No. SU/Acad/24/02
Dated: 02.01.2024

Assistant Controller of Examinations (P.S),
Office of Controller of Examinations
University of Sargodha
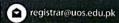
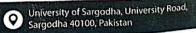Subject: **PROVISION OF SYLLABUS OF BS-IT, BS-SE AND BS-CS SESSION 2023-2027**

Kindly refer to your office Letter No.SU/CE/ACE (Secrecy-P.S)/01 dated 01.01.2024 on the subject captioned above.

2. It is to inform you that no revision in Syllabus of BS-IT, BS-SE and BS-CS program has been made by the department concerned in light of Undergraduate Education Policy (UEP-2023). After revision and approval from the relevant bodies, the same will be communicated to your good office.

Syed Abid Hussain
Assistant Registrar (Acad)
for registrar

Revised
Curriculum
of
BS Software Engineering
for
Main Campus, Sub Campuses
and
Affiliated Colleges

Department of Computer Science & Information Technology

University of Sargodha

(Applicable from Fall 2019)

Table of Contents

Guidelines for Affiliated Colleges

- BSSE program shall be offered under Term System observing University of Sargodha's Affiliation Rules & Regulation.
- There shall be two terms in a calendar academic year.
- The affiliated college(s)/institutions shall follow the prescribed curriculum and course matrix. Necessary modification/changes shall be communicated to the affiliated Colleges/Institutions, if any.
- For domain 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 which are being offered in the main campus. 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 I stitution to offer the requested specialization track already approved by the BOS. The competent authority shall give the final approval.

Curriculum

for
BS (Software Engineering) Program

The Discipline of Software Engineering

Software Engineering is a bridge connecting the basic concepts and principles off Computer Science with the variety of users who can benefit from technologies based upon those principles. It includes the design and development of software systems which are effective, efficient, robust, maintainable, and maximally useful and usable. It also includes the design and development of techniques, processes and higher level tools by which these applications can be developed in a timely, cost effective and sustainable manner. At both levels it requires a systematic approach which deals with quantifiable measures of quality and effectiveness, as well as attention to the critical n ture of the various products of the process.

Software engineering therefore requires familiarity with the basic needs and processes in the various application domains, with the principles of good engineering practice and with the underlying concepts and principles of computer science. It requires facility in problem analysis, solution design, program development and documentation. It also requiires a basic understanding of the ways in which humans interact with technological systems.

A software engineering program should develop professionals who have a mastery of software development principles, theory, practice, and process.

Software Engineering and Computer Science differ in much the same way as do Electrical Engineering and Physics1. Generally, engineering should be concerned with applying what we already know to create products, while science is more theoretical. Therefore, the goal of Computer Science, according to Parnas2, is to learn and to extend the science. SE on the other hand aims to use the science and technology already available to create products and tools for use.

Software Engineering derives its essence from computer science as other engineering disciplines do from natural or life sciences, with an emphasis on issues of process, design, measurement, analysis and verification providing a strong foundation in engineering principles and practices as applied to software development.

Definition

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[1] David Parnas, "Software Engineering Programmes are not Computer Science Programmes", *IEEE Software, Nov/Dec. 1999, pp. 19-30.*

[2] David Parnas, "Software Engineering Programmes are not Computer Science Programmes", *IEEE Software, Nov/Dec. 1999, pp. 19-30.*

Software Engineering is a discipline concerned with the development of software systems by applying engineering principles with the goal of developing cost-effective quality systems. There are many definitions in literature. Such as:

- "The establishment and use of sound engineering principles (methodss) in order to obtain economically software that is reliable and works on real machines" [Bauer 1972].
- "Software engineering is that form of engineering that applies the principles of computer science and mathematics to achieving cost-effective solutions to software problems." [CMU/SEI-90-TR-003]
- "The application of a systematic, disciplined, quantifiable approach to the development, operation, and maintenance of software" [IEEE 1990].

Software Engineering could also be defined as:

"The application of systematic, disciplined, quantifiable approach to design, development, deployment, and maintenance of reliable and economical software systems."

Vision of Software Engineering Education

Software engineering is the discipline of creating high-quality software systems in a systematic, controlled and efficient manner. It involves the application of engineering concepts, techniques, and methods to the design, development, deployment and maintenance of software systems. A software engineering program should develop professionals who have a mastery of principles, theory, practices, and processes necessary to produce quality software systems. The curriculum committee formalized the Vision Statement for SE education in Pakistan as follows:

> "The SE education in Pakistan will focus on imparting the knowledge and training which should enable students to harmonize theory with practice, concept with application, and problem with solution. It will prepare them to apply ably engineering principles, practices, and processes to design, develop, deploy, and maintain software systems. The program will lead to development of student's professional and interpersonal skills. It will help students to enhance their ability in oral and written communication, and their adaptability to team environments. The program will inculcate among students a strong sense of civic, professional and ethical responsibility. The program will also strive to develop a capacity for innovation and a passion for lifelong learning."

SE curricula thus developed would reflect the aim to satisfy professional demands of the industry and academia both in terms of immediate needs and the capaciity for longer term development. The graduates thus produced will be adequately equipped to exploit the opportunities and answer the challenges offered by the modern world.

Knowledge Areas of SE Curriculum DevelopmentABET Engineering Criteria 2000 notes:

"The curriculum must provide both breadth and depth across the range of engineering and computer science topics implied by the title and objecttive of the program. The program must demonstrate that graduates have: the abiility to analyze, design, verify, validate, implement, apply, and maintain software systems; the ability to appropriately apply discrete mathematics, probability and statistics, and relevant topics in computer and management sciences to complex software systems."

SE curriculum has been developed systematically by identifying the major knowledge areas of SE education, in the spirit of engineering criteria above. It is noted that efforts carried out by ACM and IEEE-CS to develop international software curricula are very relevant and provide excellent guidelines on the issue. Outcome of these efforts is documented in *Software Engineering Body of Knowledge* (SWEBOK)[3], Software Engineering Education Knowledge (SEEK)[4], and Computing Curriculum 2008[5].

The following major areas of relevant pedagogy have been identified to be appropriate for design of the software engineering curriculum:

1. Computing Foundati n (CS/SE/CE)
2. Software Engineering (SE Major)
3. Software Engineering Application Domain
4. Supporting Areas (Mathematics and Natural Sciences)
5. General Education (Management, Humanities, Social Sciences)

The revised curriculum focuses on building a solid foundation in the early stages of learning. It gradually introduces and strengthens the core professional competencies and desired skill-sets. Software engineering concepts have been taken up as early as the start of 2nd year. The main technical SE contentsare covered in the third and fourth years. Practical component should use medium to large scale projects to develop in students a systematic approach to problem solving and program development.

Software Engineering Programs' Rationale

The 21st century is loaded with a large number of challenges. These challenges include globalized business environment, keeping pace with innovative technologies, the availability of information with respect to ime, speed, volume, mode, nature and management of this exponentially growing information, keeping control on international and inter-organizational business processes in real time, optimization of business processes across multiple sites, highly uncertain and chaotic business environments, a new level of national & international competition (hyper-competition), social & cultural diversity, rapidly changing products and processes, government regulations, increasing importance of skills, qualities, productivity and other stresses. To face these challenges and to bring a high level of agility, control and

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[3]*Guide to Software Engineering Body of Knowledge,* 2004 Edition,.
[4]*Software Engineering – Curriculum Guidelines for Undergraduate Degree Programs in Software Engineering, 2004August 23, 2004*
[5] Computing Curriculum 2008—Draft

transparency organizations now increasingly focus on maximizing their existing technology and human infrastructure through automating various processes that can free human resource to add value elsewhere within the organization. Accordingly, the software industry looks for graduates who are not only equipped with conventional computing skills but also have the capability to develop complex software that can provide verifiable insight into underlying business processes.

Software Engineering is the discipline of developing and maintaining software systems that behave reliably and efficiently, are affordable to develop and maintain, and satisfy all the requirements that customers have defined for them. Software engineering is different in character from other engineering disciplines due to both the intangible nature of software and the related operations. It seeks to integrate the principles of mathematics **a**nd computer science with the engineering practices developed for tangible, physical artifacts. Software engineering students learn more about software reliability and maintenance and focus more on developing and maintaining software techniques while Computer Science students just acquire abstract knowledge of these aspects.

Software Engineering is a bridge connecting the basic concepts and principles of Computer Science with a variety of users who can benefit from technologies based upon those principles. It includes the design and development of software systems which are effective, efficient, robust, maintainable, and maximally useful and usable. It also includes the design and development of techniques, processes and higher level tools by which these applications can be developed in a timely, cost effective and sustainable manner. At both levels, it requires a systematic approach which deals with quantifiable measures off quality and effectiveness, as well as attention to the critical nature of various products of the process. Software Engineering, therefore, requires familiarity with the basic needs and processes in the various application domains, with the principles of good engineering practices and with the underlying concepts and principles of computer science. It requires facilitty in problem analysis, solution design, program development and documentation. It also requires a basic understanding of ways in which humans interact with technological systems and necessary skills to create high-quality software systems in a systematic, controlled and efficient manner. It involves the application of e gineering concepts, techniques, and methods to the design, development, deployment and maintenance of software systems.

The key rationale behind BS Software Engineering program is to produce graduates who have masteryinthe above discussed aspects. The program intends to impart knowledge and training which enable students to harmonize a theory with practice, a concept with an application, and a problem with a solution. It will prepare them to apply ably engineering principles, practices, and processes to design, develop, deploy, and maintain software systems. The program will lead to development of students' professional and interpersonal skills. It will help them to enhance their ability in oral and written communication, and their adaptability to team environments. The program will inculcate among students a strong sense of civic, professional and ethical responsibility. The program will also strive to develop a capacity for innovation and a pa sion for lifelong learning.

Software Engineering Programs' Curriculum Underlying Principles

Curriculum plays an important role within education as it outlines the planned and structured learning experiences that an academic program p ovides. 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' educ tion 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.

In the light of these principles, the curriculum of the program 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 the 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 purpose, the curriculum has focused 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 make curriculum more effective, specialization tracks have also been integrated within the curriculum. 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.

BS Software Engineering Program's Aims & Objectives

BSSE Program aims to create, expand, disseminate and teach the Software Engineering body of knowledge through academics, applications and research which positively impact society locally, nationally, and internationally.

The objective of the program is to prepare students for professional careers and graduate studies with a balance between computing theory and practical application of software engineering concepts, methodologies, tools and technologies in the modern software development environments. The curriculum is designed to ensure breadth across allied disciplines and supporting subjects; and depth in most areas of the software engineering body of knowledge. Various components have been included in the curriculum to ensure that the graduates will:

- Understand and be able to apply mathematics, physical science, computer science and related disciplines.
- Understand and be able to apply the principles of software engineering practices and processes, subject to realistic constraints.
- Be able to model, analyze, document and track system requirements, both functional and non-functional.
- Be able to design, implement, deploy and maintain quality oriented software systems.
- Be able to verify and validate quality oriented software systems.
- Have an awareness of current industry standards and practices.
- Be able to work in one or more application domains.
- Understand and apply the principles of software quality assurance.
- Be able to understand and apply software project management skills: measurement, estimation, costing, planning, documenting, deployment and tracking of resources.
- Have strong communication, team management and interpersonal skills.
- Be capable of independent learning.
- Understand professional responsibility and application of ethical principles.

• Have knowledge of economics, humanities and social sciences.

BSSE Program's Outcome

The program will produce entrepreneurs of great character, competence, visiion and drive equipped 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.

BSSE Program's Structure

The structure of a BS program in Software Engineering meets the needs of students with formal computing experience and with established relevant skills. The students are expected to learn theoretical and practical understanding of the entire field of Software Engineering. The program structure 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:

Degree Requirement

To become eligible for award of BS degree, a student must satisfy the following requirements:

a) Must have studied and passed the prescribed courses, totaling at least 130 credit hours.
b) Must have earned CGPA (Cumulative Grade Point Average) of at least 2.0 on a scale of 4.0.

Duration

The **minimum duration** for completion of BS degree is four years. The HEC allows a **maximum period of seven years** to complete BS degree requirements.

Eligibility Criteria

The minimum requirements for admission in a Bachelor degree program in Computer Science/ Information Technology/ Software Engineering, is **at least 50% marks in Intermediate (HSSC) examination with Mathematics or equivalent qualification with Mathematics certified by IBCC**..

