introduction To PL/SQL – Declare, Begin Statements, Variables, Control Structure, PL/SQL Transactions – Savepoint, Cursor, PL/SQL Database Objects – Procedures, Functions, Packages, Triggers. Programmatic SQL – Embedded SQL, Dynamic SQL, And ODBC Standard.
2. Transaction Processing And Concurrency Control Definition Of Transaction And ACID Properties. Transaction Processing - Transaction-Processing Monitors, Transactional Workflows, Main-Memory Databases, Real-Time Transaction Systems, Long-Duration Transactions, Transaction Management In Multi-Databases. Concurrency Control – Locks, Optimistic Concurrency Control (Backward and Forward Validations), Timestamping Concurrency Control.
3. Object-Based Databases And Xml Object-Based Databases – Complex Data Types, Structured Types and Inheritance In SQL, Table Inheritance, Array and Multiset Types in SQL, Objectidentity and Reference Types in SQL, Implementing O-R Features, Persistent
4. Programming Languages, OO Vs OR. XML – Structure of XML, Document Schema, Querying and Transformation, API In XML, XML Applications.

5. Data Warehousing: Introduction To Data Warehousing – Concepts, Benefits and Problems, DW Architecture – Operational Data, Load Manager, Meta Data, DW Data Flows – Inflow, Upflow, Meta Flow, DW Tools and Technologies – Extraction, Cleansing and Transformation Tools, DW DBMS, Admin and Management Tools, Data Marts – Reasons And Issues, Data Warehousing Using Oracle.
6. Data Warehousing Design – Designing, Dimensionality Modeling, Design Methodology, DW Deign Using Oracle.
7. OLAP And Data Mining On-Line Analytical Processing – OLAP Benchmarks, Applications, Benefits, Tools, Categories, Extensions To SQL, Data Mining – Introduction, Techniques, Predictive Modeling, Tools. Data Mining Algorithms – Apriori, Decision Tree, K-Means, Bayesian Classifier.
8. Database Security: Security and Integrity Threats, Defence Mechanisms, Statistical Database Auditing & Control. Security Issue Based On Granting/Revoking of Privileges, Introduction to Statistical Database Security. PL/SQL Security – Locks – Implicit Locking, Types And Levels of Locks, Explicit Locking, Oracles' Named Exception Handlers.

Textbook(s):

1. Database System Concepts by A. Silberschatz, H. Korth and S. Sudarshan, McGraw-Hill Science/Engineering/Math; 6th Edition (January 27, 2010). ISBN-10: 0073523321
2. Database Systems – A Practical Approach to Design, Implementation and Management by Thomas Connolly and Carolyn Begg, 5th Edition, ISBN-10: 0321601106.
3. SQL, PL/SQL – The Programming Language of ORACLE by Ivan Bayross, Third Revised Edition, BPB Publication ISBN-10: 8176560723

Reference Material:

- Data Mining – Concepts and Techniques by Jiawei Han and Micheline Kamber, Morgan Kaufmann; 3rd Edition (July 6, 2011). ISBN-10: 0123814790
- Handbook of Database Security- Application and Trends by M. Gertz, and S. Jajodia, 2008, Springer.
- Handbook of Database Security: Applications and Trends by Michael Gertz (Editor) and Sushil Jajodia (Editor), Springer; Softcover reprint of hardcover 1st Edition (November 4, 2010). ISBN-10: 1441943056

Course Title: Software Requirement Engineering

Course Code: SE-3342
Course Structure: Lectures: 3/Labs: 0
Credit Hours: 3
Prerequisites: CMP-3310 (Software Engineering)

Course Objectives:

To understand Issues in Requirements Engineering, to understand and apply Requirements Engineering Process, to understand and use Requirements Elicitation and Specification, to understand and use Formal Techniques, to understand modeling and analysis of Non-Functional Requirements.

Course Syllabus:

Basics of Requirements Engineering.RE Processes.Requirements Analyst Role, Tasks, Essential Skills & Knowledge.Dealing with Customers.Prototype Categories. Evaluation, Risks, Validating the Requirements. Documenting the Requirements.Non Functional Requirements. Software Quality Attributes. Setting Requirements Priorities.Special Requirements Challenges. Requirements Development Plans. Requirements Management Principles and Practices.Requirements Creeping.Tracing Requirements.Tools for Requirements Management.Software Requirements Risk Management.

Course Outline:

1. Requirements Engineering (RE): Essential Software Requirement, Bad Requirements, Characteristics and Benefits Requirement Engineering, Requirements from the Customer's Perspective [TB: Ch. 1&2]
2. RE Processes: Requirements Elicitation, Requirements Analysis, Requirements Specification, Requirements Validation, Requirements Management, and Requirements Development Process [TB: Ch. 3].
3. The Requirements Analyst Role, Tasks, Essential Skills & Knowledge, Defining the Vision through Business Requirements, Vision and Scope Document[TB: Ch. 4&5]
4. Dealing with Customers: Elicitation Techniques, Interviews, Surveys, Workshops, Classifying Customer Input, Incomplete Requirements (Finding Missing Requirements) [TB: Ch. 7+ handouts]
5. Prototype Categories (Throwaway, evolutionary, paper and electronic), evaluation, Risks, Validating the Requirements: Requirements Review and Inspection, Requirements Review Challenges, Acceptance Criteria [TB: Ch. 13 & Ch. 15].
6. Documenting the Requirements: The Software Requirements Specification, Labelling, Dealing with Incompleteness, User Interfaces and the SRS, A Software Requirements Specification Template, The Data Dictionary [TB: Ch. 10].
7. Non Functional Requirements: Software Quality Attributes: Defining, Performance Requirements, Defining Non-functional Requirements Using Planguage, Attribute Tradeoffs, Implementing Non-functional Requirements [TB: Ch. 12].
8. Setting Requirements Priorities: Why Prioritize Requirements? Play With Priorities. A Prioritization Scale, Prioritizing Based on Value, Cost, and Risk [TB: Ch. 14].
9. Special Requirements Challenges: Requirements for Maintenance Projects, Begin Capturing Information, New Requirements Techniques, Follow the Traceability Chain, Consider Business Rules, Requirements for Outsourced Projects, Requirements for Emergent Projects [TB: Ch. 16].
10. Requirements Development Plans, Estimation, Scheduling, From Requirements to Designs, Code, Tests and Success [TB: Ch. 17].
11. Requirements Management Principles and Practices, Baseline, Procedures, Requirements Version Control, Tracking Requirements Status, [TB: Ch. 18].
12. Requirements Creeping, Managing Scope Creep, The Change Control Process, The Change Control Board, Change-Control Tools, Measuring Change Activity, Impact Analysis [TB: Ch. 19].
13. Tracing Requirements introduction, The Requirements Traceability Matrix, Tools for Requirements Traceability, Requirements Traceability Procedure, Is Requirements

Traceability Feasible? [TB: Ch. 20].

14. Tools for Requirements Management: Benefits and Capabilities of tool for Requirements Management, Requirements Management Automation, Selecting a Tool, Changing the Culture [TB: Ch. 21].
15. Software Requirements Risk Management: Fundamentals, Elements, Documenting Project Risks, Planning for Risk Management, Requirements-Related Risks [TB: Ch. 23]

Class Assignments:

- The requirements are for the development of case applications. Ask students to outline business requirements, the product vision and scope for applications.
- Use case elicitation using automated tools e.g. UML, Mobile Scenarios and PDA's etc
- Development of Software Requirement Specification (SRS)
- Requirement Engineering Group Discussion activity and resource allocation etc

Textbook(s):

- Software Requirements 2 by Karl Wiegers, 2nd Edition (2003). Microsoft Press; ISBN-10: 0735618798

Reference Material:

- Requirements Engineering: Processes and Techniques, Kotonya and Sommerville, John Wiley Sons, 1998. ISBN-10: 0471972088
- Software Requirements Engineering, 2nd Edition by Richard H. Thayer and Merlin Dorfman, Wiley-IEEE Computer Society Pr; 2nd Edition (1997). ISBN-10: 0818677384
- Requirements Engineering: From System Goals to UML Models to Software Specifications by A. van Lamsweerde, Wiley; 1st Edition (2009). ISBN-10: 0470012706.
- Requirements Engineering: Fundamentals, Principles, and Techniques by Klaus Pohl, Springer; 1st Edition (July 23, 2010). ISBN-10: 3642125778
- Requirements Engineering by Hull, Jackson, and Dick, Springer; 3rd Edition (October 11, 2010). ISBN-10: 1849964041

Course Title: Software Design and Architecture

Course Code: SE-4343
Course Structure: Lectures: 3/Labs: 0
Credit Hours: 3
Prerequisites: SE-3342 (Software Requirement Engineering)

Course Objectives:

Upon completion of this course, students will develop the ability to apply a wide variety of design patterns, frameworks, and architectures in designing a wide variety of software.

Course Syllabus:

Basics of Software Architecture (SA).Characteristics of SA, Importance of SA, SA Business Cycle and Software Processes, Architectural Patterns.SA Case Study. Creating Architecture, Quality Attributes, Business Qualities, Architecture Qualities. Achieving Qualities.Global Analysis.Conceptual Architecture View.Module Architecture View.Execution Architecture View.Code Architecture View.Designing & Documenting the Architecture. Analyzing Architectures.The CBAM.Reconstructing Software Architectures.

Course Outline:

1. Software Architecture (SA): SA in Context, SA as a Design Plan, Abstraction, SA Terminology, 4+1 Views Model: Coupling Between Views, Uses and Notation of Four Views. IS2000: The Advanced Imaging Solution, Chapter 1 [TB 1:Ch. 1, Ch. 2]
2. Characteristics of SA, Importance of SA, SA Business Cycle and Software Processes, SA History, "Good" Architecture, Architectural Patterns, Reference Models, and Reference Architectures, Architectural Structures and Views [TB 2: Ch.1, Ch.2]
3. SA Case Study: A-7E Avionics System - -Architecture, Business Cycle, Requirements and Qualities [TB 2: Ch. 3]
4. Creating Architecture: Understanding Quality Attributes, Functionality and Architecture, Architecture and Quality Attributes, System Quality Attributes, Quality Attribute Scenarios in Practice, Other System Quality Attributes, Business Qualities, Architecture Qualities [TB 2: Ch. 4]
5. Achieving Qualities: Introducing Tactics, Availability Tactics, Modifiability Tactics, Performance Tactics, Security Tactics, Testability Tactics, Usability Tactics, Relationship of Tactics to Architectural Patterns, Architectural Patterns and Styles [TB 2: Ch. 5]
6. Global Analysis: Overview of Global Analysis Activities, Analyze Factors, Develop Strategies., Analyze Organizational Factors, Begin Developing Strategies, Analyze Technological Factors, Continue Developing Strategies, Analyze Product Factors, Continue Developing Strategies [TB 1: Ch. 3]
7. Conceptual Architecture View: Design Activities for the Conceptual Architecture View, Global Analysis, Central Design TasksCentral Design Tasks: Components, Connectors, and Configuration, Final Design Task: Resource Budgeting, Traceability, Uses for the Conceptual Architecture View [TB 1: Ch. 4]
8. Module Architecture View: Design Activities for the Module Architecture View, Global Analysis, Central Design Tasks: Modularization and Layering, Final Design Task: Interface Design, Traceability, Uses for the Module Architecture View [TB 1: Ch. 5]
9. Execution Architecture View: Design Activities for the Execution Architecture View, Global Analysis, Central Design Tasks: Runtime Entities, Communication Paths, and Configuration, Final Design Task: Resource Allocation, Traceability, Uses for the Execution Architecture View [TB 1: Ch. 6]
10. Code Architecture View: Design Activities for the Code Architecture View, Global Analysis, Central Design Tasks, Final Design Tasks, Traceability, Uses for the Code Architecture View [TB 1: Ch. 7]
11. Designing & Documenting the Architecture: Architecture in the Life Cycle, Designing the Architecture, Forming Team, Creating a Skeletal System. Documenting Software Architectures, Uses of Architectural Documentation, Views, Choosing the Relevant Views, Documenting a View, Documentation across Views, Unified Modelling Language [TB 2: Ch. 7, Ch. 9]
12. Analyzing Architectures: The ATAM - A Comprehensive Method for Architecture Evaluation, Participants in the ATAM, Outputs of the ATAM, Phases of the ATAM, The Nightingale System: A Case Study in Applying the ATAM [TB 2: Ch. 11]
13. The CBAM: A Quantitative Approach to Architecture Design Decision Making, Decision-Making Context, The Basis for the CBAM, Implementing the CBAM, Case Study: The NASA ECS Project, Results of the CBAM Exercise [TB 2: Ch. 12]

Class Assignments:

- Planning and Practice of existing software design methodologies.
- Outline of requirements, the existing design & architecture practices using up to date tools and technologies.
- Applications of Software Development Life Cycle (SDLC), its phases and thus implementation of different process models.
- Efficient use of different modeling and design tools e.g. UML (for code generation), open source code development etc.
- Writing of Software Design Specifications.

Text Book(s):

1. Applied Software Architecture by Christine Hofmeister, Robert Nord and DilipSoni, Addison-Wesley Professional (1999). ISBN-10: 0201325713.
2. Software Architecture in Practice by Len Bass, Paul Clements and Rick Kazman, Addison-Wesley Professional; 2nd Edition (April 19, 2003). ISBN-10: 0321154959

Reference Material:

- Software Architecture in Practice by Len Bass, Paul Clements and Rick Kazman, Addison-Wesley Professional; 3rd Edition (2012). ISBN-10: 0321815734
- Software Architecture and Design Illuminated by Kai Qian, Xiang Fu, Lixin Tao and Chong-weiXu, Jones & Bartlett Publishers; 1st Edition (2009). ISBN-10: 076375420X
- Software Architecture: Foundations, Theory, and Practice by R. N. Taylor, N. Medvidovic and E. M. Dashofy, Wiley; 1st Edition (2009). ISBN-10: 0470167742.

Course Title: Software Quality Engineering

Course Code: SE-4341
Course Structure: Lectures: 3/Labs: 0
Credit Hours: 3
Prerequisites: CMP-3310 (Software Engineering)

Course Objectives:

The objective of this course is to make students have ability to understand Software Quality Engineering concepts and practice.

Course Syllabus:

A Quality Principles, Benefits of Quality, Organization and Process Benchmarking. Ethical and Legal Compliance.Standards and Models.Leadership Skills.Quality Management System.Methodologies for Quality Management. Audit Types, Audit Roles and Responsibilities, Audit Process. Project Tracking and Control, Tracking Methods, Project Reviews and Program Reviews. Software Verification and Validation Method, Software Product Evaluation. Testing Planning and Design.Reviews and Inspection. Test Execution Documentation. Customer Deliverables.

Course Outline:

1. A Quality Principles, Benefits of Quality, Organization and Process Benchmarking [TB: Ch. No.1]

2. Ethical and Legal Compliance: ASQ Code of Ethics, Legal and Regularity Issues [TB: Ch. No.2]
3. Standards and Models: ISO 9000 Standards, IEEE Software Engineering Standards, SEI Compatibility Maturity Model Integration (CMMI).[TB: Ch. No.3]
4. Leadership Skills: Organizational Leadership, Facilitation Skills, Communication Skills [TB: Ch. No.4]
5. Team Skills, Team Management, Team Tools [TB: Ch. No.5]
6. Quality Management System: Quality Goals and Objectives, Customers and Other Stakeholders, Planning, Outsourcing [TB: Ch. No.6]
7. Methodologies for Quality Management: Cost of Quality, Process Improvement Models, Corrective Action Procedures, Defect Prevention [TB: Ch. No.7]
8. Audit Types, Audit Roles and Responsibilities, Audit Process [Ch. No.8]
9. Project Tracking and Control, Tracking Methods, Project Reviews and Program Reviews [TB: Ch. No.16]
10. Software Verification and Validation Method, Software Product Evaluation [TB: Ch. No.21]
11. Testing Planning and Design: Test Strategies, Test Plans, Test Design, Test Coverage Specifications, Code Coverage Techniques, Test Environments, Test Tools [TB: Ch. No.22]
12. Reviews and Inspection: Peer Reviews, Formal Versus Informal Reviews, Types of Peer Reviews, Walk-Throughs, Inspections, Technical Reviews [TB: Ch. No.23]
13. Test Execution Documentation: Test Execution, Test Case, Test Procedure, Test Log, Problem Report, Test Result Data and Metrics, Test Report [TB: Ch. No.24]
14. Customer Deliverables: Peer Reviews, Development Testing, Development Audits, Pilots, Installation Testing, Customer/User Testing [TB: Ch. No.25]

Textbook(s):

- The Certified Software Quality Engineer by Linda Westfall, Quality Press; (September 28, 2009), ISBN-10: 0873897307

Reference Material:

- Software Quality Assurance: Principles and Practice by Nina S. Godbole, published by Alpha Science (2004). ISBN-10: 1842651765.
- Software Testing: Fundamental Principles and Essential Knowledge by James D. McCaffrey, BookSurge Publishing (2009). ISBN-10: 1439229074.
- Perfect Software: And other illusions about testing by Gerald M. Weinberg, published Dorest House (2008). ISBN-10: 0932633692.
- Software Quality Engineering: Testing, Quality Assurance, and Quantifiable Improvement by Jeff Tian, published by John Wiley & Sons, (2005). ISBN-10: 0471713457
- Mastering Software Quality Assurance: Best Practices, Tools and Techniques for Software Developers by MuraliChemuturi, J. Ross Publishing (2010). ISBN-10: 1604270322.

Course Title: Mobile Computing
Course Code: CS-4545
Course Structure: Lectures: 3/Labs: 0
Credit Hours: 3
Prerequisites: CS-3548 (Web Systems and Technologies)
Course Objectives:
The course is aimed to prepare students to grasp the concepts and features of mobile computing technologies and applications.

Course Syllabus:
Introduction to Mobile Computing, Architecture of Mobile Software Applications, Mobile Development Frameworks and Tools.Creating Consumable Web Services for Mobile Devices.Memory Management.Mobile Applications.Mobile User-Interface Design.Dynamic Linking.Concurrency.Managing Resources. Introduction to Mobile Application Development with Andriod. Introduction to Mobile Application Development with IOS. Introduction to Mobile Application Development with Windows Phone. Introduction to Mobile Application Development with Blackberry.

Course Outline:
1. Introduction to Mobile Computing, Architecture of Mobile Software Applications, Introduction to Mobile Development Frameworks and Tools. [TB2: Ch. 1,2]
2. Creating Consumable Web Services for Mobile Devices: Intro to Web Services, Web Services Languages (Formats), Creating and Debugging Web Services [TB2: Ch. 3].
3. Memory Management: Design Patterns for Limited Memory, Strategies for Allocating Variable to Memory, Memory Management in Mobile Java, Symbian OS Memeory Management.[TB1]
4. Mobile Applications: Components of Mobile Application, Workflow for Application Development, Techniques for Composing Application, Application Models in Mobile Java, Symbian OS Application Infrastructure. [TB1]
5. Mobile User-Interface Design: Effective Use of Screen, Understanding Mobile Application Users, Understanding Mobile Information Design, Understanding Mobile Platforms, Using the Tools of Mobile Interface Design. [TB 2: Ch. 4]
6. Dynamic Linking: Introduction to DLL, Implementation Techniques & Plugins, Managing Memory in DLL, Rules of Thumb for Using DLL, Mobile Java and Dynamic Linking, Symbian OS Dynamic Libraries. [TB1]
7. Concurrency: Introduction, Infrastructure for Concurrent Programming, Faking Concurrency, MIDP Java and Concurrency, Symbian OS and Concurrency. [TB1]
8. Managing Resources: Resource-Related Concerns in Mobile Devices, Common Concerns, MIDP Java, Symbian OS. [TB1]
9. Security: Secure Coding and Design, Infrastructure for Enabling Secure Execution, Security Features in MIDP Java, Symbian OS Security. [TB1]
10. Introduction to Mobile Application Development with Andriod [TB2: Ch. 6]
11. Introduction to Mobile Application Development with IOS [TB2: Ch. 7]
12. Introduction to Mobile Application Development with Windows Phone [TB2: Ch. 8]
13. Introduction to Mobile Application Development with Blackberry [TB2: Ch. 9]

Textbook(s):
1. Programming Mobile Devices: An Introduction for Practitioners by TommiMikkonen,

Wiley; 1st Edition (March 19, 2007). ISBN-10: 0470057386.
2. Professional Mobile Application Development by Jeff McWherter& ScottGowell, Wrox; 1st Edition (September 4, 2012). ISBN-10: 1118203909