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:

Major Areas	Cr. Hrs.	%
Computing Foundation-Core Courses	39	30%
Software Engineering Core Courses	24	18%
Mathematics and Science oundation Courses	12	9%

SE-Supporting Elective Courses	9	7%
General Education Required Courses	19	15%
GE/University Elective C urses	12	9%
SE Electives+ Application Domain Electives	15	12%
Total	**130**	**100%**

Proposed Curriculum for BS-SE

Computing Core Courses – 39 Credit Hours				
#	Code	Pre-Req	Course Title	Cr. Hrs.
1	CMPC-101	-	Programming Fundamentals	4 (3+1)
2	CMPC-102	CMPC-101	Object Oriented Programming	4 (3+1)
3	CMPC-106	-	Discrete Structures	3 (3+0)
4	CMPC-104	-	Software Engineering	3 (3+0)
5	CMPC-201	CMPC-102	Data Structure and Algorithms	4 (3+1)
6	CMPC-202	-	Operating Systems	4 (3+1)
7	CMPC-204	-	Database Systems	4 (3+1)
8	CMPC-301	-	Computer Communication and Networks	4 (3+1)
9	CMPC-302	-	Information Security	3 (3+0)
10	CMPC-401	-	Capstone Project	6 (0+6)

Software Engineering Core Courses – 24 Credit Hours				
#	Code	Pre-Req	Course Title	Cr. Hrs.
11	SECC-201	CMPC-106	Software Requirement Engineering	3(3+0)
12	SECC-205	-	Human Computer Interaction	3(3+0)
13	SECC-202	-	Software Design & Architecture	3(2+1)
14	SECC-301	-	Software Construction & Development	3(2+1)
15	SECC-302	CMPC-106	Software Quality Engineering	3(3+0)
16	SECC-304	-	Web Engineering	3(3+0)
17	SECC-401	-	Software Project Management	3(3+0)
18	SECC-403	-	Software Re-Engineering	3(3+0)

General Education Courses – 19 Credit Hours				
#	Code	Pre-Req	Course Title	Cr. Hrs.
19	ENGL-101	-	English Composition & Comprehension	3(3+0)
20	ENGL-102	-	Communication Skills	3(3+0)
21	ENGL-301	-	Technical and Report Writing	3(3+0)
22	PKST-101	-	Pakistan Studies	2(2+0)
23	ISLS-102	-	Islamic Studies	2(2+0)
24	ICTC-101	-	Introduction to Information & Communication Technologies	3 (2+1)
25	SESC-306	-	Professional Practices	3 (3+0)

SE -Supporting (Math/Science) Required Elective Courses - 12 Credit Hours				
#	Code	Pre-Req	Course Title	Cr. Hrs.
26	MATH-101	-	Calculus and Analytical Geometry	3(3+0)
27	MATH-201	-	Linear Algebra	3(3+0)
28	STAT-202	-	Probability and Statistics	3(3+0)
29	PHYS-101	-	Applied Physics	3(3+0)

Supporti g Elective Courses - 9 Credit Hours				
#	Code	Pre-Req	Course Title	Cr. Hrs.
30	SESC-301	-	Business Process Engineering	3(3+0)
31	SESC-305	-	Formal Methods in Software Engineering	3(3+0)
32	SESC-304	-	Cyber Security	3(3+0)

GE/University Elective Courses - 12 Credit Hours				
#	Code	Pre-Req	Course Title	Cr. Hrs.

33	BUSB-102	-	Principles of Management	3(3+0)
34	BUSB-201	-	Human Resource Management	3(3+0)
35	BUSB-401	-	Organizational Behavior	3(3+0)
36	BUSB-202	-	Business Economics	3(3+0)
37	BUSB-402	-	Entrepreneurship	3(3+0)

Software Engineering Elective Courses - 15 Credit Hours

Regular Track Elective Courses - 15 Credit Hours (Any 5 Courses) for **Main Campus, Mianwali, Bhakkar Campus**				
39	SEEC-401	-	Model-Driven Software Development	3(3+0)
40	SEEC-402	-	Software Engineering Economics	3(3+0)
41	SEEC-403	-	Big Data Analytics	3(3+0)
42	SEEC-404	-	Software CASE Tools & Applications	3(3+0)
43	SEEC-405	-	E-Commerce Applications Development	3(3+0)
44	SEEC-406	-	Enterprise Resource Planning Systems	3(3+0)
45	SEEC-407	-	Mobile Application Development	3(3+0)
46	SEEC-408	-	Enterprise Application Development	3(3+0)
47	SEEC-301	-	Artificial Intelligence	3(3+0)
48	SEEC-409	-	Cloud Computing	3(3+0)
49	SEEC-410	-	Systems Programming	3(3+0)
50	SEEC-311	-	Management Information Systems	3(3+0)
51	SEEC-411	-	Game Application Development	3(3+0)
52	SEEC-426	-	Software Metrics	3(3+0)
53	SEEC-314	-	Multimedia Systems and Design	3(3+0)
54	SEEC-414	-	Virtual Reality	3(3+0)
55	SEEC-415	-	IOT	3(3+0)
56	SEEC-416	-	Semantic Web Techniques	3(3+0)
57	SEEC-417	-	Mobile Computing	3(3+0)
58	SEEC-418	-	Data Warehousing	3(3+0)
59	SEEC-419	-	Data Mining	3(3+0)
60	SEEC-420	-	Business Intelligence and Analytics	3(3+0)
61	SEEC-302	-	Database Administration & Management	3(3+0)
62	SEEC-423	-	Advance Database Management	3(3+0)
63	SEEC-423	-	Business Process Management	3(3+0)
64	SEEC-424	-	Knowledge Management	3(3+0)

Regular Track Elective Cours s - 15 Credit Hours (Any 5 Courses) for **PPP-Sub Ca pus and Affiliated Colleges**

42	SEEC-401	-	Model-Driven Software Development	3(3+0)
43	SEEC-402	-	Software Engineering Economics	3(3+0)
44	SEEC-404	-	Software CASE Tools & Applications	3(3+0)
45	SEEC-301	-	Artificial Intelligence	3(3+0)
46	SEEC-409	-	Cloud Computing	3(3+0)
47	SEEC-426	-	Software Metrics	3(3+0)
48	SEEC-314	-	Multimedia Systems and Design	3(3+0)

Course Coding Scheme

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

Course Level	
Level	**Course Type**
1	Foundation, Core Level 1 Courses
2	Foundation, Core Level 1 Courses
3	Core Level 2 + Specialization Level 1
4	Specialization Level 2

Discipline Code	
CMPC	Computing
SECC	Software Engineering Core
SESC	Software Engineering Supporting
SEEC	Software Engineering Elective
PKST	Social Studies
MATH	Mathematics
ENGL	English
BUSB	Management
PHYS	Physics
ICTC	Information & Communication Technologies

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Scheme of Studies for BS Software Engineering Program Affiliated Colleges and PPP- Sub Campuses
(130 Credit Hours)

(For Regular Track)

Semester - I

Code	Course Title	Credit Hours
ICTC-101	Introduction to Information and Communication Technologies	3(2-1)
CMPC-101	Programming Fundamentals	4(3-1)
ENGL-101	English Co position & Comprehension	3(3-0)
MATH-101	Calculus & Analytical Geometry	3(3-0)
PKST-101	Pakistan Studies	2(2-0)
PHYS-101	Applied Physics	3(3-0)
	Total	18

Semester - II

Code	Course Title	Credit Hours
CMPC-102	Object Oriented Programming	4(3-1)
ENGL-102	Communication & Presentation Skills	3(3-0)
CMPC-106	Discrete Structures	3(3-0)
CMPC-104	Software Engineering	3(3-0)
ISLS-102	Islamic Studies	2(2-0)
BUSB-102	Principles of Management	3(3-0)
	Total	18

Semester - III

Code	Course Title	Credit Hours
CMPC-201	Data Structures & Algorithms	4(3-1)
SECC-201	Software Requirement Engineering	3(3-0)
SECC-205	Human Computer Interaction	3(3-0)
MATH-201	Linear Algebra	3(3-0)
BUSB-201	Human Resource Management	3(3-0)
	Total	16

Semester - IV

Code	Course Title	Credit Hours
CMPC-202	Operating Systems	4(3-1)
CMPC-204	Database Systems	4(3-1)
SECC-202	Software Design and Architecture	3(2-1)
STAT-202	Probability and Statistics	3(3-0)
BUSB-202	Business Economics	3(3-0)
	Total	17

Semester - V

Code	Course Title	Credit Hours
SECC-301	Software Construction and Development	3(2-1)
CMPC-301	Computer Networks	4(3-1)
ENGL-301	Technical and Business Writing	3(3-0)
SESC-301	Business Pr cess Engineering	3(3-0)
SESC-305	Formal Methods in Software Engineering	3(3-0)
	Total	16

Semester - VI

Code	Course Title	Credit Hours
SECC-302	Software Q ality Engineering	3-0
CMPC-302	Information Security	3-0
SESC-306	Professional Practice	3-0
SECC-304	Web Engineering	3-0
SEEC-314	Multimedia Systems and Design	3-0
SESC-304	Cyber Security	3-0
	Total	18-0

Semester - VII

Code	Course Title	Credit Hours
SECC-401	Software Project Management	3-0
SECC-403	Software Re-Engineering	3-0
SEEC-401	Model Driven Software Development	3-0
SEEC-409	Cloud Computing	3-0
CMPC-401	Final Year Project - I	0-3
	Total	12-3

Semester - VIII

Code	Course Title	Credit Hours
SEEC-426	Software Metrics	3-0
SEEC-402	Software Engineering Economics	3-0
CMPC-402	Final Year Project - II	0-3
BUSB-402	Entrepreneurship	3-0
	Total	9-3

Course Contents for BS Software Engineering

Contents of Computing Core Courses

CMPC-101 Programming Fundamentals			
Credit Hours:	3+1	**Prerequisites:**	None

Course Learning Outcomes (CLOs):		
At the end of the course the students will be able to:	**Domain**	**BT Level***
1. Problem solving skills.	C	1
2. Coding skills.	C	2
* BT= Bloom's Taxonomy, C=Cognitive domain, P=Psychomotor domain, A= Affective domain		

Course Content:

1. Introduction, Introduction to Computer Programming: Machine Languages, Assembly Languages and High-Level Languages. History of C, C Standard Library, Typical C Program Development Environment, Memory Concepts, white spaces, comments. [TB 1: Ch. 1]

2. Principles of Structured and Modular Programming: Algorithms, Psseudo code, flowchart representation. Basic Data Types (variables, constants). [TB 1: Ch. 2]

3. Unary (increment/decrement) and Binary (arithmetic, relational, arithmetic assignment) operators. Arithmetic (Expression) in C. C Programming Basics: Programming Practices [TB 1: Ch. 1, 2, 3]

4. Decision Statements: if statement, if-else statement, Multi if-else-if statement. Decision Statements: Nested if-else statements, Switch Statement. [TB 1: Ch. 3]

5. Decision Statements: Cond tional operator, Logical Operators, Programming Practices, and Summary. Program Control: Repetition Essentials, Counter-Controlled Repetition. for loop. [TB 1: Ch. 3]

6. Loops: while loop, do while loop [TB 1: Ch. 4]

7. Nested loop structures. Other Control Statements, break and continue Statements, Logical Operators, Confusing Equality (==) and Assignment (=) Operators. Programming Practices, Summary. [TB 1: Ch. 4]

8. Arrays: Defining Arrays, Array Examples (finding max, min value from the array). Searching techniques (linear search, Binary search). Sorting Arrays: selection sort, bubble sort. Case Study: Computing Mean, Median and Mode Using Arrays. [TB 1: Ch. 6]

9. Strings: String Library Functions Characters and Strings: Fundamentals of Strings and Characters. Strings: Character-Handling Library, Programming Practices, Summary. [TB 1: Ch. 8]

10. Functions: Function declaration, definition, Passing Arguments to functions, Returning values from functions. Functions: Arguments pass by reference and pass by copy. [TB 1: Ch. 8]

11. Functions: Passing arrays and strings to functions. Functions: Inline functions, Default arguments, Local and global variables, Summary. [TB 1: Ch. 8]

12. Pointers: Pointers and their purpose. Pointer expressions. Pointers: Pointers and arrays, Pointers in functions. [TB 1: Ch. 8]

13. Pointers: Static and dynamic memory allocation, Memory Management using Pointers. Problems with pointers, program practice, Summary. [TB 1: Ch. 8]

14. Structures: Purpose, Defining structures, Initializing Structures, Accessing Structure Members. Example (complex number or Time). Structures: Passing Structures to functions, Structures using pointers. [TB 1: Ch.10]

15. File Processing: Data Hierarchy, Files and Streams, Creating a Sequential-Access File,

Reading Data from a Sequential-Access File. File Processing: Random-Access Files, Creating a Random-Access File, Writing Data Randomly to a Random-Access File, Reading Data from a Random-Access File. [TB 1: Ch.10]

Teaching Methodology:
Lectures, Written Assignments, Semester Project, Lab Assignments, Presentations
Course Assessment:
Sessional Exam, Home Assignments, Quizzes, Project, Presentations, Final Exam
Reference Materials:
1. C How to Program by Paul Deitel and Harvey Deitel, Prentice Hall; 7th Edition (March 4, 2012)
2. Programming in C by Stephen G. Kochan, Addison-Wesley Professional; 4th Edition (September 25, 2013). ISBN-10: 0321776410

CMPC-102 Object Oriented Programming			
Credit Hours:	3+1	**Prerequisites:**	CMPC-101

Course Learning Outcomes (CLOs):		
At the end of the course the students will be able to:	**Domain**	**BT Level***
1. Understand principles of object oriented paradigm.	C	2
2. Identify the objects & their relationships to build object oriented solution	C	3
3. Model a solution for a given problem using object oriented principles	C	3
4. Examine an object oriented solution.	C	4
* BT= Bloom's Taxonomy, C=Cognitive domain, P=Psychomotor domain, A= Affective domain		

Course Content:
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 [TB 1: 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. [TB 1: 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. [TB 1: 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 () [TB 1: 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.. [TB 1: Ch. 11]]

6. Polymorphism: Introduction, Relationships Among Objects in an Inheritance Hierarchy, Type Fields a d switch Statements, Abstract Classes and Pure virtual Functions, Polymorphism, Virtual Functions and Dynamic Binding ―Under the Hood‖. [TB 1: 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 Manipu ators, 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 [TB 1: 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. [TB 1: 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. [TB 1: Ch. 17]

Teaching Methodology:
Lectures, Written Assignments, Practical labs, Semester Project, Presentations
Course Assessment:
Sessional Exam, Home Assignments, Quizzes, Project, Presentations, Final Exam
Reference Materials:

1. C++ How to Program, 10th Edition, Deitel & Deitel.
2. Object Oriented Programming in C++, 3rd Edition by Robert Lafore
3. Starting Out with C++ from Control Structures to Objects, 9th Edition, Tony Gaddis
4. Java: How to Program, 9th Edition by Paul Deitel
5. Beginning Java 2, 7th Edition by Ivor Horton
6. An Introduction to Object Oriented Programming with Java, 5th Edition by C. Thomas Wu

CMPC-106 Discrete Structures			
Credit Hours:	3+0	**Prerequisites:**	None

Course Learning Outcomes (LOs):		
At the end of the course the students will be able to:	**Domain**	**BT Level***
1. The course provides a solid theoretical foundation of discrete	C	1

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.