Reference Material:

- Mobile Computing Principles: Designing and Developing Mobile Applications with UML and XML by Reza B'Far and Roy T. Fielding, Cambridge University Press (2004). ISBN-10: 0521817331.
- Mobile Design and Development: Practical concepts and techniques for creating mobile sites and web apps (Animal Guide) by Brian Fling, O'Reilly Media; 1st Edition (2009). ISBN-10: 0596155441.
- Fundamentals of Mobile and Pervasive Computing by Frank Adelstein, Sandeep KS Gupta, Golden Richard III and Loren Schwiebert, McGraw-Hill Professional; 1st Edition (2004). ISBN-10: 0071412379.
- Mobile Design Pattern Gallery: UI Patterns for Mobile Applications by Theresa Neil, O'Reilly Media (2012). ISBN-10: 1449314325.
- Programming Android: Java Programming for the New Generation of Mobile Devices by ZigurdMednieks, Laird Dornin, G. Blake Meike and Masumi Nakamura, O'Reilly Media; 2nd Edition (2012). ISBN-10: 1449316646.
- Beginning Android 4 Application Development by Wei-Meng Lee, Wrox; 1st Edition (March 6, 2012). ISBN-10: 1118199545

Course Title: Software Engineering Economics

Course Code: SE-4342
Course Structure: Lectures: 3/Labs: 0
Credit Hours:3
Prerequisites: CMP-3310 (Software Engineering)

Course Objective:

The course is aimed to develop students' software cost estimation skills using industry standards.

Course Syllabus:

The Software Life-Cycle.The Waterfall Model.The Software Work Breakdown Structure (WBS) Software Maintenance.The Basic COCOMO Model.Development Modes.Model-Product Level Estimates.Performance Models & Cost Effectiveness Models.Decision Criteria.Present vs. Future Expenditure & Income - Cost Analysis.Goals as Constraints.Coping with Un-reconcilable & Un-quantified Goals.Detailed COCOMO. Detailed COCOMO Cost Drivers. Detailed COCOMO Cost Drivers-Personal Attributes: ACAP, AEXP, PCAP, VEXP, LEXP. Detailed COCOMO Cost Drivers: Project Attributes–Modern Programming Practices, Use of Software Tools, Schedule Constraint.

Course Outline:

1. The Software Life-Cycle: The Waterfall Model, Economic Rationale for the WM, Refinements of the WM, Life-Cycle Phase/Activity, The Software Work Breakdown Structure (WBS) Software Maintenance. The Basic COCOMO Model: Introduction, Definitions & Assumptions, Development Effort & Schedule, Phase Distribution, Nominal

Project Profiles, The Rayleigh Distribution, Interpolation, Basic Software Maintenance Effort Estimation [TB: Ch. 4, 5]

2. Development Modes: Introduction, Basic Effort & Schedule Equations, COCOMO Modes of Software Development, COCOMO Effort & Schedule Equations, Phase Distribution of Effort & Schedule. Activity Distribution. Limitations of Basic COCOMO [TB: Ch. 6, 7]
3. Model-Product Level Estimates: Introduction, Software Development Effort Estimation, Estimate of Annual Maintenance, Interpolation & Extrapolation, Estimating the Effects of Adapting Existing Software, Intermediate COCOMO Effort Equations. Component Level Estimation: Introduction, the Component Level Estimating Form (CLEF), Using CLEF with Adapted Software. [TB: Ch. 8, 9]
4. Performance Models & Cost Effectiveness Models: Performance Models, Optimal Performance, Sensitivity Analysis, Cost Effectiveness Models. Economies of Scale: Discrete Production Functions, Basic Production Functions, Economies & Diseconomies of Scale, Diseconomies of Scale on Large Software Projects. [TB: Ch. 10, 11]
5. Decision Criteria: Minimum Available Budget, Minimum Performance Requirement, Maximum Effectiveness-Cost Ratio, Maximum Effectiveness-Cost Difference, Composite Options. Net Value & Marginal Analysis. [TB: Ch. 12,13]
6. Cost Analysis, Interest Calculation, Present Value Calculation, Value of a Series of Cash Flows, Present Value Characteristics, Sensitivity to Interest Rate or Discount Rate, Applications to SE. Figures of Merit: Software Package Selection, Net Value Analysis, Figure of Merit Analysis, A Weighted Sum Analysis for Hardware & Software Selection. [TB: Ch. 14, 15]
7. Goals as Constraints: System Reliability & Availability, Figure of Merit Evaluation, Expressing Goals as Constraints, Goals as Constraints: Feasible Sets & Cost Value Contours, Decision Problems with Constraints, SE Applications, Mathematical Optimization Techniques, Capabilities& Limitation of Mathematical Optimization Techniques. Systems Analysis & Constrained Optimization (TB: Ch 16, 17)
8. Coping with Un-reconcilable & Un-quantified Goals: In-House vs. Vendor Development, Presentation Methods, Unquantifiable Criteria, Presentation Techniques for Unquantifiable Criteria, Presenting & Interpreting Multivariate Data. Coping with Uncertainties: Decision Rules for Complete Uncertainty, Subjective Probabilities, Decision Rules Under Complete Uncertainty, The Value of Information, Subjective Probabilities, Utility Functions, SE Implications. [TB: Ch 18, 19]
9. Detailed COCOMO: Summary & Operational Description: The Software Hierarchy Estimating Form & Procedures, Detailed COCOMO Example, Schedule Adjustment Calculations. Detailed COCOMO Cost Drivers: Product Attributes –Required Software Reliability, Data base Size, Software Product Complexity [TB: Ch. 23, 24]
10. Detailed COCOMO Cost Drivers: Computer Attributes –Execution Time, Main Storage Constraint, Virtual Machine Volatility, Computer Turn Around Time [TB: Ch 25]
11. Detailed COCOMO Cost Drivers-Personal Attributes: ACAP, AEXP, PCAP, VEXP, LEXP. [TB: Ch. 26]
12. Detailed COCOMO Cost Drivers: Project Attributes–Modern Programming Practices, Use of Software Tools, Schedule Constraint [TB: Ch 27]

Reference Material:

- Software Engineering Economics by Boehm, Prentice Hall, 1981.ISBN-10: 0138221227.

Reference Books:

- Estimating Software Costs: Bringing Realism to Estimating by Capers Jones, McGraw-Hill Osborne Media; 2nd Edition (April 19, 2007).ISBN-10: 0071483004
- Software Cost Estimation with COCOMO II by Barry W. Boehm, Chris Abts, A. Winsor Brown and Sunita Chulani, Prentice Hall (August 11, 2000). ISBN-10: 0130266922.
- Software Cost Estimation and Sizing Methods, Issues, and Guidelines by Shari Lawrence Pfleeger, Rand Publishing (September 13, 2005). ISBN-10: 0833037137.
- Software Engineering Economics and Declining Budgets by Pamela T. Geriner, Thomas R. Gulledge, William P. Hutzler, Springer London, Limited, (31-Jul-2012)

Course Title: System Integration and Architecture

Course Code: SE-4344
Course Structure: Lectures: 3 / Labs: 0
Credit Hours: 3
Prerequisites: CMP-3310 (Software Engineering)

Course Objectives:
The course aims to teach student about system integration issues, including integration in a system of systems and federation of systems, role of architectures in systems integration, performance and effectiveness.

Course Syllabus:
Enterprise Architecture (EA) and Enterprise Engineering (EE). Balanced Scorecard and Strategy Maps (BSSM). Using Strategy Analysis (SA).Governance Analysis Using EA. Enterprise Architecture Methods.Using Business-Driven Data Mapping for Integrated Data. Strategic Modeling for Rapid Delivery of EA. Strategic Alignment, Activity and Workflow Modeling, and Business Rules. Using Business Normalization for Future Business Needs.Menu Design, Screen Design, Performance Analysis, and Process Modeling.Enterprise Application Integration Concepts.Enterprise Portal Technologies for Integration.Web Services for Real-Time Integration.Service-Oriented Architecture for Integration.Managing and Delivering EA. Future Directions in EA and Integration.

Course Outline:

1. Enterprise Architecture (EA) and Enterprise Engineering (EE): The Evolution of EA, Zachman Framework for EA, EE for Rapid Development, Using EA of Enterprise Integration. [TB: Ch. 1]
2. Balanced Scorecard and Strategy Maps (BSSM): Introduction, Basic Concepts of Balanced Scorecard, Basic Concepts of Strategy Maps, Examples of BSSM, Steps to Develop BSSM. [TB: Ch. 2]
3. Using Strategy Analysis (SA) to Define the Future: SA in Business Planning, The Steps of SA, SA for Project Specifications, Preparation for SA, Questionnaire Templates for EA. [TB: Ch. 3]
4. Governance Analysis Using EA: Responsibilities Imposed by Sarbanes-Oxley, Governance Analysis Framework for Sarbanes-Oxley, Step-by-Step Approach for Governance Analysis. [TB: Ch. 4]
5. Enterprise Architecture Methods: Methods for Building EA, Evolution of Systems

Development Methodologies, Government Methods for Building EA, Department of Defense Architecture Frameworks, The Open Group Architecture Framework, EA Project Experience, Strategies for EA Implementation, EE for EA. [TB: Ch. 5]

6. Using Business-Driven Data Mapping for Integrated Data: EA Incremental Build Context, Data Modeling Conventions, Data Entity Types, Data Attribute Types. [TB: Ch. 6]
7. Strategic Modeling for Rapid Delivery of EA: EA Incremental Build Context, Developing Strategic Models, Identifying Business Activities from a Data Map, Deriving Project Plans for Rapid EA Delivery, Case Study Entity Dependency Problems. [TB: Ch. 7]
8. Strategic Alignment, Activity and Workflow Modeling, and Business Rules: EA Incremental Build Context, Define Strategic Alignment Matrices, Activity Modeling Concepts, Activity-Based Costing, Workflow Modeling, Business Rules for Workflow Modeling. [TB: Ch. 8]
9. Using Business Normalization for Future Business Needs:EA Incremental Build Context, Introduction to Normalization, 1st, 2nd, 3rd, and 4th Business Normal Form, Identifying Current and Future Business Needs, Capturing Expert Business Knowledge. [TB: Ch. 9]
10. Menu Design, Screen Design, Performance Analysis, and Process Modeling: EA Incremental Build Context, Initial Menu Structure from a Data Model, Preliminary Screen Designs from a Data Model, Database Capacity Planning and Transaction Performance, Prototyping from a Data Model, Process Modeling. [TB: Ch. 10]
11. Enterprise Application Integration Concepts: Technologies for Enterprise Integration, B2B Cost-Effective Business Drivers, XML Messaging and Repository Standards, ebXML, EAI Vendors and Products. [TB: Ch. 11]
12. Enterprise Portal Technologies for Integration: The Evolution of Enterprise Portals, Enterprise Portal Product Categories, Enterprise Portal Product Descriptions. [TB: Ch. 12]
13. Web Services for Real-Time Integration: Introduction to Web Services, Intranet and Internet Web Services for Integration, XML Standards for Web Services, Web Services Evolution, Challenges in Phase 3 Evolution, Web Services Products. [TB: Ch. 13]
14. Service-Oriented Architecture for Integration: Importance of Service-Oriented Architecture, Introduction to Service-Oriented and Event-Driven Architectures, SOA Business Process Management Products. [TB: Ch. 14]
15. Managing and Delivering EA: Virtualization and On-Demand Computing, Costs of Integration, Role of Modeling Tools, Modeling Tool Products and Directions, Key EA Principles, Future Directions in EA. [TB: Ch. 15]

Textbook(s):

- Enterprise Architecture for Integration: Rapid Delivery Methods and Technologies by Clive Finkelstein, Artech House Print on Demand; 1st Edition (March 31, 2006). ISBN-10: 1580537138

Reference Material:

- Systems Integration (Systems Engineering) by Jeffrey Grady, CRC-Press; 1st Edition (September 30, 1994). ISBN-10: 0849378311
- The Business of Systems Integration by Andrea Prencipe (Editor), Andrew Davies (Editor), Mike Hobday (Editor). Oxford University Press, USA (June 30, 2005). ISBN-

10: 019926323X

- Enterprise Integration: An Architecture for Enterprise Application and Systems Integration by Fred A. Cummins, Wiley; 1st Edition (February 14, 2002). ISBN-10: 0471400106

Course Title: Design Patterns

Course Code: SE-4345
Course Structure: Lectures: 3/0
Credit Hours: 3
Prerequisites: CMP-3310 (Software Engineering)

Course Objectives:

The aim of this course is to make the students competent in designing effective and maintainable complex software systems of high quality. To this end, students will learn and gain hands-on experience in designing software systems by reusing/applying design patterns. Design patterns are successful solutions to recurring problems that arise when building software systems. Reusing design patterns helps to prevent subtle issues that can cause major problems and improves code readability for the developers familiar with the patterns. In addition to mastering these good design abstractions, the students will also learn how to evaluate a design, identify common problems, and how to fix these problems through refactoring.

Course Syllabus:

Overview of Object-oriented design, Overview of UML & OCL.Introduction to design patterns.Coupling and Cohesion. Why design patterns? Creational patterns: Singleton, Abstract Factory, Builder, Prototype. Structural patterns: Facade, Composite, Bridge, Proxy, Adapter, Decorator. Behavioral patterns: Chain of responsibility, Visitor, Observer, Iterator, Command, Mediator, Strategy, Interpreter, Memento. Patterns for concurrent and distributed systems: Event handling patterns. Synchronization and Concurrency patterns.Concurrency Controller pattern. Antipatterns: Common pitfalls and antipattern examples, Recovering from bad designs, Refactoring to patterns. Introduction to Aspect-Oriented design: Aspects, themes, concerns

Course Outline:

1. Overview of Object-oriented design.
2. Overview of UML: Use cases, class diagrams, and other UML diagrams.
3. Object constraint language (OCL)
4. Review of "Getting started using the use cases to capture requirements" by J. Rumbaugh
5. Introduction to design patterns : Coupling and cohesion, Why design patterns?
6. Reading assignment: The paper "Design Patterns: Abstraction and Reusable of Object Oriented Design" by E. Gamma, R. Helm, R. Johnson, and J. Vlissides
7. Creational patterns: Singleton, Abstract Factory, Builder, Prototype
8. Structural patterns : Facade, Composite, Bridge, Proxy, Adapter, Decorator
9. Behavioral patterns :Chain of responsibility, Visitor, Observer, Iterator, Command, Mediator, Strategy, Interpreter, Memento
10. Patterns for concurrent and distributed systems: Event handling patterns (ref. 3). Synchronization and Concurrency patterns (ref. 3 &4) . Concurrency Controller pattern
11. Anti-patterns: Common pitfalls and antipattern examples. Recovering from bad designs. Refactoring to patterns

Textbooks:

1. Design Patterns: Elements of Reusable Object Oriented Software, E. Gamma, R. Helm, R. Johnson, and J. Vlissides, Addison -Wesley Professional, 1995
2. Java Design Pattern Essentials by Tony Bevis, Ability First Limited; 2nd Edition (October 11, 2012). ISBN-10: 0956575846

Reference Material:

1. Patterns in Java: A Catalog of Reusable Design Patterns Illustrated with UML by Mark Grand, 2nd Edition, Volume 1, Wiley, (2002) . ISBN-10: 0471227293
2. Object-Oriented Software Engineering: Using UML, Patterns, and Java by B. Bruegge and A. H. Dutoit, 2nd Edition, Prentice Hall, (2003). ISBN-10: 0136061257
3. Refactoring to Patterns by J. Kerievsky, Addison-Wesley, (2004). ISBN-10: 0321213351
4. A System of Patterns: Pattern-Oriented Software Architecture by Buschmann, F., Meunier, R., Rohnert, H., Sommerlad, P. & Stal, M, Wiley & Sons, (1996). ISBN-10: 0471958697
5. Pattern-Oriented Software Architecture: Patterns for Concurrent and Networked Objects by D.C Schmidt, M. Stal, H. Rohnert and F. Bushmann, Wiley & Sons, (2000).
6. Aspect-Oriented Analysis and Design: The Theme Approach, S. Clarke and E. Baniassad, Addison-Wesley Professional,(2005). ISBN-10: 0321246748
7. Aspect Oriented Software Development with Use Cases, I. Jacobson and Pan-Wei Ng, Addison-Wesley Professional, (2004). ISBN-10: 0321268881

Course Title: Data & Network Security

Course Code: CS-4541
Course Structure: Lectures:3/ Labs: 0
Credit Hours: 3
Prerequisites: CS-4511(System and Network Administration)

Course Syllabus:

Network Security Overview, Understanding Defenses, Cryptography, Security Policies, Secure Design, Web Security, Router Security, Firewalls, Intrusion Detection System, Remote Access, Virtual Private Networks, Public Key Infrastructure, Wireless Security, Logging and Auditing, Case Studies.

Course Outline:

1. Network Security Overview: Defining Trust, Weaknesses and Vulnerabilities, Responsibilities for Network Security, Security Objectives, the Need for Security, Risk and Vulnerability, TCP/IP Suite Weaknesses, Buffer Overflows, Spoofing Techniques, Social Engineering. [TB1: Ch. 1,2]
2. Understanding Defenses: Digital IDs, Intrusion Detection System, PC Card-Based Solutions, Physical Security, Encrypted Login, Firewalls, Reusable Passwords, Antivirus Software, Encrypted Files, Biometrics. [TB1: Ch. 3]
3. Cryptography: Introduction, Cryptography versus Cryptanalysis, Modern-Day Techniques. [TB1: Ch. 4]
4. Security Policies: Defining a Security Policy, Importance of a Security Policy, Development Process, Incident Handling Process, Security Wheel, Sample Security Policy. [TB1: Ch. 5]

5. Secure Design: Network Design-Principles, Network Design-Methodology, Return on Investment, Physical Security Issues, Switches and Hubs. [TB1: Ch. 6]
6. Web Security: Hardening, Case Study. [TB1: Ch. 7]
7. Router Security: Basic Router Security, Router Security to Protect the Network, CBAC, Case Study. [TB1: Ch. 8]
8. Firewalls: Firewall Basics, Different Types of Firewalls, Enhancements for Firewalls, Placing Filtering Routers and Firewalls. [TB1: Ch. 9]
9. Intrusion Detection System: Introduction to Intrusion Detection, Host-Based IDSs, Network-Based IDSs, IDS Management Communications-Monitoring the Network, Sensor Maintenance, Case Study: Deployment of IDS Sensors in the Organization and Their Typical Placement. [TB1: Ch. 10]
10. Remote Access: AAA Model, AAA Servers, Lock-and-Key Feature, Two-Factor Identification, Case Study: Configuring Secure Remote Access. [TB1: Ch. 11]
11. Virtual Private Networks: Generic Routing Encapsulation Tunnels, IP Security, VPNs with IPSec, Case Study: Remote Access VPN. [TB1: Ch. 12]
12. Public Key Infrastructure: Public Key Distribution, Trusted Third Party, PKI Topology, Enrollment Procedure, Revocation Procedure, Case Study: Creating Your Own CA. [TB1: Ch. 13]
13. Wireless Security: Different WLAN Configurations, What Is a WLAN? How Wireless Works, Risks of Open Wireless Ports, War-Driving and War-Chalking, SAFE WLAN Design Techniques and Considerations, Case Study: Adding Wireless Solutions to a Secure Network. [TB1: Ch. 14]
14. Logging and Auditing: Logging, SYSLOG, Simple Network Management Protocol, Remote Monitoring, Service Assurance Agent, Case Study. [TB1: Ch. 15]

Textbook(s):

- Network Security Fundamentals by Gert DeLaet and Gert Schauwers, Cisco Press; 1st Edition (September 18, 2004). ISBN-10: 1587051672

Reference Material:

- Network Security Bible by Eric Cole, Wiley; 2nd Edition (September 8, 2009). ISBN-10: 0470502495
- Network Security Essentials: Applications and Standards by William Stallings, Prentice Hall; 4th Edition (March 22, 2010). ISBN-10: 0136108059
- Security in Computing by Charles P. Pfleeger and Shari Lawrence Pfleeger, Prentice Hall; 4th Edition (2006). ISBN-10: 0132390779
- CISSP All-in-One Exam Guide, 6th Edition by Shon Harris, McGraw-Hill Osborne Media; 6th Edition (2012). ISBN-10: 0071781749
- Hacking Exposed 7: Network Security Secrets & Solutions, Seventh Edition by Stuart McClure, Joel Scambray and George Kurtz, McGraw-Hill Osborne Media; 7th Edition (2012). ISBN-10: 0071780289

Course Title: Network Design and Management
Course Code:CS-3541
Course Structure: Lectures: 3 / Labs: 0
Credit Hours: 3
Prerequisites: CMP-2540 (Computer Communication and Networks)

Course Objectives:
This course is aimed to prepare students to design and manage various aspects of organizational network.