* BT= Bloom's Taxonomy, C=Cognitive domain, P=Psychomotor domain, A= Affective domain

Course Content:

1. Logic: Propositional Equivalences, Predicates and Quantifiers, Nested Quantifiers, Methods of Proof. [TB 1: Ch. 1]
2. Sets & Functions, Sequences and Summations. [TB 1: Ch. 2]
3. Algorithms: the Growth of Functions, Complexity of Algorithms, the Integers and Division, Matrices. [TB 1: Ch. 3]
4. Number Theory and Cryptography. [TB 1: Ch. 4]
5. Advanced Counting Techniques: Recurrence Relations, Solving Recurrence Relations, Divide-and-Conquer Algorithms and Recurrence Relations, Generating Functions, Inclusion-Exclusion & its Application. [TB 1: Ch. 8]
6. Relations and Their Properties, n-ary Relations and Their Applications, Representing Relations, Closures of Relations, Equivalence Relations, Partial Orderings. [TB 1: Ch. 9]
7. Graph: Representing Graphs and Graph Isomorphism, Connectivity, Euler and Hamilton Paths, Shortest-Path Problems, Planar Graphs, Graph Coloring. [TB 1: Ch. 10]
8. Trees: Applications of Trees, Tree Traversal, Spanning Trees, Minimum Spanning Trees. [TB 1: Ch. 11]

Teaching Methodology:

Lectures, Class Exercises

Course Assessment:

Sessional Exam, Home Assignments, Quizzes, Final Exam

Reference Materials:

1. K. H. Rosen, Discret Mathematics and Its Applications, McGraw-Hill Science/Engineering/Math, 7th Ed. 2011. ISBN-10: 0073383090
2. R. Johnsonbaugh, Discrete Mathematics, Pearson; 7th Ed., 2008. ISBN-10: 0131593188
3. S. B. Maurer and A. Ralston, Discrete Algorithmic Mathematics, A K Peters/CRC Press; 3rd Ed., 2004. ISBN-10: 1568811667
4. B. Kolman, R. Busby and S. C. Ross, Discrete Mathematical Structures, Pearson, 6th Ed. 2008. ISBN-10: 0132297515

C PC-104 Software Engineering			
Credit Hours:	3+0	**Prerequisites:**	None

Course Learning Outcomes (LOs):		
At the end of the course the students will be able to:	**Domain**	**BT Level***
1. Explain how various software development models and software	C	4

development life cycles are applied.		
2. Presents the fundamentals concepts of project management.	C	3
3. Important Requirements modeling, fact-finding techniques.	C	3
4. Have knowledge of software configuration management.	C	4
* BT= Bloom's Taxonomy, C=Cognitive domain, P=Psychomotor domain, A= Affective domain		

Course Content:

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 1: 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]

Teaching Methodology:

Lecturing, Written Assignments, Report Writing

Course Assessment:

Sessional Exam, Home Assignments, Quizzes, Presentations, Final Exam
Reference Materials:
1. Software Engineering: A Practitioner's Approach by Roger S. Pressman, McGraw-Hill Science/Engineering/Math; 7th Edition (2009). ISBN-10: 0073375977
2. Software Engineering 8E by Ian Sommerville, Addison Wesley; 8th Edition (2006). ISBN-10: 0321313798
3. Systems Analysis and Desi n by Gary B. Shelly, Thomas J. Cashman and Harry J. Rosenblatt, Course Technology; 7th Edition (2007). ISBN-10: 1423912225
4. Systems Analysis and Design by Gary B. Shelly, Thomas J. Cashman and Harry J. Rosenblatt, Course Technology; 7th Edition (2007). ISBN-10: 1423912225

CMPC- 01 Data Structures and Algorithms			
Credit Hours:	3+1	**Prerequisites:**	Programming Fundamentals

Course Learning Outcomes (CL s):		
At the end of the course the students will be able to:	**Domain**	**BT Level***
1. Acquire the basic knowledge of data structures & algorithms and understand the concepts of various data structures and use them in different applications.	C	1,2
2. Solve, analyze and evaluate the problems using different data structures and algorithms.	C	3
3. Demonstrate& apply independently the various forms of data structures and algorithms	P	3,4
* BT= Bloom's Taxonomy, C=Cognitive domain, P=Psychomotor domain, A= Affective domain		

Course Content:
1. Introduction to Course, Basic Object Orientation concepts, Properties of Algorithm, Introduction to Algorithm's Performance Analysis and Measurement (Big Oh Notation)
2. ADT, Basic Operations, Reading, Writing, Insertion, Deletion, Merging, Binary Search.
3. Introduction to Sorting types and Techniques, Logical and Algorithmic Implementation of Bubble, Selection Sort, Insertion, Quick Sort, Merge Sort.
4. The Stack ADT, Expressions, Postfix Notation, Infix to postfix, postfix evaluation, Applications of stack
5. Introduction to Recursion, Examples of Recursion, Writing Recursive Programs
6. The Queue ADT and Its Applications, Variation of Queue ADT i.e. Circular and Double Ended Queue
7. Priority Queues, Introduction to Pointers, Linear single Link
8. Linked Stacks and Queues, Linear Doubly Linked list
9. Circular Lists: Implementation of queues and stacks, Doubly Link List
10. Introduction to Trees, Tree Terminology, Logical construction and Representation

of Trees, Introduction to Binary Tree ADT, Mathematical properties, Linked Implementation of Binary Trees (Insertion, Traversing, Searching and deletion in Binary Trees)
11. Binary Search Tree, Implementation and Applications of BSTs
12. Heaps and Heaps as Priority Queues, Introduction to Balanced and AVL Trees, Heap Sort.
13. Hashing, Overflow Handling, Open Addressing, Chaining
14. Introduction to graph and related terminology, Adjacency Matrix representation of graph and Adjacency list
15. Elementary Graph Operations, DFS, BFS, Spanning Trees
16. Shortest path algorithms: Dijkstra Algorithm, Minimum Cost Spanning Trees.

Teaching Methodology:

Lectures, Written Assignments, Practical labs, Semester Project, Presentations

Course Assessment:

Sessional Exam, Home Assignments, Quizzes, Project, Presentations, Final Exam

Reference Materials:

1. Data Structures and Algorithms in C++ by Michael T. Goodrich, Roberto Tamassia, and David Mount (2nd Edition) : ISBN-13: 978-0470383278
2. Data Structures and Algorithms in C++ 4th Edition by Adam Drozdek : ISBN-13: 978-1133608424
3. Data Structures and Algorithm Analysis in Java (3rd Edition) 3rd Edition **b**y Mark A. Weiss : ISBN-13: 978-0132576277
4. Thomas H. Cormen, Charles E. Leiserson, Ronald L. Rivest, and Clifford Stein, "Introduction to Algorithms", 2nd Ed, MIT Press, 2001, ISBN 0-07-013151-1
5. Data Structures and Abstractions with Java (5th Edition) (What's New in Computer Science) 5th Edition by Frank M. Carrano (Author), Timothy M. Henry (Author) : ISBN-13: 978-0134831695
6. Data Structures & Algorithm Analysis in C++ 4th Edition by Mark A. Weiss : ISBN-13: 978-0132847377

CMPC-202 Operating Systems			
Credit Hours:	3+1	**Prerequisites:**	None

Course Learning Outcomes (CLOs):		
At the end of the course the students will be able to:	**Domain**	**BT Level***
1. Understand the characteristics of different structures of the Operating Systems and identify the core functions of the Operating Systems.	C	2
2. Analyze and evaluate the algorithms of the core functions of the Operating Systems and explain the major performance issues with regard to the core functions.	C	5
3. Demonstrate the knowledge in applying system software and tools available in modern operating systems.	C	3
* BT= Bloom's Taxonomy, C=Cognitive domain, P=Psychomotor domain, A= Affective domain		

Course Content:

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 1: 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 1: 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 1: Ch. 3, 4]
4. CPU Scheduling: Basic Concepts, Scheduling Criteria, Scheduling Algorithms, Multiple-Processor Scheduling, Thread Scheduling, Algorithm Evaluation. [TB 1: Ch. 5]
5. Process Synchronization: Background, Monitors, The Critical-Section Problem, Peterson's Solution, Synchronization Hardware, Semaphores, Classic Problems of Synchronization. [TB 1: Ch. 6]
6. Deadlocks: System Model, Deadlock Characterization, Methods for Handling Deadlocks, Deadlock Prevention, Deadlock Avoidance, Deadlock Detection, Recovery from Deadlock. [TB 1: Ch. 7]
7. Main Memory: Swapping, Contiguous Memory Allocation, Paging, Structure of the Page Table, Segmentation, Example: The Intel Pentium. [TB 1: Ch.8]
8. Virtual Memory: Allocating Kernel Memory, Demand Paging, Copy-on-Write, Page Replacement, Allocation of Frames, Thrashing. [TB 1: 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 1: Ch. 11]
10. 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 1: Ch. 15]

Teaching Methodology:
Lectures, Written Assignments, Practical labs, Semester Project, Presentations

Course Assessment:
Sessional Exam, Home Assignments, Quizzes, Project, Presentations, Final Exam

Reference Materials:

1. Operating Systems Concepts, 9th edition by Abraham Silberschatz [Text Book]
2. Modern Operating Systems, 4th edition by Andrew S. Tanenbaum
3. Operating Systems, Internals and Design Principles, 9th edition by William Stallings

CMPC-204 Database Systems			
Credit Hours:	3+1	**Prerequisites:**	None

Course Learning Outcomes (LOs):	Domain	BT Level*
At the end of the course the students will be able to:		
1. Explain fundamental database concepts.	C	2

2. Design conceptual, logical and physical database schemas using different data models.	C	3
3. Identify functional dependencies and resolve database anomalies by normalizing database tables.	C	3
4. Use Structured Query Language (SQL) for database definition and manipulation in any DBMS.	C	3
* BT= Bloom's Taxonomy, C=Cognitive domain, P=Psychomotor domain, A= Affective domain		

Course Content:

1. Databases Overview: Basic Concepts and Definitions, Traditional File Processing & Database Approach [TB1: Ch 1]
2. Data Models, Advantages of Database Approach, Costs and Risks of Database Approach, Components of the Database Environment, The Database Development Process [TB1: Ch 1]
3. E-R Model, Modelling Rul s of the Organisation, Modelling Entities and Attributes, Modelling Relationships [TB1: Ch 2]
4. Enhanced E-R Model, Representing Supertypes and Subtypes, Specifying Constraints in Supertype/Subtype Relationships [TB1: Ch 3]
5. Relational Data Model, Integrity Constraints, Transforming EER Diagrams into Relations [TB1: Ch 4]
6. Introduction to Normalization, First Normal Form, Second Normal Form, Third Normal Form, Functional Dependencies and Keys [TB1: Ch 4]
7. The Physical Database Design Process, Designing Fields: Choosing Data Types, Coding Techniques, Handling Missing Data [TB1: Ch 5]
8. Denormalizing and Partitioning Data, File Organizations (Heap, Sequential, Indexed, Hashed), Creating a Unique/Nonunique Key Index, When to Use Indexes [TB1: Ch 5]
9. Introduction to SQL, The SQL Environment, Defining a Database in SQL [TB1: Ch 6]
10. Basic SQL Commands for Processing Single Tables [TB1: Ch 6]
11. SQL Commands for Processing Multiple Tables using Joins and Subqueries [TB1: Ch 7]
12. Client/Server Architectures, Databases in a Two-Tier Architecture, Three-Tier Architectures [TB1: Ch 8]
13. Web Application Components, Databases in Three-Tier Applications [TB1: Ch 8]
14. The Roles of Data and Database Administrators, Database Backup and Recovery, Types of Database Failure, Disaster Recovery [TB1: Ch 12]
15. Controlling Concurrent Access, Serializability, Locking Mechanisms, Data Dictionaries and Repositories [TB1: Ch 12]

Teaching Methodology:

Lectures, Written Assignments, Practical labs, Semester Project, Presentations

Course Assessment:

Sessional Exam, Home Assignments, Quizzes, Project, Presentations, Final Exam

Reference Materials:

1. Modern Database Management by Jeffrey A. Hoffer, V. Ramesh, and Heikki Topi. Pearson; 12th Edition (2015). ISBN-10: 1292101857
2. Fundamentals of Database Systems by R. Elmasri and S. Navathe. Pearson; 7th Edition (2015). ISBN-10: 0133970 79
3. Database System Concepts by Abraham Silberschatz, Henry F. Korth and S. Sudarshan. McGraw-Hill Education; 6th Edition (2010). ISBN-10: 0073523321

4. Oracle 12c: SQL by Joan E. Casteel. Cengage Learning; 3rd Edition (2015). ISBN-10: 1305251032

C PC-301 Computer Networks			
Credit Hours:	3+1	**Prerequisites:**	None

Course Learning Outcomes (CLOs):		
At the end of the course the students will be able to:	**Domain**	**BT Level***
1. Describe the key terminologies and technologies of computer networks.	C	2
2. Explain the services and functions provided by each layer in the Internet protocol stack.	C	2
3. Identify various internetworking devices and protocols, and their functions in a network.	C	4
4. Analyze working and performance of key technologies, algorithms and protocols.	C	4
5. Build Computer Network on various Topologies.	C	3
* BT= Bloom's Taxonomy, C=Cognitive domain, P=Psychomotor domain, A= Affective domain		