Course Syllabus:
Analyzing Business Goals and Constraints.Top-Down Network Design Methodology.Characterizing the Existing Internetwork.Designing a Network Topology.Designing Models for Addressing and Numbering.Selecting Switching and Routing Protocols.Developing Network Security Strategies.Developing Network Management Strategies.Physical Network Design.Selecting Technologies and Devices for Enterprise Networks.Testing Network Design.Optimizing Network Design.Documenting Network Design. Network Management Standards & Models. SNMP Management.

Course Outline:
1. Analyzing Business Goals and Constraints: Using a Top-Down Network Design Methodology, Analyzing Business Goals, Analyzing Business Constraints. Analyzing Technical Goals and Tradeoffs: Scalability, Availability, Network Performance, Security, Manageability, Usability, Adaptability, Affordability, Making Network Design Tradeoffs. [TB1: Ch. 1, 2]
2. Characterizing the Existing Internetwork: Characterizing the Network Infrastructure, Checking the Health of the Existing Internetwork. Characterizing Network Traffic: Characterizing Traffic Flow, Characterizing Traffic Load, Characterizing Traffic Behavior, Characterizing Quality of Service Requirements. [TB1: Ch. 3, 4]
3. Designing a Network Topology: Hierarchical Network Design, Redundant Network Design Topologies, Modular Network Design, Designing a Campus Network Design Topology, Virtual LANs, Wireless LANs, Redundancy and Load Sharing in Wired LANs, Server Redundancy, Workstation-to-Router Redundancy, Designing the Enterprise Edge Topology, Secure Network Design Topologies. [TB1: Ch. 5]
4. Designing Models for Addressing and Numbering: Guidelines for Assigning Network Layer Addresses, Designing a Model for Naming. [TB1: Ch. 6]
5. Selecting Switching and Routing Protocols: Making Decisions as Part of the Top-Down Network Design Process, Selecting Switching Protocols, Selecting Routing Protocols, IP Routing. [TB1: Ch. 7]
6. Developing Network Security Strategies: Network Security Design, Security Mechanisms, Modularizing Security Design, [TB1: Ch. 8]
7. Developing Network Management Strategies: Network Management Design, Network Management Architectures, Selecting Network Management Tools and Protocols. [TB1: Ch. 9]
8. Physical Network Design: Selecting Technologies and Devices for Campus Networks: LAN Cabling Plant Design, LAN Technologies, Selecting Internetworking Devices for a

Campus Network Design, Example of a Campus Network Design. [TB1: Ch. 10]

9. Selecting Technologies and Devices for Enterprise Networks: Remote-Access Technologies, Selecting Remote-Access Devices for an Enterprise, WAN Technologies, Example of a WAN Design. [TB1: Ch. 11]
10. Testing Network Design: Using Industry Tests, Building and Testing a Prototype Network System, Writing and Implementing a Test Plan for Network Design, Tools for Testing a Network Design. [TB1: Ch. 12]
11. Optimizing Network Design: Optimizing Bandwidth Usage with IP Multicast Technologies, Reducing Serialization Delay, Optimizing Network Performance to Meet Quality of Service Requirements, Cisco IOS Features for Optimizing Network Performance. Documenting Network Design: Responding to a Customer's Request for Proposal, Contents of a Network Design Document [TB1: Ch. 13, 14].

Textbook(s):

- Top-Down Network Design by Priscilla Oppenheimer, Cisco Press; 3rd Edition (September 3, 2010). ISBN-10: 1587202832 (TB1)

Reference Material:

- Networking Systems Design and Development by Lee Chao, CRC Press; 1st Edition (December 21, 2009). ISBN-10: 142009159X (TB2)
- Networks: Design and Management by Steven Karris, Orchard Publications (August 2002). ISBN-10: 0970951140
- Network Design: Management and Technical Perspectives by Teresa C. Piliouras and Kornel Terplan, CRC Press (August 19, 1998). ISBN-10: 0849334047
- Network Warrior by Gary A. Donahue, O'Reilly Media; 2nd Edition (May 13, 2011). ASIN: B004W8ZL3W
- Modeling and Tools for Network Simulation by Klaus Wehrle, Mesut Günes, and James Gross, Springer (September 23, 2010). ISBN-10: 3642123309
- The Practice of System and Network Administration by Thomas Limoncelli, Christina Hogan, and Strata Chalup, Addison-Wesley Professional; 2nd Edition (July 15, 2007). ISBN-10: 0321492668
- Network Management: Principles and Practice by Mani Subramanian; Timothy A. Gonsalves and N. Usha Rani, Pearson Education India (2010). ISBN-10: 81-3172-759-9

Course Title: Mobile and Wireless Networks

Course Code: CS-4543
Course Structure: Lectures: 3 / Labs: 0
Credit Hours: 3
Prerequisites: CS-3513 (Internet Architecture and Protocols)

Course Objectives:

This course provides a general introduction to mobile networking, with an emphasis on the mechanisms, protocols and standards. The purpose of the course is to deliver a in-depth understanding of the architecture and operating principles of mobile and wireless networks.

Course Syllabus:
Basics of Wireless Local Area Networks. Radio Transmitters and Receivers, Multiple Access Methods: FDMA, TDMA, CDMA, Random Access, ALOHA, Slotted ALOHA, Reservation-based ALOHA. Radio Propagation.Antennas and Transmission Lines.Communication Protocols and Modulation.High-Speed Wireless Data.GSM/Cellular Networks.Indoor Networks.Security in Wireless Local Area Networks. Voice Over Wi-Fi and Other Wireless Technologies. Mobile Ad Hoc Networks.Wireless Sensor Networks. Reliable Wireless Networks for Industrial Applications. Applications and Technologies.Conflict and Compatibility, Ultra-wideband Technology.

Course Outline:

1. Basics of Wireless Local Area Networks: Networks Large and Small, WLANs from LANs, 802.11 WLANs, HiperLAN and HiperLAN 2, From LANs to PANs. [TB1: Ch2]
2. Radio Transmitters and Receivers, Multiple Access Methods: Overview of Radios, Radio Components, FDMA, TDMA, CDMA, Random Access, ALOHA, Slotted ALOHA, Reservation-based ALOHA. [TB1: Ch3]
3. Radio Propagation: Radio Propagation, Mechanisms of Radio Wave Propagation, Open Field Propagation, Diffraction, Scattering, Path Loss, Multipath Phenomena, Flat Fading, Diversity Techniques. [TB1: Ch4]
4. Antennas and Transmission Lines: Introduction and Antenna Characteristics, Types of Antenna, Impedance Matching, Measuring Techniques. [TB1: Ch5]
5. Communication Protocols and Modulation: Baseband Data Format and Protocol, Baseband Coding, RF Frequency and Bandwidth, Modulation, RFID. [TB1: Ch6]
6. High-Speed Wireless Data: System Types, Standards-Based and Proprietary Solutions: Fixed Networks, Nomadic Networks, Mobile Networks, Standards-Based Solutions and Proprietary Solutions, Overview of the IEEE 802.11 Standard, Overview of the IEEE 802.16 Standard, 10–66 GHz Technical Standards, 2–11 GHz Standards, Overview of the IEEE 802.20 Standard. [TB1: Ch7]
7. GSM/Cellular Networks: First-Generation Analog , Second-Generation TDMA , Second-Generation CDMA, Third-Generation Systems, 4G and Beyond, LTE. [TB2: Ch10] (wc Willian Stallings Ch. 5 and from GSM to LTE book)
8. Indoor Networks: Behind Closed Doors, How Buildings Are Built (with W. Charles Perry, P.E.), Microwave Properties of Building Materials, Realistic Metal Obstacles, Real Indoor Propagation [TB1: Ch9]
9. Security in Wireless Local Area Networks: Introduction Key Establishment in 802.11, Anonymity in 802.11, Authentication in 802.11, Confi dentiality in 802.11, Data Integrity in 802.11, Loopholes in 802.11 Security, WPA, WPA2 (802.11i). [TB1: Ch10]
10. Voice Over Wi-Fi and Other Wireless Technologies: Introduction and Ongoing 802.11 Standard Work, Wi-Fi and Cellular Networks, WiMax, VoWi-Fi and Bluetooth, VoWi-Fi and DECT, VoWi-Fi and Other Ongoing 802.x Wireless Project. [TB1: Ch11]
11. Mobile Ad Hoc Networks: Mobile Ad Hoc Networks, Physical Layer and MAC, Routing in Ad Hoc Networks. [TB1: Ch12]
12. Wireless Sensor Networks: Application, Plant Network Layouts, Plant Network Architecture, Sensor Subnet Selection, Functional Requirements. [TB1: Ch13]
13. Reliable Wireless Networks for Industrial Applications: Benefits of Using Wireless, Issues in Deploying Wireless Systems, Wireless Formats, Wireless Mesh Networks,

Industrial Applications of Wireless Mesh Networks [TB1: Ch14]

14. Applications and Technologies: Wireless Local Area Networks (WLAN) and PAN: Bluetooth, Zigbee, Conflict and Compatibility, Ultra-wideband Technology. [TB1: Ch15]

Textbook(s):

- Wireless Networking: Know It All by Praphul Chandra, Daniel M. Dobkin, Dan Bensky, Ron Olexa, David Lide, and Farid Dowla, Newnes (September 28, 2007). ISBN-10: 0750685824 (TB1)
- Wireless Communications & Networks by William Stallings, Prentice Hall; 2nd Edition (November 22, 2004). ISBN: 0131918354.

Reference Material:

- CCNA Wireless Official Exam Certification Guide by Brandon James Carroll, Cisco Press; 1st Edition (November 2, 2008). ISBN-10: 1587202115
- Wireless Crash Course by Paul Bedell, McGraw-Hill Professional; 3rd Edition (September 5, 2012). ISBN-10: 0071797890
- Wireless and Mobile Data Networks by Aftab Ahmad, Wiley-Interscience; 1st Edition (July 20, 2005). ISBN-10: 0471670758

Course Title: System and Network Administration

Course Code: CS-4511
Course Structure: Lectures: 3/Labs: 0
Credit Hours: 3
Prerequisites: CMP-2540(Computer Communication and Networks)

Course Objectives:

This course will give an overview of systems and network administration based on both Windows and Linux environments. The objective are common system administration tasks and practices and how to implement and maintain standard services like email, file sharing, DNS and similar.