Course Content:
1. Introduction to networks and protocols architecture [TB1: Ch. 1]. 2. Basic concepts of networking, network topologies and the Internet [TB1: Ch. 1]. 3. Layered architecture and the OSI model [TB1: Ch. 2]. 4. Physical layer functionality, data link layer functionality and the TCP/IP protocol architecture [TB1: Ch. 2]. 5. Multiple access techniques, WAN Technologies and protocols , circuit switching and packet switching.[TB1: Ch. 9] 6. Wireless networks, Cellular Network Generations and LTE-Advanced [TB1: Ch. 10] 7. LAN technologies, LAN protocol architecture and virtual LANs [TB1: Ch. 11] 8. MAC addressing. [TB1: Ch. 11] 9. Networking devices , bridges, hubs and switches [TB1: Ch. 11] 10. Network layer protocols, Principles of Internetworking, IPv4 and IPv6. [TB1: Ch. 14] 11. IP addressing, Internet Protocol Operation, virtual private networks and IP Security and Subletting, CIDR. [TB1: C . 14]. 12. Transport layer protocols, ports and sockets and connection-oriented transport protocol mechanisms [TB1: Ch. 15] 13. Routing protocols OSPF, EIGRP, RIP and routing in packet-switching networks [TB1: Ch. 19] 14. Connection establishment, flow and congestion control, effects of congestion, TCP congestion control and datagram congestion control protocol [TB1: Ch. 20] 15. Application layer protocols electronic mail (SMTP and MIME), Web Access: HTTP and DNS [TB1: Ch. 24] 16. Latest trends in computer networks , real-time traffic and voice over IP [TB1: Ch. 25]
Teaching Methodology:
Lectures, Written Assignments, Practical labs, Semester Project, Presentations

Course Assessment:

Sessional Exam, Home Assignments, Quizzes, Project, Presentations, Final Exam

Reference Materials:

1. Data and Computer Communications, 10th Edition by William Stallings.
2. Computer Networking: A Top-Down Approach Featuring the Internet, 6th edition by James F. Kurose and Keith W. Ross.
3. Computer Networks, 5th Edition by Andrew S. Tanenbaum.
4. Data Communication and Computer Networks, 5th Edition by Behrouz A. Forouzan.

C	PC-302 Information Security

Credit Hours:	3+0	**Prerequisites:**	None

Course Learning Outcomes (CLOs):

At the end of the course the students will be able to:	**Domain**	**BT Level***
1. Explain key concepts of information security such as design principles, cryptography, risk management, and ethics.	C	2
2. Discuss legal, ethical, and professional issues in information security.	C	2
3. Apply various security and risk management tools for achieving information security and privacy.	C	3
4. Identify appropriate techniques to tackle and solve problems in the discipline of information security.	C	4
* BT= Bloom's Taxonomy, C=Cognitive domain, P=Psychomotor domain, A= Affective domain		

Course Content:

1. Information security foundations, security design principles; security mechanisms [TB 1: Ch 1]
2. Vulnerabilities and protections: Malwares [TB 1: Ch 6]
3. Hash functions [TB 1: Ch 2, 21]
4. Digital signatures [TB 1: Ch 2]
5. Key management [TB 1: Ch 2,20]
6. Authentication: Access control [TB 1: Ch 3,4]
7. Symmetric cryptography: Symmetric Encryption Principles, Data Encryption Standard, 8. Advanced Encryption Standard, Cipher Block Modes of Operation [TB 1: Ch 20]
8. Asymmetric cryptography: HMAC, The RSA Public-Key Encryption Algorithm, Diffie-Hellman and Other Asymmetric Algorithms [TB 1: Ch 21]
9. Software security [TB 1: Ch 11]
10. Database security: The Need for Database Security, Database Management Systems
    1. Relational Databases, SQL Injection Attacks, Database Access Control, Inference, Database Encryption [TB 1: Ch 5]
11. Network security: Secure E-Mail and S/MIME, Domain Keys Identified Mail, Secure Sockets Layer (SSL) and Transport Layer Security (TLS), HTTPS, IPv4 and IPv6 Security, Wireless Security, Mobile Device Security [TB 1: Ch 22, 24]
12. Firewalls: The Need for Firewalls, Firewall Characteristics and Access Policy, Types of

13. Firewalls, Firewall Basing [TB 1: Ch 9]
13. Intrusion detection: Intruders, Intrusion Detection, Analysis Approaches, Types of IDS [TB 1: Ch 8]
14. Security policies, policy formation and enforcement, risk assessment [TB 1: Ch 14,15]
15. Cybercrime, law and ethics in information security, privacy and anonymity of data [TB 1: Ch 19]

Teaching Methodology:

Lectures, Written Assignments, Semester Project, Presentations

Course Assessment:

Sessional Exam, Home Assignments, Quizzes, Project, Presentations, Final Exam

Reference Materials:

1. Computer Security: Principles and Practice, 3rd edition by William Stallings[TB1]
2. Principles of Information Security, 6th edition by M. Whitman and H. Mattord
3. Computer Security, 3rd edition by Dieter Gollmann
4. Computer Security Fundamentals, 3rd edition by William Easttom
5. Official (ISC)2 Guide to the CISSP CBK, 3rd edition

MPC-401 Capstone Project			
Credit Hours:	6+0	**Prerequisites:**	None

Course Content:

1. Project Proposal
2. Introduction
3. Software Requirements Specification
4. Software Function Specification

CMPC-402 Capstone II			
Credit Hours:	3	**Prerequisites:**	None

Course Learning Outcomes (CL s):		
At the end of the course the students will be able to:	**Domaiin**	**BT Level***
	C	1
* BT= Bloom's Taxonomy, C=Cognitive domain, P=Psychomotor domain, A= Affective domain		

Course Content:

1. Database Design
2. Interface Design
3. Initial Prototype
4. Implementation
5. Testing

Teaching Methodology:
Lectures, Semester Project, Assignments, Presentations, Interactive sessions
Course Assessment:
Sessional Marks(Assignments, Quizzes, Project, Presentations), Mid Exam, Final Exam
Reference Materials:

Contents of Software Engineering Core Courses

SECC-201 Software Requirements Engineering			
Credit Hours:	3+0	**Prerequisites:**	CMPC-106

Course Learning Outcomes (CLOs):		
At the end of the course the students will be able to:	**Domain**	**BT Level***
1. To understand Issues in Requirements Engineering, to understand and apply Requirements Engineering Process,	C	2
2. To understand and use Requirements Elicitation and Specification,	C	2
3. To understand and use Formal Techniques,	C	2
4. To understand modeling and analysis of Non-Functional Requirements.	C	2
5. Manage and control changes in Requirement	C	2
* BT= Bloom's Taxonomy, C=Cognitive domain, P=Psychomotor domain, A= Affective domain		

Course Content:
1. Requirements Engineering (RE): Essential Software Requirement, Bad Requirements, Characteristics and Benefits Requirement Engineering, Requirements from the Customer's Perspective.
2. RE Processes: Requirements Elicitation, Requirements Analysis, Requirements Specification, Requirements Validation, Requirements Management, and Requirements Development Process.

3. The Requirements Analyst Role, Tasks, Essential Skills & Knowledge, Defining the Vision through Business Requirements, Vision and Scope Document.
4. Dealing with Customers: Elicitation Techniques, Interviews, Surveys, Workshops, Classifying Customer Input, Incomplete Requirements (Finding Missing Requirements).
5. Prototype Categories (Throwaway, evolutionary, paper and electronic), evaluation, Risks, Validating the Requirements: Requirements Review and Inspection, Requirements Review Challenges, Acceptance Criteria.
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.
7. Non Functional Requirements: Software Quality Attributes: Defining, Performance Requirements, Defining Non-functional Requirements Using Planguage, Attribute Tradeoffs, Implementing Non-functional Requirements.
8. Setting Requirements Priorities: Why Prioritize Requirements? Play with Priorities, A Prioritization Scale, Prioritizing Based on Value, Cost, and Risk.
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.
10. Requirements Development Plans, Estimation, Scheduling, From Requirements to Designs, Code, Tests and Success.
11. Requirements Management Principles and Practices, Baseline, Procedures, Requirements Version Control, Tracking Requirements Status.
12. Requirements Creeping, Managing Scope Creep, The Change Control Process, The Change Control Board, Change-Control Tools, Measuring Change Activity, Impact Analysis.
13. Tracing Requirements introduction, The Requirements Traceability Matrix, Tools for Requirements Traceability Requirements Traceability Procedure, Is Requirements Traceability Feasible?
14. Tools for Requirements Management: Benefits and Capabilities of tool for Requirements Management, Requirements Management Automation, selecting a Tool, Changing the Culture.
15. Software Requirements R sk Management: Fundamentals, Elements, Documenting Project Risks, Planning for Risk Management, Requirements-Related Risks

| **Teaching Methodology:** |
| Lectures, Written Assignments, Semester Project, Presentations |
| **Course Assessment:** |
| Sessional Exam, Home Assignments, Quizzes, Project, Presentations, Final Exam |
| **Reference Materials:** |

1. Software Requirements 2 by Karl Wiegers, 2nd Edition (2003). Microsoft Press; ISBN-10: 0735618798
2. Requirements Engineering: Processes and Techniques, Kotonya and Sommerville, John Wiley Sons, 1998. ISBN-10: 0471972088
3. Software Requirements Engineering, 2nd Edition by Richard H. Thayer and Merlin Dorfman, Wiley-IEEE Computer Society Pr; 2nd Edition (1997). ISBN-10: 0818677384
4. Requirements Engineering: From System Goals to UML Models to Software Specifications by A. van Lamsweerde, Wiley; 1st Edition (2009). ISBN-10:

0470012706.

5. Requirements Engineering: Fundamentals, Principles, and Techniques by Klaus Pohl, Springer; 1st Edition (July 23, 2010). ISBN-10: 3642125778
6. Requirements Engineering by Hull, Jackson, and Dick, Springer; 3rd Edition (October 11, 2010). ISBN-10: 1849964041

SECC-205 Human Computer Interaction			
Credit Hours:	3+0	**Prerequisites:**	None

Course Learning Outcomes (LOs):		
At the end of the course the students will be able to:	**Domain**	**BT Level***
1. Explain context of HCI and different measures for evaluation.	C	2
2. Apply the principles of good design for people from the perspective of age and disabilities.	C	3
3. Analyze techniques for user centered design for a medium sized software.	C	4
4. Evaluate the usability of a medium size software user interface.	C	5
***** BT= Bloom's Taxonomy, C=Cognitive domain, P=Psychomotor domain, A= Affective domain		

Course Content:
1. The human: Input–output channels, Human memory, Thinking, Emotion, Individual differences, Psychology and the design of interactive systems. [TB 1: 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. [TB 1: 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. [TB 1: 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. [TB 1: Ch. 5]
5. HCI in the software process: The software life cycle, Usability engineering, Iterative design and prototyping, Design rationale. [TB 1: Ch. 6]
6. Design rules: Principles to support usability, Standards, Guidelines, Golden rules and heuristics, HCI patterns. [TB 1: Ch. 7]
7. Implementation support: Elements of windowing systems, Programming the application, Using toolkits, User interface management systems. [TB 1: Ch. 8]
8. Evaluation techniques: What is evaluation? Goals of evaluation, Evaluation through expert analysis, Evaluation through user participation, Choosing an evaluation method. [TB 1: Ch. 9]
9. Universal design: Universal design principles, Multi-modal interaction, Designing for diversity. [TB 1: Ch. 10]
10. User support: Requirements of user support, Approaches to user support, Adaptive help systems, Designing user support systems. [TB 1: 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 [TB 1: Ch. 15]

12. Dialog notations and design: What is dialog? Dialog design notations, Diagrammatic notations, Textual dialog notations, Dialog semantics, Dialog analysis and design. [TB 1: Ch. 16]

13. Models of the system: Standard formalisms, Interaction models, Continuous behaviour. [TB 1: Ch. 17]

14. Modeling rich interaction: Introduction, Status–event analysis, Rich contexts, Low intention and sensor-based interaction. [TB 1: Ch. 18]

15. Groupware: Groupware systems, Computer-mediated communication, Meeting and decision support systems, Shared applications and artifacts, Frameworks for groupware, Implementing synchronous groupware. [TB 1: Ch. 19]

16. Ubiquitous computing and augmented realities: Ubiquitous computing applications research, Virtual and augmented reality, Information and data visualization. [TB 1: Ch. 20]

17. Hypertext, multimedia and the World Wide Web: Understanding hypertext, Finding things, Web technology and issues, Static web content, Dynamic web content. [TB 1: Ch. 21]

Teaching Methodology:

Lectures, Written Assignments, Presentations

Course Assessment:

Sessional Exam, Home Assignments, Quizzes, Presentations, Final Exam

Reference Materials:

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

2. Designing the User Interface: Strategies for Effective Human-Computer Interaction, Ben Shneiderman and Catherine Plaisant, 6th Ed, Pearson Inc, 2016.

3. Designing Interactive Systems: A Comprehensive Guide to HCI, UX and Interaction Design, Benyon, D. 3rd Ed., Pearson. 2013

4. About Face: The Essentials of Interaction Design, Alan Cooper, Robert Reimann, David Cronin, Christopher Noesse , 4th Ed, Wiley, 2014

SECC-202 Software Design & Architecture			
Credit Hours:	2+1	**Prerequisites:**	None

Course Learning Outcomes (CLOs):		
At the end of the course the students will be able to:	**Domain**	**BT Level***
1. Understand the role of design and its major activities within the OO software development process, with focus on the Unified process.	C	2
2. Comprehend the advantages of consistent and reliable software design.	C	3
3. Design OOD models and refine them to reflect implementation details	C	3
4. Apply and use UML to visualize and document the design of software systems.	C	3
5. Implement the design model using an object-oriented programming language.	C	5
* BT= Bloom's Taxonomy, C=Cognitive domain, P=Psychomotor domain, A= Affective domain		

Course Content:

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 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]

14. Reconstructing Software Architectures: Introduction, Information Extraction, Database Construction, View Fusion, Reconstruction [TB 2: Ch. 10]

Teaching Methodology:
Lectures, Written Assignments, Presentations

Course Assessment:
Sessional Exam, Home Assignments, Quizzes, Presentations, Final Exam

Reference Materials:

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; 2ndEdition (April 19, 2003). ISBN-10: 0321154959
3. Software Architecture in Practice by Len Bass, Paul Clements and Rick Kazman, Addison-Wesley Professional; 3rdEdition (2012). ISBN-10: 0321815734
4. Software Architecture and Design Illuminated by Kai Qian, Xiang Fu, Lixin Tao and Chong-weiXu, Jones & Bartlett Publishers; 1stEdition (2009). ISBN-10: 076375420X
5. Software Architecture: Foundations, Theory, and Practice by R. N. Taylor, N. Medvidovic and E. M. Dashofy, Wiley; 1stEdition (2009). ISBN-10: 0470167742.

SECC-301 Software Construction & Development			
Credit Hours:	2+1	**Prerequisites:**	None

Course Learning Outcomes (CLOs):		
At the end of the course the students will be able to:	**Domain**	**BT Level***
1. To apply a wide variety of software construction techniques and tools, including state-based and table-driven approaches to low-level design of software.	C	2
2. Able to state-based and table-driven approaches to low-level design of software.	C	2
3. To understand and apply collaborative construction	C	2
4. To understand Refactoring & its strategies	C	2
5. To understand layout and styling of developing software	C	2

Course Content:
1. Software Construction: What Is Software Construction? Why Is Software Construction Important? Metaphors for Software Development, The Importance of Metaphors, how to Use Software Metaphors, Common Software Metaphors. [TB1: Ch. 1, 2]
2. Prerequisites: Importance of Prerequisites, Type of Target Software, Problem-Definition Prerequisite, Requirements Prerequisite, Architecture Prerequisite, Time Constraints. [TB1: Ch. 3]
3. Key Construction Decisi ns: Choice of Programming Language, Programming Conventions, Localization Aspects of Technology, Selection of Constructiion Practices. [TB1: Ch. 4]
4. Design in Software Construction: Design Challenges, Key Design Concepts, Design Building Blocks: Heuristics, Design Practices, Popular Methodologies. [TB1: Ch. 5]
5. Defensive Programming: Protecting Your Program from Invalid Inputs, Assertions, Error Handling Techniques, Exceptions, Barricade Your Program to Contain the Damage Caused by Errors, Debugging Aids, Determining How Much Defensive Programming to Leave in Production Code, Being Defensive About Defensive Programming, The Pseudocode. [TB1: Ch. 8]
6. The Software-Quality Landscape: Characteristics of Software Quality, Techniques for Improving Software Quality, Relative Effectiveness of Quality Techniques, when to Do Quality Assurance, Principl of Software Quality. [TB1: Ch. 20]
7. Collaborative Construction: Overview of Collaborative Development Prractices, Pair Programming, Formal Inspections, Other Kinds of Collaborative Development Practices. [TB1: Ch. 21]
8. Refactoring: Kinds of Software Evolution, Introduction to Refactoring, Reasons to Refactor, Specific Refactoring, Refactoring Safely, Refactoring Strategies. [TB1: Ch. 24]
9. Program Size & Software Construction: Communication and Size, Range of Project Sizes, Effect of Project Size on Errors, Effect of Project Size on Productivity, Effect of Project Size on Development Activities. [TB1: Ch. 27]
10. Managing Construction: Encouraging Good Coding, Configuration Management, estimating a Construction Schedule, Measurement, Treating Programmers as People, 8.6 Managing Your Manager. [TB1: Ch. 28]
11. Integration: Importance of the Integration Approach, Integration Frequency—Phased or Incremental? Incremental Integration Strategies, Daily Build and Smoke Test. [TB1: Ch. 29]
12. Programming Tools: Design Tools: Source-Code Tools, Executable-Code Tools, Tool-Oriented Environments, Building Your Own Programming Tools, Tool Fantasyland. [TB1: Ch. 30]
13. Layout and Style: Layout Fundamentals, Layout Techniques, Layout Styles, Laying Out Control Structures, Laying Out Individual Statements, Laying Out Comments, Laying Out Routines, Laying Out Classes. [TB1: Ch. 31]
14. Self-Documenting Code: External Documentation, Programming Style as Documentation, To Comment or Not to Comment, Keys to Effective Comments, Commenting Techniques. [TB1: Ch. 32]
Teaching Methodology:
Lectures, Written Assignments, Semester Project, Presentations
Course Assessment:

Sessional Exam, Home Assignments, Quizzes, Project, Presentations, Final Exam

Reference Materials:

1. Code Complete: A Practical Handbook of Software Construction by Steve McConnell, Microsoft Press; 2nd Edition (July 7, 2004). ISBN-10: 0735619670
2. Compiler Construction (International Computer Science Series) by Niklaus Wirth, Addison-Wesley Pub (Sd); (1996). ISBN-10: 0201403536.
3. Object-Oriented Software Construction (Book/CD-ROM) (2nd Edition) by Bertrand Meyer, Prentice Hall; 2nd Edition (2000). ISBN-10: 0136291554.
4. The Design of Well-Structured and Correct Programs, S. Alagic& M.A. Arbib, Springer-Verlag (1978), ISBN 0-387-90299-6.
5. Object-Oriented Software Construction, by Bertrand Meyer, Second Edition, Published by, Prentice Hall in 1997. Prentice Hall; 2nd Edition (March 21, 2000). ISBN-10: 0136291554

SECC-302 Software Quality Engineering			
Credit Hours:	3+0	**Prerequisites:**	CMPC-106

Course Learning Outcomes (CLOs):		
At the end of the course the students will be able to:	**Domain**	**BT Level***
5. Outline software testing and software quality assurance principles.	C	1
6. Prepare test case and test suites for completely testing all aspects of a system under test (SUT)	C	3
7. Analyze which of the software testing techniques are relevant for a particular case and know software reliability analysis tools and techniques.	C	4
8. Compile findings of a quality assurance cycle.	C	5
* BT= Bloom's Taxonomy, C=Cognitive domain, P=Psychomotor domain, A= Affective domain		

Course Content:

1. A Quality Principles, Benefi s of Quality, Organization and Process Benchmarking [TB 1: Ch. No.1]
2. Ethical and Legal Compliance: ASQ Code of Ethics, Legal and Regularity Isssues [TB 1: Ch. No.2]
3. Standards and Models: ISO 000 Standards, IEEE Software Engineering Standards, SEI Compatibility Maturity Model Integration (CMMI).[TB 1: Ch. No.3]
4. Leadership Skills: Organizational Leadership, Facilitation Skills, Communication Skills [TB 1: Ch. No.4]
5. Team Skills, Team Management, Team Tools [TB 1: Ch. No.5]
6. Quality Management System: Quality Goals and Objectives, Customers and Other Stakeholders, Planning, Outsourcing [TB 1: Ch. No.6]
7. Methodologies for Quality Management: Cost of Quality, Process Improvement Models, Corrective Action Procedures, Defect Prevention [TB 1: Ch. No.7]
8. Audit Types, Audit Roles and Responsibilities, Audit Process [TB 1: Ch. No.8]
9. Project Tracking and Control, Tracking Methods, Project Reviews and Program

Reviews [TB 1: Ch. No.16]

10. Software Verification and Validation Method, Software Product Evaluation [TB 1: 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 1: Ch. No.22]

12. Reviews and Inspection: Peer Reviews, Formal Versus Informal Reviews, Types of Peer Reviews, Walk-Throughs, Inspections, Technical Reviews [TB 1: 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 1: Ch. No.24]

14. Customer Deliverables: Peer Reviews, Development Testing, Development Audits, Pilots, Installation Testing, Customer/User Testing [TB 1: Ch. No.25]

15. Configuration Control and Status Accounting: Item, Baseline, Version Control, CCB, Concurrent Development, and Status Accounting, Configuration Audit [TB 1: Ch. No.28-29]

| **Teaching Methodology:** |
| Lectures, Written Assignments, Presentations |
| **Course Assessment:** |
| Sessional Exam, Home Assignments, Quizzes, Presentations, Final Exam |
| **Reference Materials:** |

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

2. Software Quality Assurance: Principles and Practice by Nina S. Godbole, published by Alpha Science (2004). ISBN-10: 1842651765.

3. Software Testing: Fundamental Principles and Essential Knowledge by James D. McCaffrey, BookSurge Publishing (2009). ISBN-10: 1439229074.

4. Perfect Software: And other illusions about testing by Gerald M. Weinberg, published Dorest House (2008). ISBN-10: 0932633692.

5. Software Quality Engineering: Testing, Quality Assurance, and Quantifiable Improvement by Jeff Tian published by John Wiley & sons, (2005). ISBN-10: 0471713457

6. Mastering Software Quality Assurance: Best Practices, Tools and Techniques for Software Developers by Murali Chemuturi, J. Ross Publishing (2010). ISBN-10: 1604270322.

SECC-304 Web Engineering			
Credit Hours:	3+0	**Prerequisites:**	None

Course Learning Outcomes (CLOs):		
At the end of the course the students will be able to:	**Domain**	**BT Level***
1. Discuss how web standards impact software development.	C	1
2. Describe the constraints that the web puts on developers.	C	2
3. Design and Implement a simple web application.	C	4
4. Review an existing web application against a current web	C	4

standard.		

* BT= Bloom's Taxonomy, C=Cognitive domain, P=Psychomotor domain, A= Affective domain

Course Content:

1. An Introduction to Web Eng neering: 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 1: 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 1: Ch. 3]
4. Web Application Architectures: Fundamentals of WAA, Specifics of WAA, Components of a Generic AA, Layered Architecture, Data-aspect Architectures. [TB 1: Ch. 4]
5. Technology-away Web Application Design: Web Design from an Evolutionary Perspective, Presentation Design, Interaction Design, Functional Design, Outlook. [TB 1: Ch. 5]
6. Technologies for Web Applications: Fundamentals, Client/Server Communication on the Web, Client-side Technologies, Document-specific Technologies, Server-side Technologies. [TB 1: 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 1: 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 1: Ch. 8]
9. Web Project Management: Project Management to Web Project Management, Challenges in WPM, Managing Web Team, Managing the Development Process. [TB 1: Ch. 9]
10. Web Application Development Process: Fundamentals, Requirements for a Web Ap plication Development Process, Analysis of the Rational Unified Development Process, Analysis of Extreme Programming. [TB 1: 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 1: 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 1: 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 1 : Ch. 13]
14. The Semantic Web: Fundamentals, Technological Concepts, Specifics of Semantics Web Applications, Tools. [TB 1: Ch. 14]

Teaching Methodology:

Lecturing, Written Assignments, Project, Report Writing

Course Assessment:

Sessional Exam, Home Assignments, Quizzes, Project, Presentations, Final Exam
Reference Materials:
1. 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
2. Web Engineering, Rajiv Chopra, Prentice-Hall of India, 2016
3. Web Engineering, Emilia Mendes and Nile Mosley, Springer Verlag, 2010.
4. Web Engineering: A Practitioners' Approach, Roger S. Pressman, McGraw Hill, 2008.
5. Dynamic HTML: The Definitive Reference: A Comprehensive Resource for XHTML, CSS, DOM, JavaScript 3rd Edition, O'Reilly Media 2007.
6. JavaScript: The Definitive Guide, 8th Edition, David Flanagan. O'Reilly Media. 2014.