Course Syllabus:

Introduction to System Administration (SA).SA Components.Server Environment (Microsoft and Linux). Reliable Products, Understand the Cost of Server Hardware, Consider Maintenance Contracts and Spare Parts, Maintaining Data Integrity, Put Servers in the Data Center, Client Server OS Configuration, Providing Remote Console Access. Comparative Analysis of OS.Important Attributes, Key Features, Pros and Cons. Linux Installation and verification. Configuring Local services and managing basic system issues. Administer users and groups. Software Management.Managing Network Services and Network monitoring tools. Boot Management and Process Management. IP Tables and filtering.Securing network traffic. Advance File systems and logs. Bash Shell Scripting. Configuring Servers (FTP, NFS, Samba, DHCP, DNS and Apache).Configuring LYNC and Sharepoint 2010 on Windows Server 2008.

Course Outline:

1. Introduction to System Administration: Systems, SA Components, Building a Site from Scratch, Growing a Small Site, Going Global, Replacing Services, Moving a Data Center, Handling a High Rate of Office Moves, Assessing a Site (Due Diligence)
2. Server Environment (Microsoft and Linux): Known for Reliable Products, Understand the Cost of Server Hardware, Consider Maintenance Contracts and Spare Parts, Maintaining Data Integrity, Put Servers in the Data Center, Client Server OS Configuration, Provide Remote Console Access
3. Comparative Analysis of most demanded OS: Important Attributes, Key Features, Pros and Cons
4. Linux Installation and verification
5. Configuring Local services and managing basic system issues
6. Administer users and groups
7. Software Management
8. Managing Network Services and Network monitoring tools
9. Boot Management and Process Management
10. IP Tables and filtering
11. Securing network traffic
12. Advance File systems and logs
13. Bash Shell Scripting
14. Configuring Servers (FTP, NFS, Samba) LAB
15. Configuring Servers Cont. (DHCP, DNS and Apache) LAB
16. Configuring LYNC and Sharepoint 2010 on Windows Server 2008 LAB

Textbook(s):

- The Practice of System and Network Administration, Second Edition by Thomas Limoncelli, Christina Hogan and Strata Chalup, Addison-Wesley Professional; 2nd EEdition (2007). ISBN-10: 0321492668
- Red Hat Enterprise Linux 6 Bible: Administering Enterprise Linux Systems by William vonHagen, 2011

Reference Material:

- Studyguide for Practice of System and Network Administration by Thomas A. Limoncelli, Cram101; 2nd Edition (2011). ISBN-10: 1428851755
- Microsoft Windows Server 2008 R2 Administration Instant Reference by Matthew Hester and Chris Henley, ISBN-10: 0470525398.
- Networking Systems Design and Development by Lee Chao, CRC Press; 1st Edition (December 21, 2009). ISBN-10: 142009159X (TB2)
- Windows Administration Latest Edition, Microsoft Press
- Linux Administration Guide Latest Edition

Course Title: Network Programming
Course Code: CS-3542
Course Structure: Lectures: 3/Labs: 0
Credit Hours: 3
Prerequisites: CMP-2122 (Programming Fundamentals)

Course Objectives:
At the end of this course, students would be able to identify and describe the purpose of each component of the TCP/IP protocol suite. Develop large and complex client-server applications using TCP/IP. Understand the impact of multiple threads or processes for an application. Understand the approaches toward building a robust server. This course is about implementation of TCP/IP networking concepts, Socket programming in Linux and Windows environment, developing client/server applications using C language, advanced networking software concepts, Handling multiple processes and threads, sharing data or passing information between processes or threads (IPC).

Course Syllabus:
Introduction and TCP/IP. Transport Layer details: Sockets Introduction and Elementary TCP Sockets. I/O Multiplexing: Socket Options. Elementary UDP Sockets.Elementary Name and Address Conversions.IPv4 and IPv6 Interoperability. Daemon Processes and advanced I/O functions. Non-blocking I/O and ioctl operations. Routing Sockets, Broadcasting, Multicasting. Threads and Raw Sockets. Datalink Access & Streams.

Course Outline:
1. Introduction and TCP/IP: A Simple Daytime Client, Protocol Independence, Roadmap to Client/Server, BSD Networking, Unix standard, 64-bit Architectures. [Ch. 1]
2. Transport Layer details: UDP, TCP, SCTP, connections, port numbers, buffers etc [Ch. 2]
3. Sockets Introduction and Elementary TCP Sockets : Socket Address Structure, Arguments and Functions, TCP/IP client server Application [Ch. 3]
4. I/O Multiplexing: The SELECT and POLL function with all aspects. [Ch. 6]
5. Socket Options: getsockopt and setsockopt functions, default, socket states, generic, IPv4, IPv6, ICMPv6 socket options etc. [Ch. 7]
6. Elementary UDP Sockets: sendto and recvfrom functions, UDP echo server and client, summary of UDP. [Ch. 8]
7. Elementary Name and Address Conversions. [Ch. 9]
8. IPv4 and IPv6 Interoperability. [Ch. 10]
9. Daemon Processes and advanced I/O functions. [Ch. 12, 13]
10. Non-blocking I/O and ioctl operations. [Ch. 15,16]
11. Routing Sockets, Broadcasting, Multicasting. [Ch. 17,18, 19
12. Threads and Raw Sockets [Ch. 23, 25]
13. Datalink Access & Streams [Ch. 26, 33]

Textbook(s):
- UNIX Network Programming Volume I by Richard Steven, Prentice Hall; 2nd Edition (September 4, 1998).ISBN-10: 0130810819

Reference Material:

- Windows System Programming by Johnson M. Hart, Addison-Wesley Professional; 4th Edition (February 26, 2010). ISBN-10: 0321657748
- The Linux Programming Interface: A Linux and UNIX System Programming Handbook by Michael Kerrisk, No Starch Press; 1st Edition (October 28, 2010). ISBN-10: 1593272200
- Linux Kernel Development by Robert Love, Addison-Wesley Professional; 3rd Edition (July 2, 2010). ISBN-10: 0672329468
- System Software: An Introduction to Systems Programming by Leland L. Beck, Addison Wesley, (3rd Edition) (1996). ASIN: B0084YEEWO

Course Title: Information Security

Course Code: CS-4561
Course Structure: Lectures: 3 / Labs: 0
Credit Hours: 3
Prerequisite: CMP-2540(Computer Communication and Networks)

Course Objectives:

The course aims to enhance students' understanding about the essentials of information securityand the algorithms for implementing security

Course Syllabus:

Security Fundamentals: Terminology, Attacks, Security Goals. Authentication, Authorization; Cipher Techniques.Cryptography.Key Management.Network Security. Security Management and Applications: Electronic Payment. Cyber Crimes & Laws.

Course Outline:

1. Security Fundamentals: Introduction, Terminology, Attacks, Security Goals : Authentication, Authorization, Cipher Techniques: Substitution and Transposition, One Time Pad, Modular Arithmetic, GCD, Euclid's Algorithms, Chinese Remainder Theorem, Discrete Logarithm, Fermat Theorem, Block Ciphers, Stream Ciphers. Secret Splitting And Sharing.
2. Cryptography: Symmetric Key Algorithms: DES, AES, BLOFISH, Attacks on DES. Modes of Operations, Linear Cryptanalysis and Differential Cryptanalysis. Public Key Algorithms: RSA, Key Generation and Usage, ECC. Hash Algorithms: SHA-1, MD5.
3. Key Management: Introduction, Key Management: Generations, Distribution, Updation, Digital Certificate, Digital Signature, PKI. Diffiee Hellman Key Exchange. One Way Authtication, Mutual Authentication, Neeham Schroeder Protocol.
4. Network Security: Layer Wise Security Concerns, IPSEC- Introduction, AH And ESP, Tunnel Mode, Transport Mode, Security Associations, SSL- Introduction, Handshake Protocol, Record Layer Protocol. IKE- Internet Key Exchange Protocol. Intrusion Detection Systems: Introduction, Anomaly Based, Signature Based, Host Based, Network Based Systems.
5. Security Management And Applications: ISO 27001 Security Standard: Introduction, Evolution of Standard, Organizational Context, Implementation, Certifications And Benefits. Electronic Payment: Introduction, Payment Types, Smart Cards, Chip Card

Transactions And Attacks, Payment Over Internet, Mobile Payments, Electronic Cash.

6. Cyber Crimes & Laws: Introduction, Computer Forensics, Online Investgative Tool, Tracing And Recovering Electronic Evidence, Internet Fraud, Identity Theft, Industrial Espionage, Cyber Terrorism. Indian IT Laws: Introduction And Briefs of Law Clauses.