SECC-401 Software Project Management			
Credit Hours:	3+0	**Prerequisites:**	None

Course Learning Outcomes (LOs):		
At the end of the course the students will be able to:	**Domain**	**BT Level***
1. Explain principles of the project lifecycle and how to identify opportunities to work with learners on relevant and appropriate project scenarios to share this understanding.	C	2
2. Critically evaluate and discuss the issues around project management and its application in the real world with course participants and learners	C	3
3. Choose project management techniques for IT projects to initiate, plan, execute and evaluate a project and work in teams to create a project plan for a project scenario that includes key tasks, critical path, dependencies and a realistic timeline.	C	3
4. Present strategies for gaining confidence in managing projects through simple project planning examples.	C	3
***BT= Bloom's Taxonomy, C=Cognitive domain, P=Psychomotor domain, A= Affective domain**		

Course Content:
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. Progr m 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, Handouts]
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, Handouts]
4. Understanding Organizations, Organizational Structures, Functional -Project –Matrix,

Organizational Impact on Projects, Identifying stakeholders: Define Responsibilities, Authority Relationships, Position Qualifications [TB2, Handouts]

5. Project Planning: Project Selection, Project Scope, Project Infrastructure, Analyze 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 Appropriat 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, Co figuration 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]

15. Challenges of Outsourcing in Project Management, Presentations

Teaching Methodology:

Lectures, Written Assignments, Presentations

Course Assessment:

Sessional Exam, Home Assignments, Quizzes, Presentations, Final Exam

Reference Materials:

1. Software Project Management by Bob Hughes and Mike Cotterell, McGraw-Hill Education; 5th Edition (2009). ISBN-10: 0077122798
2. A Guide to the Project Management Body of Knowledge, 3rdEdition (PMBOK Guides), ISBN-13: 978-1930699458
3. Applied Software Project Management by Andrew Stellman and Jennifer Greene, O'Reilly Media; 1st Edition (2005). ISBN-10: 0596009488
4. Software Project Survival Guide (Pro -- Best Practices) by Steve McConnell, Microsoft Press; 1stEdition (1997), ISBN-10: 1572316217
5. 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
6. Effective Project Management: Traditional, Agile, Extreme by Robert K. Wysocki, Wiley; 6th Edition (2011). ISBN-10: 111801619X
7. The Software Project Manager's Handbook - Principles that work at work by Dwayne Phillips, 2ndEdition, IEEE Computer Society Press and Wiley Inter-science, 2004. ISBN 0-471-67420-6

SECC-403 Software Re- Engineering			
Credit Hours:	3+0	**Prerequisites:**	None

Course Learning Outcomes (CLOs):		
At the end of the course the students will be able to:	**Domain**	**BT Level***
1. Understand basic of software maintenance terminologies	C	2
2. Understand concept of maintenance effort using COCOMO model, analyzing the software scale drivers and software cost drivers	C	2
3. Explain legacy systems, legacy system components and the concept of software reuse in supporting software maintainability,	C	2
4. List the concept of architectural evolution concept.	C	2
5. Understand Reusability techniques and software metrics	C	2
*** BT= Bloom's Taxonomy, C=Cognitive domain, P=Psychomotor domain, A= Affective domain**		

Course Content:
1. Software Maintenance: The nature of Software maintenance, Software Maintenance types, Characteristics of maintainable software.
2. Software Maintenance Process Models: The Software Maintenance Process Lifecycle, Evolution Process, Change Request and Change Requests Management.
3. Software Maintenance Process Models: Impact Analysis, System Release Planning, Change Implementation, Regression Testing and System Testing, Acceptance Testing, Quality Assurance, System Release, Version and Release management issues
4. Software Maintenance Pro ess Models; The software maintenance process Models: Quick-and-Fix Model, Bohem's Model
5. Software Maintenance Process Models: Osborne Model, Iterative Model, SW Maintenance difficulties

6. Legacy Systems: Software Types: S-Type, P-Type, Lehman's laws, Legacy Systems Structure and definitions.
7. Legacy Systems: Legacy System Design, Legacy replacement strategies., Legacy System Assessment
8. Software Cost Modeling: Maintenance Cost issues using COCOMO II model, Bohem's Maintenance Cost Model.
9. Software Cost Computing: Application Scenario, Software Scale Drivers, Software Cost Drivers, Function Points.
10. System Evolution; Program evolution dynamics, Architectural evolution (n-tire), Architectural evolution (VMC, SC, Web services).
11. Software Re- engineering in Maintenance; The Re- Engineering Process Definition, Advantages, Re-engineering Process: Source code translation, Reverse engineering, Reverse Engineering v/s Forward Engineering
12. Software Re- engineering in Maintenance: Reverse Engineering Process, Program structure improvement, Program modularization.
13. Data re-engineering in Maintenance; Data re-engineering Process, Data Migration, Data Restructuring
14. Software Reuse and Reuse Landscape; Software Reusability Definition, Problems. Benefits, Approaches to Reuse, Software Reuse and Maintainability Issues Design Patterns, Frameworks, Program Generators, COTS, Reuse, Aspect-Oriented Development, Product Lines, Web-Services.
15. Software Metrics; Software Quality Measures, Types of measures: Size –Oriented Metrics, Metrics for Source Code, Metrics for Testing, Metrics For Maintenance, Metrics For Design, Metrics For Specification

Teaching Methodology:

Lectures, Written Assignments, Semester Project, Presentations

Course Assessment:

Sessional Exam, Home Assignments, Quizzes, Project, Presentations, Final Exam

Reference Materials:

1. P.i Tripathy & K. Naik, Software Evolution and Maintenance: A Practitioner's Approach, Wiley, 2015.
2. I. Sommerville Software Engineering, 10th Edition, Addison Wesley, 2016.
3. Software Engineering A practitioner's Approach, Roger Pressman, 7th edition, 2010
4. Penny Grubb & Armstrong A Takang Software Maintenance: Concepts and Practice, (2nd Edition), World Scientific Publishing Co. Pte. Ltd , 2003
5. Software Engineering A practitioner's Approach, Roger Pressman, 7th edition, 2010
6. Software Engineering, Ian Sommerville, 8th Edition, Addison Wesley, 2007.

Contents of General Education Courses

ENGL-101 English Composition & Comprehension			
Credit Hours:	3+0	**Prerequisites:**	None

Course Learning Outcomes (CLOs):		
At the end of the course the students will be able to:	**Domain**	**BT**

	Level*
1. 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.	C	2
2. This 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.	C	2

* BT= Bloom's Taxonomy, C=Cognitive domain, P=Psychomotor domain, A= Affective domain

Course Content:

1. Punctuation: Periods, Question Marks, Exclamation Marks, Semicolons, Colons, Commas, Apostrophes, Quotation Marks.
2. Writing Mechanics: Capitals, Abbreviations; Vocabulary: Frequently Confussed 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. Kinds 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

Teaching Methodology:

Lecturing, Written Assignments, Presentations

Course Assessment:

Sessional Exam, Home Assignments, Quizzes, Presentations, Final Exam

Reference Materials:

1. A Practical English Grammar by A. J. Thomson and A. V. Martinet,4th Edition Oxford University Press (1986).
2. Basic English Usage by Michael Swan, Oxford UnivPr (Sd) (January 1986). ISBN-10: 0194311872
3. 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).

4. AQA Functional English Student Book: Pass Level 2 by Mr David Stone, Heinemann; 1st Edition (28 Jun 2010). ISBN-10: 0435151401

5. English Composition and Grammar: Complete Course by John E. Warriner, Harcourt Brace Jovanovich; Complete Course Benchmark Edition (January 1988). ISBN-10: 0153117362

6. Companion to English: Vocabulary (Learners Companion) by George Davidson, Prim-Ed Publishing (March 1, 2003). ISBN-10: 9814070904

7. Word Power Made Easy by Norman and Lewis, Goyal Publishers (September 1, 2009). ISBN-10: 8183071007

8. 1000 Most Important Words by Norman W. Schur, Ballantine Books (July 12, 1982). ISBN-10: 0345298632

9. High School English Grammar and Composition by P.C Wren, Chand & Co (July 13, 2008). ISBN-10: 812192197X

ENGL-102 Communication Skills (English-II)			
Credit Hours:	3+0	**Prerequisites:**	None

Course Learning Outcomes (CLOs):		
At the end of the course the students will be able to:	**Domain**	**BT Level***
1. To sensitize students to their communicative behavior	C	2
2. To enable them to reflect and improve on their communicative behavior/performance.	C	2
3. To build capacities for self-criticism and facilitate growth.	C	2
4. To lead students to effective performances in communication.	C	2
* BT= Bloom's Taxonomy, C=Cognitive domain, P=Psychomotor domain, A= Affective domain		

Course Content:
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 Re-presentational System, Eye ovements as an Indication, Visual Recall, Visual Con-struct, 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, Feedback, 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.
Teaching Methodology:
Lecturing, Written Assignments, Report Writing, Presentations
Course Assessment:
Sessional Exam, Home Assignments, Quizzes, Presentations, Final Exam
Reference Materials:

1. Effective Communication Skills, MTD Training & Ventus Publishing ApS.(2010) ISBN 978-87-7681-598-1 (TB1)

2. Messages: The Communica ion Skills Book by Matthew McKay PhD , Martha Davis PhD, and Patrick Fanning, New Harbinger Publications; Third Edition (M**a**rch 3, 2009). ISBN-10: 1572245921

3. Secrets of Successful Presenters: A Guide for Successful Presenters by Dr. **M**. A. Pasha & Dr. S. Pasha, Lambert Academic Publishing (2012). ISBN-10:3659217557

4. Communication Skills in English by Prof P N Kharu, Dr.Varinder Gandhi Publisher: Laxmi. EAN: 9788131806920

5. Essential Communication Skills: Teacher Edition with Talking Points by Patty Ann, Patty Ann; 1st Edition (July 5, 2012). ASIN: B008HYUDWQ

6. Communication Skills Magi : 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 (Janu-ary 5, 2010). ISBN-10: 1450513344

7. People Skills: How to Assert Yourself, Listen to Others, and Resolve Confliicts by Robert Bolton,Touchstone (June 6, 1986). ISBN-10: 067162248X

8. The Handbook of Communication Skills by Owen Hargie, Routledge; 4th Edittion, Taylor & Francis, (12-Oct-2012). Web Engineering: A Practitioners' Approach, Roger S. Pressman, McGraw Hill, 2008.

9. Dynamic HTML: The Definitive Reference: A Comprehensive Resource for XHTML, CSS, DOM, JavaScript 3rd Edition, O'Reilly Media 2007.

10. JavaScript: The Definitive Guide, 8th Edition, David Flanagan. O'Reilly Media. 2014.

ENGL-301 Technical and Report Writing (English-III)

Credit Hours:	3+0	**Prerequisites:**	None

Course Learning Outcomes (CLOs):		
At the end of the course the students will be able to:	**Domain**	**BT Level**[*]
1. Effectively plan and structure technical reports and to recognize the various stages in writing a technical report.	C	2
* BT= Bloom's Taxonomy, C=Cognitive domain, P=Psychomotor domain, A= Affective domain		

Course Content:
1. Writing for Readers: Academic, Public, and Work Communities; Analyzing Electronic Communities; 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; Creatiing a The-sis; 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 Is-sue, 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,
15. Abstract, Informative Repor , Lab Report, Research Report,
16. Public Writing: Goals of Public Writing, Public Audiences, Public Writing Tasks, Types of Public Writing, Public Flyer, Letter to the Editor, Oral Presentation.
17. 16. Researching and Writing: Beginning Your Research, Types of Research Writing, Developing a Research Question, Developing a Preliminary Thesis, Creating a Re-search File and a Timeline, Reading and Notetaking, Summarizing, Paraphrasing, and Synthesizing.

Teaching Methodology:

Lecturing, Written Assignments, Report Writing, Presentations

Course Assessment:

Sessional Exam, Home Assignments, Quizzes, Presentations, Final Exam

Reference Materials:

1. 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
2. Technical English: Writing, Reading, and Speaking by Pickett and Laster. 8tth Edition.
3. The Technical Writer's Companion byAlred, Gerald, Charles T. Brusaw and Walter E. Oliu, 3rd Edition. ISBN 0-312-25978-6.

PKST-101 Pakistan Studies			
Credit Hours:	2+0	**Prerequisites:**	None

Course Learning Outcomes (CLOs):		
At the end of the course the students will be able to:	**Domain**	**BT Level**[*]
1. Develop vision of historical perspective, government, politics, contemporary Pakistan, ideological background of Pakistan.	C	2
2. Study the process of governance, national development, issues arising in the modern age and posing challenges to Pakistan.	C	2
* BT= Bloom's Taxonomy, C=Cognitive domain, P=Psychomotor domain, A= Affective domain		

Course Content:
1. [TB 1: Ch 1]
2.
Teaching Methodology:
Lecturing, Written Assignments, Class Discussion
Course Assessment:
Sessional Exam, Home Assignments, Quizzes, Presentations, Final Exam
Reference Materials:
1.

ISLS-102 Islamic Studies			
Credit Hours:	2+0	**Prerequisites:**	None

Course Learning Outcomes (CLOs):		
At the end of the course the students will be able to:	**Domain**	**BT Level**[*]
1. Enhance understanding of the students regarding Islamic Civilization.	C	2
2. Improve Students skill to perform prayers and other worships.	C	2
3. Enhance the skill of the students for understanding of issues related to faith and religious life.	C	2
* BT= Bloom's Taxonomy, C=Cognitive domain, P=Psychomotor domain, A= Affective domain		

Course Content:
1. [TB 1: Ch 1]
2.
Teaching Methodology:
Lectures, Written Assignments, Class Discussion
Course Assessment:
Sessional Exam, Home Assignments, Quizzes, Presentations, Final Exam
Reference Materials:
1.

ICTC-101 Introduction to Information & Communication Technologies			
Credit Hours:	2+1	**Prerequisites:**	None

Course Learning Outcomes (CLOs):		
At the end of the course the students will be able to:	**Domain**	**BT Level**[*]
1. Get basic understanding of computer software, hardware, and associated technologies.	C	2
2. Learn how computers are used in the workplace, how communications systems can help boost productivity, and how the Internet technologies can influence the workplace.	C	2
* BT= Bloom's Taxonomy, C=Cognitive domain, P=Psychomotor domain, A= Affective domain		

Course Content:

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 [TB 1: 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 [TB 1: Ch. 2].

3. Application Software: Business Software, Graphics and Multimedia Software, Soft-ware for Home, Personal, and Educational Use, Web Applications, Application Soft-ware for Communications. [TB 1: Ch. 3]

4. The System Unit: Processor, Data Representation, Memory, Expansion Slots and Adapter Cards, Ports and Connectors, Buses, Bays, Power Supply. [TB 1: Ch. 4]

5. Input Devices: What Is Input? What Are Input Devices? The Keyboard, Pointing De-vices, Mouse, Other Pointing Devices, Touch Screens And Touch-Sensitive Pads, Pen Input, Other Input For Smart Phones, Game Controllers, Digital Cameras, Voice In-put, Video Input, Scanners And Reading Devices, Biometric Input, Terminals, Putting It All Together, Input Devices For Physically Challenged Users. [TB 1: Ch. 5]

6. Output Devices: What is Output? Display Devices, Printers, Speakers, Headphones, and Ear buds, Other Output Devices. [TB 1: Ch. 6]

7. Storage: Hard Disks, Flash Memory Storage, Cloud Storage, Optical Discs, Other Types of Storage. [TB 1: 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 [TB 1: 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 Transmis ion Media, Wireless Transmission Media. [TB 1: 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 Vandal-ism, Software Theft, Information Theft, System Failure, Backing Up, Wireless Security, Health Concerns Of Computer Use, Ethics And Society

| **Teaching Methodology:** |
| Lecturing, Written Assignments, Class Discussion |
| **Course Assessment:** |
| Sessional Exam, Home Assignments, Quizzes, Presentations, Final Exam |
| **Reference Materials:** |

1. Discovering Computers by Gary B. Shelly & Misty E. Vermaat, Course Technology; 1st Edition (January 25, 2011).
2. Computing Essentials 2012 by Timothy J. O'Leary and Linda I. O'Leary, McGraw Hill Higher Education; 22nd Revised Edition (February 1, 2011).
3. Computers: Understanding Technology by Fuller, Floyd; Larson, Brian, Fourth Edition, ISBN: 978-0-76383-927-7 (OR Latest Edition.)
4. The Concepts of Information Technology by Imran Saeed, Afsan Raza, Tariq Mahmood and Zafar Hussain, 6th Edition, IT Series Publications.
5. The Essential Guide to Computing: The Story of Information Technology by by E Garrison Walters, Prentice Hall PTR (August 11, 2000). ISBN-10: 0130194697
6. Computer Applications by Tasleem Mustafa, Tariq Mahmood, Imran Saeed and Zahid Javed, IT Publication Series

SESC-306 Professional Practices			
Credit Hours:	3+0	**Prerequisites:**	None

Course Learning Outcomes (CLOs):		
At the end of the course the students will be able to:	**Domain**	**BT Level***
1. Understand responsibilities with respect to the society	C	2
2. Understand historical, social, economic, ethical, and professional issues related to the discipline of Computing	C	2
3. It identifies key sources for information and opinion about professionalism and ethics.	C	2
4. Analyze, evaluate, and assess ethical and professional computing case studies.	C	2
***** BT= Bloom's Taxonomy, C=Cognitive domain, P=Psychomotor domain, A= Affective domain		

Course Content:
1. The Engineering Profession [TB 1: Ch. 1]
2. The Structure of Organizations [TB 1: Ch. 2]
3. Finance and Accounting [TB 1: Ch. 3]
4. Anatomy of a Software House [TB 1: Ch. 4]
5. Computer Contracts [TB 1: Ch. 5]
6. Intellectual Property Rights [TB 1: Ch. 6]

7. The Framework of Employee Relations Law and Changing Management Practices [TB 1: Ch. 7]
8. Human Resource Management and Software Engineering [TB 1: Ch. 8]
9. Health and Safety at Work [TB 1: Ch. 9]
10. Software Liability: Liability and Practice [TB 1 : Ch. 10]
11. Computer Misuse and the Criminal Law [TB 1: Ch. 11]
12. Regulation and Control of Personal Information: Data Protection, Defamation and Related Issues [TB 1: Ch. 12]
13. The British Computer Society Code of Conduct [Online]
14. IEEE Code of Ethics [Onlin]
15. ACM Code of Ethics and Professional Conduct [Online]
16. 16. ACM/IEEE Software Engi eering Code of Ethics and Professional Practice [Online]

Teaching Methodology:

Lectures, Written Assignments, Class Discussion

Course Assessment:

Sessional Exam, Home Assignments, Quizzes, Presentations, Final Exam

Reference Materials:

1. Professional Issues in Software Engineering by Frank Bott, Allison Coleman, Jack Eaton and Diane Rowland, CRC Press; 3rd Edition (2000). ISBN-10: 0748409513
2. Online Resources
3. 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
4. Applied Professional Ethics by Gregory R. Beabout, University Press Of America (1993). ISBN-10: 0819193747.
5. 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
6. 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 SE Sup orting (Math/Science) Required Elective Courses

MATH-1 1 Calculus and Analytical Geometry			
Credit Hours:	3+0	**Prerequisites:**	None

Course Learning Outcomes (CLOs):		
At the end of the course the students will be able to:	**Domain**	**BT Level***

1. Understand the foundation and basic ground for calculus and analytical geometry background.	C	2

* BT= Bloom's Taxonomy, C=Cognitive domain, P=Psychomotor domain, A= Affective domain

Course Content:

1. Real Numbers and the Real Line, Coordinates, Lines, and Increments, Functions, Shifting Graphs, Trigonometric Functions. [TB 1: 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 1: 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 1: 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 1: Ch. 3]
5. Integration: Indefinite Integrals, Integration by Substitution—Running the Chain Rule Backward, Estimating with Finite Sums, Riemann Sums and Definite Inttegrals, Properties, Area, and the Mean Value Theorem. Substitution in Definite Integrals. Numeri-cal Integration. [TB 1: Ch. 4]
6. Applications of Integrals: Areas between Curves, Finding Volumes by Slicing, Vol-umes of Solids of Revolution—Disks and Washers. Cylindrical Shells. Lengths of Plan Curves, Areas of Surfaces of Revolution, Moments and Centers of Mass. [TB 1: Ch. 5]
7. Transcendental Functions: Inverse Functions and Their Derivatives, Natural Loga-rithms, The Exponential Function, ax and logax, Growth and Decay, L'Hôpital's Rule, Relative Rates of Growth, Inverse Trigonometric Functions, Derivatives of Inverse Trigonometric Functions; Integrals. Hyperbolic Functions. [TB 1: 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 1: 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 C ordinates. [TB 1: Ch. 9, 10]

Teaching Methodology:

Lecturing, Written Assignments

Course Assessment:

Sessional Exam, Home Assignments, Quizzes, Final Exam

Reference Materials:

1. Calculus and Analytic Geometry by George B. Thomas and Ross L. Finney, Addison Wesley; 10th Edition (1995) ISBN-10: 0201531747
2. Calculus and Analytical Geometry by Swokowski, Olinick and Pence, 6th Edition, (1994), Brooks/Cole Publishers.
3. Calculus by Howard Anton, Irl C. Bivens, Stephen Davis, Wiley; 10th Edition (2012), ISBN-10: 0470647728
4. Calculus with Analytic Geometry: Student Solution Manual by Howard Anton, Wiley; 5th Edition (1995). ISBN-10: 0471105899

MATH-201 Linear Algebra			
Credit Hours:	3+0	**Prerequisites:**	None

Course Learning Outcomes (CLOs):		
At the end of the course the students will be able to:	**Domain**	**BT Level***
1. Understand the fundamentals of solution for system of linear equations, operations on system of equations, matrix properties, solutions and study of their properties.	C	2
* BT= Bloom's Taxonomy, C=Cognitive domain, P=Psychomotor domain, A= Affective domain		

Course Content:

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: Sollving 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]

Teaching Methodology:
Lecturing, Written Assignments
Course Assessment:
Sessional Exam, Home Assignments, Quizzes, Final Exam
Reference Materials:
1. Introduction to Linear Algebra by Gilbert Strang, Wellesley Cambridge Press; 4th Edition (February 10, 2009). ISBN-10: 0980232716
2. Elementary Linear Algebra with Applications by Bernard Kolman, David Hill, 9th Edition, Prentice Hall PTR, 2007. ISBN-10: 0132296543
3. Strang's Linear Algebra And Its Applications by Gilbert Strang, Strang, Brett Coonley, Andy Bulman-Fleming, Andrew Bulman-Fleming, 4th Edition, Brooks/Cole, 2005

4. Elementary Linear Algebra: Applications Version by Howard Anton, Chris Rorres, 9th Edition, Wiley, 2005.
5. Linear Algebra and Its Applications by David C. Lay, 2nd Edition, Addison-Wesley, 2000.
6. Linear Algebra by Harold M. Edwards, Birkhäuser; 1st Edition (2004). ISBN-10: 0817643702
7. Linear Algebra: A Modern Introduction by David Poole by Brooks Cole; 3rd Edition (May 25, 2010).ISBN-10: 0538735457

STAT-202 Probability and Statistics			
Credit Hours:	3+0	**Prerequisites:**	None

Course Learning Outcomes (CLOs):		
At the end of the course the students will be able to:	**Domain**	**BT Level***
1. Understand the concepts of data analysis, presentation, counting techniques, probability and decision making.	C	2
*** BT= Bloom's Taxonomy, C=Cognitive domain, P=Psychomotor domain, A= Affective domain**		

Course Content:
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 1: 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 1: Ch. 2]
3. Random Variables and Probability Distributions: Concept of a Random Variable, Discrete Probability Distributions, Continuous Probability Distributions, Joint Probability Distributions. [TB 1: 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 1: Ch. 4]
5. Discrete Probability Distributions: Binomial and Multinomial Distributions, Hyper-geometric Distribution, Negative Binomial and Geometric Distributions, Poisson Distribution and the Poisson Process. [TB 1: Ch. 5]
6. Continuous Probability Distributions: Continuous Uniform Distribution, Normal Distribution, Areas under t e Normal Curve, Applications of the Normal Distribution, Normal Approximation to the Binomial, Gamma and Exponential Distributions, Chi-Squared Distribution, Beta Distribution. [TB 1: 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 Plotts. [TB 1: 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, Pre-diction Intervals, Tolerance Limits, Estimating the Difference between Two Means. [TB 1: 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 1: 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 1: 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 1: Ch. 10]

12. One- and Two-Sample Tests Concerning Variances, Goodness-of-Fit Test, Test for Independence (Categorical Data), Test for Homogeneity [TB 1: 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 1: Ch. 11]

14. 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 1: Ch. 12]

Teaching Methodology:
Lecturing, Written Assignments

Course Assessment:
Sessional Exam, Home Assignments, Quizzes, Final Exam

Reference Materials:

1. 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

2. Probability and Statistics for Engineers and Scientists by Anthony J. Hayter, Duxbury Press; 3rd Edition (February 3, 2006), ISBN-10: 0495107573

3. Schaum's Outline of Probability and Statistics, by John Schiller, R. AluSrinivasan and Murray Spiegel, McGraw-Hill; 3rd Edition (2008). ISBN-10: 0071544259

4. Probability: A Very Short Introduction by John Haigh, Oxford University Press (2012). ISBN-10: 0199588481

PHYS-101 Applied Physics			
Credit Hours:	3+0	**Prerequisites:**	None

Course Learning Outcomes (CLOs):		
At the end of the course the students will be able to:	**Domain**	**BT Level***
1. Understand the basic laws of physics, circuiting and basics of transistors.	C	2
***BT= Bloom's Taxonomy, C=Cognitive domain, P=Psychomotor domain, A= Affective domain**		

Course Content:

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 Resiistor, Cells in Series and Parallel.[TB 1: Ch 1]
2. Resistive Circuits. [TB 1: Ch 2]
3. Resistors(5.1-15), Inductors(5.19-21) Capacitors(5.35-48) .[TB 1: Ch 5]
4. Energy Sources. [TB 1: Ch 6]
5. Magnetism and electromagnetism [TB 1: 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.[TB 1: 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, Re-verse Saturation Current, Reverse V/I Characteristics, Junction breakdown, Junction Capacitance. [TB 1: 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. [TB 1: 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)[TB 1: Ch 17]
10. The Basic Transistor. Transistor Biasing, Transistor Circuit Configuration. [TB 1: Ch 18]
11. Modulation and Demodulation. Carrier Waves, Modulation, Demodulation or Detection, Comparison between Amplitude Modulation (AM) and Frequency Modulation (FM). [TB 1: 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. [TB 1: Ch 31]
13. Fiber Optics. Structure of Optical Fibres, Classification of Optical Fibres, Fibre Characteristics, Choice of Wavelength, Optical Fibre cable, Application of Fibre Optic Communication. [TB 1: Ch 38]

Teaching Methodology:
Lecturing, Written Assignments, Presentations
Course Assessment:
Sessional Exam, Home Assignments, Quizzes, Presentations, Final Exam
Reference Materials:

1. A Practical English Grammar by A. J. Thomson and A. V. Martinet,4th Edition Oxford University Press (1986).
2. Basic English Usage by Michael Swan, Oxford UnivPr (Sd) (January 1986). ISBN-10: 0194311872
3. 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).
4. AQA Functional English Student Book: Pass Level 2 by Mr David Stone, Heinemann; 1st Edition (28 Jun 2010). ISBN-10: 0435151401
5. English Composition and Grammar: Complete Course by John E. Warriner, Harcourt Brace Jovanovich; Complete Course Benchmark Edition (January 1988). ISBN-10:

0153117362
6. Companion to English: Vocabulary (Learners Companion) by George Davidson, Prim-Ed Publishing (March 1, 2003). ISBN-10: 9814070904
7. Word Power Made Easy by Norman and Lewis, Goyal Publishers (September 1, 2009). ISBN-10: 8183071007
8. 1000 Most Important Words by Norman W. Schur, Ballantine Books (July 12, 1982). ISBN-10: 0345298632
9. High School English Grammar and Composition by P.C Wren, Chand & Co (July 13, 2008). ISBN-10: 812192197X

Contents of SE Sup orting Elective Courses

SESC-301 Business Process Engineering			
Credit Hours:	3+0	**Prerequisites:**	None

Course Learning Outcomes (CLOs):		
At the end of the course the students will be able to:	**Domain**	**BT Level***
1. Discover the various technologies that support Business Process Engineering	C	2
2. Analyze the performance of existing processes and identify process improvement.	C	3
3. Propose business solutions in written and verbal forms for process innovation and redesign projects.	C	3
4. Create a BPM implementation strategy and implementation plan for an organization.	C	4
* BT= Bloom's Taxonomy, C=Cognitive domain, P=Psychomotor domain, A= Affective domain		