Textbook(s):

1. Applied Cryptography- Protocols, Algorithms and Source code in C by Bruice Schneier, Wiley; 2nd Edition (October 18, 1996). ISBN-10: 0471117099
2. Network Security and Cryptography by Bernard Menezes, Cengage Learning, Cengage Learning (March 30, 2010). ISBN-10: 8131513491
3. Cryptography and Network Security: Principles and Practice by William Stallings, Prentice Hall; 5th Edition (January 24, 2010). ISBN-10: 0136097049

Reference Material:

- Information Security: Principles and Practice by Mark Stamp, Wiley; 2nd Edition (May 3, 2011). ISBN-10: 0470626399
- Computer Security: Principles and Practice by William Stallings and Lawrie Brown, Prentice Hall; 2nd Edition (November 19, 2011). ISBN-10: 0132775069
- Information Security-Principles and Practices by Mark Merkow, Prentice Hall (August 29, 2005). ISBN-10: 0131547291

Annexure-A

یونیورسٹی آف سرگودھا SS-2311 - Islamic Studies

نصاب برائے اسلامیات لازمی کلاس BS 4 Years

باب اول: مطالعہ قرآن وحدیث

باب دوم: مطالعہ سیرت

باب سوم: مطالعہ تہذیب وتمدن

باب اول: مطالعہ قرآن وحدیث (Topical Study of Quran & Hadith)

موضوعات

ا۔توحید (دلائل کا عقلی ونقلی مطالعہ، تفکر وتدبر)

آیات

۱. لله مافی السمٰوٰت وما فی الارض وان تبدوا مافی انفسکم او تخفوہ یحاسبکم به الله فیغفرلمن یشاء ویعذب من یشآء والله ع
شئي قدیرٌ. (البقرة:۲۸۴)

۲. الم تروا ان الله سخر لکم مافی السموت وما فی الارض واسبغ علیکم نعمه ظاهرةً و باطنةً ومن الناس من یجادل فی الله بغیر
هدی ولا کتاب منیر. (لقمان:۲۰)

۳. ربنا لاتواخذنا ان نسینا او اخطانا ربناولا تحمل علینا اصرا کما حملته علی الذین من قبلنا ربنا ولا تحملنا مالا طاقة لنا به
واغفرلنا وارحمنا انت مولانا فانصرنا علی القوم الکافرین (البقرة:۲۸۶)

۴. سنریهم ایاتنا فی الآفاق وفی انفسهم حتی یتبین لهم انه الحق اولم یکف بربک انه علی کل شیءٍ شهید. (حم السجدة:۴۱)
ان فی خلق السمٰوٰت والارض و اختلاف اللیل والنهار لایت الاولی الالباب. (آل عمران:۱۹۰)

۵. الذین یذکرون الله قیاماً و قعوداً وعلی جنوبهم و یتفکرون فی خلق السمٰوٰت والارض ربنا ما خلقت هذا باطلا، سبحانک
عذاب النار. (آل عمران:۱۹۲)

احادیث

عن عمر بن الخطابؓ قال: قال رسول اللهﷺ حین سئل عن الایمان ان تومن بالله و ملائکته و کتبه ورسله والیوم الاخرو تو
بالقدرخیره و شره (متفق علیه)

۲: رسالت (الہامی کتب، وملائکہ پرایمان، آدابِ نبوی، اطاعتِ رسول اورختمِ نبوت)

آیات:

۱. امن الرسول بما انزل الیه من ربه والمومنون کل امن بالله و ملائکته ورسله لا نفرق بین احد من رسله وقالوا سمعنا واطعنا
ربنا والیک المصیر (البقرة:۲۸۵)

۲. یاایهاالذین امنوا لا تقدموا بین یدی الله ورسوله واتقوا الله ان الله سمیع علیم. (الحجرات:۱)

چیئرمین
شعبہ علوم اسلامیہ
یونیورسٹی آف سرگودھا

واخرى تحبونها نصر من الله وفتح قريب وبشر المؤمنين .(الصف: ۱۳)

احادیث

۱. عن ابن عمر قال: قال رسول الله ﷺ بنی الاسلام علی خمس شهادة ان لااله الا الله وان محمداعبده ورسوله واقام الصلوة وايتاء الزكوة والحج وصوم رمضان (متفق عليه)

۲. عن شبرمة بن معبد قال: قال رسول الله ﷺ مروا الصبی الصلوة اذا بلغ سبع سنين واذا بلغ عشر سنين فاضربوه عليها (سنن ابی داود، جامع ترمذی)

۳. عن ابی هريرة قال: قال رسول ﷺ من اتاه الله مالا فلم يود زكوة مثل له ماله يوم القيامة شجاعا اقرع له زبيبتان يطوقه يوم القيامة ياخذ بلهزمتيه (يعنی شدقيه) ثم يقول انا مالک وانا كنزک ثم تلا ولا يحسبن الذين يبخلون بما آتهم الله من فضله هو خير لهم بل هو شر لهم سيطوقون ما بخلوا به يوم القيامة..... الخ (بخاری)

۴. عن علی قال: قال رسول الله ﷺ من ملک زاد راحلته تبلغه الی بيت الله ولم يحج فلا عليه ان يموت يهوديا اونصرانيا وذلک ان الله تبارک وتعالی يقول ولله علی الناس حج البيت من استطاع اليه سبيلا (جامع ترمذی)

۵. صفات مومنین

آیات

۱. و عباد الرحمن الذين يمشون على الارض هونا و اذاخاطبهم الجاهلون قالوا سلما. (الفرقان: ۱)

۲. والذين يبيتون لربهم سجدا و قياما. (الفرقان: ۶۴)

۳. والذين يقولون ربنا اصرف عنا عذاب جهنم ان عذابها كان غراما. (الفرقان: ۶۵)

۴. انها ساءت مستقرا و مقاما. (الفرقان: ۶۶)

۵. والذين اذا انفقوا لم يسرفوا ولم يقتروا وكان بين ذالک قواما. (الفرقان: ۶۷)

۶. والذين لايدعون مع الله الهاآخرولايقتلون النفس التی حرم الله الا بالحق ولا يزنون ومن يفعل ذالک يلق اثاما. (الفرقان: ۶۸)

۷. يضعف له العذاب يوم القيمة و يخلد فيه مهانا. (الفرقان: ۶۹)

۸. الا من تاب و امن وعمل صالحا فأولئک يبدل الله سياتهم حسنت وكان الله غفورا رحيما. (الفرقان: ۷۰)

۹. ومن تاب وعمل صالحا فانه يتوب الى الله متابا. (الفرقان: ۷۱)

۱۰. والذين لا يشهدون الزور واذا مروا باللغو مروا كراما. (الفرقان: ۷۲)

۱۱. والذين اذا ذكروا بايت ربهم لم يخروا عليها صما و عميانا. (الفرقان: ۷۳)

۱۲. والذين يقولون ربنا هب لنا من ازواجنا و ذريتنا قرة أعين و اجعلنا للمتقين اماما. (الفرقان: ۷۴)

۱۳. اولئک يجزون الغرفة بما صبروا و يلقون فيها تحية وسلما. (الفرقان: ۷۵)

۱۴. خلدين فيها حسنت مستقرا و مقاما. (الفرقان: ۷۶)

۱۵. قل ما يعبؤا بكم ربی لو لا دعاؤكم فقد كذبتم فسوف يكون لزاما. (الفرقان: ۷۷)

۴. والذين هم لفروجهم حافظون. (المومنون: ۵)

۵. الا على ازواجهم اوما ملكت ايمانهم فانهم غير ملومين. (المومنون: ۶)

- Stress and Coping
- Psychological aspects of Well-Being
- Promoting Health and Wellness

Social Psychology

- Attribution Theory
- Obedience And Power
- Group Dynamics
- Attitudes

Recommended Books:

1- Feldmen, R. S. (2012). *Understanding Psychology* (10th ed.). University of Massachusetts – Amherst, ISBN: 0073382795

2- Weiten, W. (2001). *Psychology: Themes and Variations.* (5th ed.). New York: Wadsworth.

٦. والذين هم على صلوتهم يحافظون. (المومنون: ٦)

٧. اولئک هم الوارثون. (المومنون: ٧)

٨. الذين يرثون الفردوس. (المومنون: ٨)

٩. هم فيها خالدون. (المومنون: ٩)

احادیث

١. عن انس قال: قال رسول الله ﷺ والذی نفسی بیده لا یؤمن عبد حتی یحب لا خیه ما یحب لنفسه (متفق علیه)

٢. عن النعمان بن بشیرؓ قال: قال رسول الله ﷺ تری المؤمنین فی تراحمهم و توادهم وتعاطفهم کمثل الجسد اذا اشتکی عضو تداعی له سائر الجسد بالسهر والحمی (متفق علیه)

٦. آدابِ معاشرت

١. وان طائفتان من المومنین اقتلوا فاصلحوا بینهما فان بغت احداهما علی الاخری فقاتلوا التی تبغی حتی تفیء الی امر الله فان فآئت فاصلحوا بینهما بالعدل واقسطوا ان الله یحب المقسطین. (الحجرات: ٩)

٢. انما المومنون اخوة فاصلحوا بین اخویکم واتقوا الله لعلکم ترحمون. (الحجرات: ١٠)

٣. یاایها الذین امنوا لایسخر قوم من قوم عسی ان یکونوا خیرا منهم ولا نساء من نساء عسی ان یکن خیرا منهن ولا تلمزوا انفسکم ولا تنابزوا بالالقاب بئس الاسم الفسوق بعد الایمان ومن لم یتب فاولئک هم الظالمون. (الحجرات: ١١)

٤. یا ایها الذین امنوا اجتنبوا کثیرا من الظن ان بعض الظن اثم ولا تجسسوا ولا یغتب بعضکم بعضا. ایحب احدکم ان یاکل لحم اخیه میتا فکرهتموه واتقوا الله ان الله توا ب رحیم (الحجرات: ١٢)

٥. یاایها الذین انا خلقناکم من ذکر وانثی وجعلناکم شعوبا وقبائل لتعارفوا ان اکرمکم عند الله اتقاکم ان الله علیم خبیر (الحجرات: ١٣)

احادیث

١. عن ابی هریرةؓ ان رسول الله ﷺ قال: ان المفلس من امتی من یأتی یوم القیامة بصلاة و صیام وزکوة، ویاتی قد شتم هذا، وقذف هذا، واکل مال هذا، وسفک دم هذا، و ضرب هذا، فیعطی هذا من حسناته ، و هذا من حسناته ، وهذا من حسناته، فان فنیت حسناته قبل ان یقضی ما علیه اخذ من خطایاهم فطرحت علیه ثم طرح فی النار

٧. دعوت واقامتِ دین

١. ومن اظلم ممن افتری علی الله الکذب و هو یدعیٰ الی الاسلام والله لا یهدی القوم الظالمین. (الصف: ٧)

٢. یریدون لیطفئوا نور الله بافواههم، والله متم نوره ولو کره الکافرون. (الصف: ٨)

٣. هو الذی ارسل رسوله بالهدیٰ ودین الحق لیظهره علی الدین کله ولو کره المشرکون. (الصف: ٩)

احادیث

١. عن ابی سعید نِ الخدریؓ عن رسول الله ﷺ قال من رای منکم منکراً فلیغیره بیده فان لم یستطع فبلسانه فان لم یستطع فبقلبه و ذالک أضعف الایمان (مسلم)

٢. عن عبدالله بن عمرؓ قال قال رسول الله ﷺ الا کلکم راع و کلکم مسؤل عن رعیته فالامام الذی علی الناس راع وهو مسؤل عن رعیته والرجل راع علی اهل بیته وهو مسؤل عن رعیته و المرأة راعیة علی بیت زوجها وولده وهی مسؤلة عنهم وعبدالرجل راع علی

۲. یاایهاالذین امنوا لا ترفعوا اصواتکم فوق صوت النبی و لا تجهروا له بالقول کجهر بعضکم لبعض ان تحبط اعمالکم و انتم لا تشعرون. (الحجرات: ۲)

۳. ان الذین یغضون اصواتهم عندرسول الله اولئک الذین امتحن الله قلوبهم للتقوی لهم مغفرة واجر عظیم. (الحجرات: ۳)

۴. ولو انهم صبروا حتی تخرج الیهم لکان خیرا لهم والله غفوررحیم. (الحجرات: ۴)

۵. ان الذین ینادونک من ورآء الحجرات اکثرهم لا یعقلون. (الحجرات: ۵)

۶. یاایهاالذین امنوا ان جاء کم فاسق بنبا فتبینوا ان تصیبوا قوما بجهالة فتصبحوا علی ما فعلتم نادمین. (الحجرات: ۶)

۷. واعلموا ان فیکم رسول الله لو یطیعکم فی کثیر من الامرلعنتم ولکن الله حبب الیکم الایمان وزینه فی قلوبکم و کره الیکم الکفر والفسوق والعصیان اولئک هم الراشدون. (الحجرات: ۷)

۸. فضلا من الله و نعمة و الله علیم حکیم. (الحجرات: ۸)

۹. النبی اولی بالمؤمنین من انفسهم وازواجه امهتهم و اولوالارحام بعضهم اولی ببعض فی کتاب الله من المؤمنین المهاجرین الا ان تفعلوا الی اولیاءکم معروفا، کان ذلک فی الکتاب مسطورا. (الاحزاب: ۶)

۱۰. ان الله وملائکته یصلون علی النبی یاایهاالذین امنوا صلوا علیه وسلموا تسلیما. (الاحزاب: ۵۶)

۱۱. ان الذین یوذون الله ورسوله لعنهم الله فی الدنیا والاخرة واعد لهم عذابا مهینا. (الاحزاب: ۵۷)

۱۲. لقد کان لکم فی رسول الله اسوة حسنة لمن کان یرجوا الله والیوم الآخرو ذکر الله کثیرا. (الاحزاب: ۲۱)

۱۳. ماکان محمد ابا احد من رجالکم ولکن رسول الله وخاتم النبیین و کان الله بکل شیء علیما. (الاحزاب: ۴۰)

احادیث

عن العباس بن عبد المطلب قال: قال رسول الله ﷺ ذاق طعم الایمان من رضی بالله ربا وبالاسلام دینا و بمحمد رسولا

۳. آخرت

آیات

۱. یاایهاالذین امنوا اتقوا الله ولتنظرنفس ماقدمت لغد واتقوا الله ان الله خبیربما تعملون. (الحشر: ۱۸)

۲. ولاتکونوا کالذین نسوا الله فانسهم انفسهم اولئک هم الفاسقون. (الحشر: ۱۹)

حدیث

عن ابن مسعود عن النبی ﷺ لاتزول قدما ابن آدم حتی یسئل عن خمس عن عمره فیما افناه وعن شبابه فیما ابلاه وعن ماله من این اکتسبه و فیما انفقه و ما ذا عمل فیم علم (جامع ترمزی)

۴. عبادات (نماز، زکوٰۃ، روزہ، حج، جہاد)

۱. قد افلح المومنون الذین هم فی صلاتهم خاشعون. (المومنون: ۱)

۲. والذین هم عن اللغومعرضون. (المومنون ۲)

۳. والذین هم للزکوة فاعلون. (المومنون: ۳)

۴. یاایهاالذین امنوا هل ادلکم علی تجارة تنجیکم من عذاب الیم. (الصف: ۱۰)

۵. تؤمنون بالله ورسوله و تجاهدون فی سبیل الله باموالکم و انفسکم ذلکم خیر لکم ان کنتم تعلمون. (الصف ۱۱)

یغفرلکم ذنوبکم و یدخلکم جنات تجری من تحتها الانهر و مساکن طیبة فی جنت عدن ذلک الفوزا العظیم. (الصف: ۱۲)

مال سیدہ وھو مسؤل عنه الا فکلکم راع و کلکم مسؤل عن رعیته (متفق علیه)

۳۔قال رسول للہ ﷺ یجاء الرجل یوم القیامته فیلقی فی النار فتندلق اقتتابه فی النار فیطحن فیها کطحن الحمار برحاه فیجتمع اهل النار علیه فیقولون، ای الان ماشانک، الیس کنت تأمر نا بالمعروف وتنهانا عن المنکر ؟ قال کنت امر کم ولا اتیه ونهاکم عن المنکر واتیه

احادیث

۱۔عن عبداللہ قال: قال رسول اللہ ﷺ طلب کسب الحلال فریضة بعدالفریضة (بیهقی: شعب الایمان)

۲۔عن ابی سعید قال : قال رسول اللہ ﷺ التاجر الصدوق الامین مع النبیین والصدیقین والشهداء (جامع ترمذی)

باب دوم: مطالعہ سیرت (Seerah Study)

۱۔ مطالعہ سیرت کی اہمیت

۲۔ تزکیہ نفس اور تعمیر شخصیت کا نبوی منہاج

۳۔ تشکیل معاشرت اور اسوۂ حسنہ

۴۔ ہجرت مدینہ، مواخات اور میثاق مدینہ

۵۔ غزوات النبی، مقاصد و حکمت

۶۔ خطبہ حجۃ الوداع

باب سوم: مطالعہ تہذیب و تمدن (Study of Culture)

۱۔ تہذیب کا مفہوم، اسلامی تہذیب کی خصوصیات

۲۔ بنیادی انسانی حقوق

۳۔ تہذیب انسانی کے ارتقاء میں مسلمانوں کا کردار

۴۔ اسلام کا تصور علم

۵۔ طبیعی علوم، حیاتیاتی علوم اور معاشرتی علوم میں مسلمانوں کا کردار

۶۔ مکالمہ بین المذاہب

.....

پرچہ میں نمبروں کی تقسیم درج ذیل ہو گی

قرآن و حدیث موضوعاتی مطالعہ : ۶۰

مطالعہ سیرت : ۲۰

مطالعہ تہذیب و تمدن : ۲۰

چیئرمین
بورڈ آف سٹڈیز

4th Semester)

Annexure-B

SS-2312 - Pakistan Studies

Course Outline for Pakistan Studies

Compulsory Course of Two Credit Hours for Under Graduate Studies and BA/BSc course of 40 marks as compulsory course.

Objectives: The objectives of this course are to acquaint the students with:

1. Two Nation Theory and Ideology of Pakistan
   a. Historical background of creation of Pakistan
   b. Two Nation Theory in its historical context, definition and interpretations
   c. Quaid-i-Azam and his political ideas.

2. Political Dynamics of Pakistan
   a. Constitutional development in Pakistan. (1947-79)
   b. Salient features of constitution of Pakistan 1973.
   c. Institutions of Pakistan; political parties, bureaucracy, army, judiciary and media.
   d. Problems of Pakistan as a Federal State.

3. Socio-Economic Issues of Pakistan.
   a. Basic natural Problems.
   b. Social and demographic issues.

4. Diplomatic Dynamics of Pakistan.
   a. Determinants and objectives of Pakistan's foreign policy.
   b. Pakistan's relations with its neighbouring countries.
   c. Pakistan and the Muslim World (A comprehensive review of foreign policy of Pakistan)

Recommended Books

1. Javed Awmad Sheikh, *Pakistan's Political, Economic, and Diplomatic Dynamics*, Lahore: Kitabistan Paper Products.
2. Other relevant readings for the individual subjects shall be recommended by the teacher during the course.

Annexure-C

SS-2410 - Principles of Psychology

Course Objectives

- To Ensure An Effective Orientation Of Students Towards The Discipline Of Psychology So That They May Be Come To Appreciate The Diversity Of The Subject And Its Pragmatic Significance.
- To Make Students Familiar With The Essential Features Of Research Enterprise In Psychology.
- To Include The Sense Of Personal Relevance Of Psychology As A Subject With The Potential Of Gaining Better Insight Into One's Own Self.

Introduction to Psychology

- Nature and Application Of Psychology With Special Reference To Pakistan.
- Research Enterprise In Psychology
- Goals Of Scientific Enterprise
- Experimental Research
- Descriptive/Corelational Research

i) Naturalistic Observation ii) Case History Method iii) Survey Method

- Statistics And Research

i) Descriptive ii) Inferential

Biological Basis of Behavior

- Communication In The Nervous System
- Organization Of The Nervous System
- The Brain And The Behavior

Sensation and Perception

- Psychophysics: Basic Concepts And Issues
- An Overview Of Sensory Perception (Vision, Hearing)
- Sleep and Dreams, Hypnosis and Meditation and drug use

Motivation and Emotions

- Definitions
- Types of Motivation

- Maslow's Theory
- James Lange Theory
- Cannon Bard Theory
- Schechter Singer Theory

Learning

- Definition Of Learning
- Types Of Learning

i. Classical Conditioning
ii. Operant Conditioning
iii. Observational Learning

Intelligence

i. What is intelligence, Artificial Intelligence
ii. Variation in intellectual abilities,
iii. Group differences in intelligence: Genetic and Environmental determinants

Human Memory

- Encoding: Getting Information Into Memory
- Storage: Maintaining Information Into Memory
- Retrieval: Getting Information Out Of Memory
- Forgetting: When Memory Lapses

Language and Thinking

- Problem Solving and reasoning: In Search Of Solutions
- Decision Making: Choices And Chances
- Language

Personality: Theory, Research and Assessment Perspective

- Biological Perspective
- Cognitive Perspective
- Psychodynamic Perspective
- Behavioral Perspective
- Humanistic approach
- Personality assessment

Health Psychology

- Coping, Stress and Well- Being

- Stress and Coping
- Psychological aspects of Well-Being
- Promoting Health and Wellness

Social Psychology

- Attribution Theory
- Obedience And Power
- Group Dynamics
- Attitudes

Recommended Books:

Feldmen, R. S. (2012). *Understanding Psychology* (10th ed.). University of Massachusetts – Amherst, ISBN: 0073382795

Weiten, W. (2001). *Psychology: Themes and Variations.* (5th ed.). New York: Wadsworth.