Course Content:
1. Introduction to Business Process Engineering, Motivation and Definitions, Business Process Lifecycle [TB1, Ch1]
2. Classification of Business Processes, Goals, Structure, and Organization [TB1, Ch2]
3. Business Reengineering for Information Technology [TB1, Ch4]
4. Evolution of Enterprise Systems Architectures. [TB1, Ch5]
5. Market-and Product-Oriented Design of Business Processes [TB1, Ch6]
6. BPR Methodologies: Methods and Tools [TB1, Ch8]
7. Knowledge-Based Reengineering of Business Processes [TB1, Ch9]
8. Defense Enterprise Planning and Management [TB1, Ch11]
9. Supporting Business Process Reengineering in Industry Week1 [TB1, Ch12]
10. Supporting Business Process Reengineering in Industry Week2 [TB1, Ch12]
11. Dynamic Simulation in Business Process Redesign Week1 [TB1, Ch12]

12. Dynamic Simulation in Business Process Redesign Week2 [TB1, Ch12]
13. Various Approaches to Engi eering [TB1, Ch14]
14. Networking as an Enabler of Business Process Reengineering [TB1, Ch15]

Teaching Methodology:
Lecturing, Written Assignments, Project, Report Writing
Course Assessment:
Sessional Exam, Home Assignments, Quizzes, Project, Presentations, Final Exam
Reference Materials:

1. Business Process Engineering: Advancing the State of the Art, D. J. Elzinga, . . ,egeeGluG ,**r**. nGG, ,CeLuGℂ2012
2. Business Process Engineering Study Edition: Reference Models for Industrial Enterprises, A. Scheer, Springer; Study Ed., 2013
3. Collaborative Business Process Engineering and Global Organizations: Framework for Service Integration, U. Bhuvan, A. Ghanbary, H. Younessi, IGI Global SR, 2009

SESC-305 F rmal Methods in Software Engineering			
Credit Hours:	3+0	**Prerequisites:**	None

Course Learning Outcomes (CLOs):		
At the end of the course the students will be able to:	**Domain**	**BT Level***
1. Describe the costs and benefits of formal methods	C	1
2. Construct formal models of sequential software systems	C	2
3. Implement sequential software systems based on formal models	C	3
4. Verify attributes of formal models	C	3
5. Demonstrate formal correctness of simple procedure	C	4
* BT= Bloom's Taxonomy, C=Cognitive domain, P=Psychomotor domain, A= Affective domain		

Course Content:

1. Formal methods: What are FM? What FM are not, When, How, and Why use FM? Popular Fallacies and Alternatives. Formal Methods and Project Management: Gathering Requirement, From Information Requirement to Formal Specifications, Validating Formal Specifications. [TB1 Ch. 1,2,3]

2. Introducing Z: What is Z? Informal Requirements, Data Flow Diagrams, State Transition Diagram, State Transition Diagram, State Transition tables. Introducing schemas: Basic Types and Abbreviations, Axiomatic Descriptions, State Schemas, Operation Schemas, Implicit preconditions, Schema Calculus. [TB1: Ch. 4, 5, 6, 7]
3. Elements of Z: Sets and Types, Declarations, Variables, Expressions, Operators, Predicates, Equations and Laws. Structure: Tuple, Records, Relations, Tables, Databases, Pairs and Binary Relations, Functions, Sequences, Operators. [TB1: Ch. 8,9]
4. Logic: Basic Predicates, Using Predicates in Z, Relations as Predicates, Logical

Connectives, Logic and Natural Language, Quantifiers, Z and Boolean Types, Predicates and undefined Expressions. Synthesis: Set Comprehensives, Lambda Expressions, Formal Specifications, Conveniences and shortcuts, Modeling Systems and Change. [TB1: Ch. 10, 11]

5. Schemas and schema calculus: Conjunctions and Disjunctions, Other Schema Operators. Schema types and Bindings: Generics & Free Types [TB1: Ch. 12, 13, 14]

6. Formal Reasoning: Calculation and proof, Laws, Checking Specifications, Preconditions, Formal Reasoning and Intuition, Machine-Checked proof. [TB1: Ch.15]

7. Studies in Z: Document Con rol System, Text Processing, Eight Queens [TB1: Ch. 16, 17, 18]

8. Computer Graphics and Computational Geometry. Rule-Based Programming: Essential Elements, Facts and Rules, Deducing New Facts, Checking the Rules, Speciffying Rule Based Programs. [TB1: Ch. 9, 20]

9. Graphical User Interface: Events, Display and Dialogs, Selecting a Display, Changing Setting Value, Z and State Transition Systems, Changing the Machine State. [TB1: Ch. 21]

10. Safety-Critical Protection System: Partition, Refinement, Enforcing the Safety Requirements. [TB1: Ch. 22]

11. Modeling Large Systems: A Single Subsystem, Many Subsystems, Useful Idioms, Subsystems, Conditions, and Modes. [TB1: Ch. 23].

12. Object-Oriented Programming Model and Z, Inherits and Schema Inclusion, OO Z Dialects. Concurrency and Real-time [TB1: Ch. 24, 25].

13. Refinement, Program Derivation and Formal Verification [TB1: Ch. 26, 27]

14. Converting Z Specification into Code

| **Teaching Methodology:** |
| Lecturing, Written Assignments, Project, Report Writing |
| **Course Assessment:** |
| Sessional Exam, Home Assignments, Quizzes, Project, Presentations, Final Exam |
| **Reference Materials:** |
| 1. The Way of Z: Practical Programming with Formal Methods by Jonathan Jacky, Cambridge University Press (November 28, 1996)
2. Logic in Computer Science, M. Huth, M. Ryan, Cambridge University Press, 2004
3. Modern Formal Methods and Applications, Hossam A. Gabbar, Springer-Verlag 2006.
4. Formal Software Development: From VDM to Java, Charatan, Quentin, and Aaron Kans. Palgrave Macmillan, 2003.
5. Understanding Z: a Specification Language and its Formal Semantics. J. M. Spivey. 1988. Cambridge University Press, New York, NY, USA. |

SESC-304 Cyber Security			
Credit Hours:	3+0	**Prerequisites:**	None

Course Learning Outcomes (CLOs):		
At the end of the course the students will be able to:	**Domain**	**BT Level**[*]

1. Describe the core information assurance (IA) principles.	C	3
2. Identify the key components of cyber security architecture.	C	3
3. Distinguish system and application security threats and vulnerabilities.	C	3
4. Define types of incidents including categories, responses and timelines for response.	C	3
* BT= Bloom's Taxonomy, C=Cognitive domain, P=Psychomotor domain, A= Affective domain		

Course Content:

1. Vulnerabilities in information system, measuring vulnerabilities. [TB1:Ch1]
2. Threat classification, cyber security starts at home and international awareness. [TB1:Ch1]
3. Vulnerabilities in the organization, access authorization and authentication, ssecurity services in wireless networks and cloud security. [TB1:Ch2]
4. Risk in information system infrastructure, hardware, software, and cyberspace. [TB1:Ch3].
5. Assets identification, resource access control and securing the assets communication. [TB1:Ch4]
6. Secure information system, information security management. [TB1:Ch4]
7. Cyber security and the CIO, data backup and archiving, cyber trainings and cyber policy. [TB1:Ch5]
8. Building a secure organizati n, system access control and computer network management securely. [TB1:Ch6]
9. Personal, physical and envir nmental security and business continuity planning. [TB1:Ch6]
10. Cyberspace Intrusions, ID/PS configuration, ID/PS management and ID/PS classification. [TB1:Ch7]
11. ID/PS implementation and operation in organization. [TB1:Ch7]
12. Cyberspace defense, file protection application, PC performance applications. [TB1:Ch8]
13. Protection tools, security analyzer, password analyzer, firewalls and email protection. [TB1:Ch8]
14. Cyberspace and law, international law and cyber related laws. [TB1:Ch9]
15. Cybercrime, trends in cyber abuse, combating cybercrime. [TB1:Ch9]
16. Cyber warfare and homeland security and distributed defense. [TB1:Ch10]

Teaching Methodology:
Lecturing, Written Assignments, Project, Report Writing
Course Assessment:
Sessional Exam, Home Assignments, Quizzes, Project, Presentations, Final Exam
Reference Materials:

1. Cyberspace and Cyber security 1st Edition by George Kostopoulos
2. Security+ Guide to Network Security Fundamentals, Fifth Edition Mark Ciampa
3. Essential Cyber Security Handbook Kindle Edition by Nam Nguyen

Contents of GE/Uni ersity Elective Courses

BUSB-102 Principles of Management			
Credit Hours:	3+0	**Prerequisites:**	None

Course Learning Outcomes (CLOs):		
At the end of the course the students will be able to:	**Domain**	**BT Level***
1. The course will cover topics fundamentals and principles of management, administrative police, objectives, and procedures and problems of organizational control and leadership.	C	2
* BT= Bloom's Taxonomy, C=Cognitive domain, P=Psychomotor domain, A= Affective domain		

Course Content:
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, Admiinistration 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 Selectio s/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]

Teaching Methodology:
Lectures, Written Assignments, Class Discussion
Course Assessment:
Sessional Exam, Home Assignments, Quizzes, Final Exam
Reference Materials:

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

4. Principles of Management by Charles W. L. Hill and Steven McShane, McGraw-Hill/Irwin; 1st Edition (2006). ISBN-10: 0073530123

5. Principles of Management by Mason Carpenter, Flat World Knowledge, Inc. (2009). ISBN-10: 0982043074

6. Management by Richard L. Daft, South-Western College Pub; 10th Edition (January 27, 2011). ISBN-10: 0538479531

7. Fundamentals of Management by Stephen P. Robbins, David A. DeCenzo and Mary Coulter, Prentice Hall; 7th Edition (January 13, 2010). ISBN-10: 0136109829

BUSB- 01 Human Resource Management			
Credit Hours:	3+0	**Prerequisites:**	None

Course Learning Outcomes (CLOs):		
At the end of the course the students will be able to:	**Domain**	**BT Level***
1. After successfully completing of this course, students will be able to understand the core aspects of Human Resource Management required in 21st Century organizations.	C	2
* BT= Bloom's Taxonomy, C=Cognitive domain, P=Psychomotor domain, A= Affective domain		

Course Content:

1. Managing Human Resources. [TB 1: Ch. 1]
2. Understanding the External and Organizational Environments. [TB 1: Ch. 2]
3. Ensuring Fair Treatment and Legal Compliance. [TB 1: Ch. 3]
4. HR Planning for Alignment and Change. [TB 1: Ch. 4]
5. Using Job Analysis and Competency Modeling. [TB 1: Ch. 5]
6. Recruiting and Retaining Qualified Employees. [TB 1: Ch. 6]
7. Selecting Employees to Fit the Job and the Organization. [TB 1: Ch. 7]
8. Training and Developing a Competitive Workforce. [TB 1: Ch. 8]
9. Conducting Performance Management. [TB 1: Ch. 9]
10. Developing an Approach to Total Compensation. [TB 1: Ch. 10]
11. Using Performance-Based ay to Achieve Strategic Objectives. [TB 1: Ch. 11]
12. Providing Benefits and Ser ices for Employees' Well-Being. [TB 1: Ch. 12]
13. Risk Management, Employee Relations, and Risk Management, Health, Safety, and Employee Well-Being. [TB 1: Ch. 13]
14. Understanding Unionization and Collective Bargaining. [TB 1: Ch. 14]

Teaching Methodology:

Lectures, Written Assignments, Class Discussion

Course Assessment:

Sessional Exam, Home Assignments, Quizzes, Final Exam

Reference Materials:

1. Managing Human Resources by Susan E. Jackson, Randall S. Schuler and Steve Werner, South-Western College Pub; 11th Edition (June 16, 2011).ISBN-10: 1111580227
2. Management of Human Resources by Gary Dessler, CarolinRekar Munro and Nina D. Cole, Pearson Education Canada; 3rd Edition (February 28, 2010). ISBN-10: 0321687140
3. Human Resource Management by Robert L. Mathis and John H. Jackson, South-Western Cengage Learning 13th Edition (August 19, 2010). ISBN-10: 053845315X
4. Human Resource Management Applications: Cases, Exercises, Incidents, and Skill Builders by Stella M. Nkomo, Myron D. Fottlerand R. Bruce McAfee, South-Western Cengage Learning; 7th Edition (September 29, 2010). ISBN-10: 0538468076

BUSB-401 Organizational Behavior			
Credit Hours:	3+0	**Prerequisites:**	None

Course Learning Outcomes (CLOs):		
At the end of the course the students will be able to:	**Domain**	**BT Level***
1. This course introduces the student to multidisciplinary approaches to human behaviour in organizational settings. Attention will be paid to both public and private sector organizations.	C	2
***BT= Bloom's Taxonomy, C=Cognitive domain, P=Psychomotor domain, A= Affective domain**		

Course Content:
1. Organizational Behavior: The Quest for People-Centered Organizations and Ethical Conduct [TB 1: Ch.1]
2. Organizational Culture, Socialization, and Mentoring [TB 1: Ch. 3]
3. Key Individual Differences and the Road to Success [TB 1: Ch. 5]
4. Values, Attitudes, Job Satisfaction, and Counterproductive Work Behaviorss [TB 1: Ch. 6]
5. Social Perceptions and Attributions [TB 1: Ch.7]
6. Foundations of Motivation [TB 1: Ch.8]
7. Improving Job Performance with Goals, Feedback, Rewards, and Positive Reinforcement [TB 1: Ch.9]
8. Group Dynamics [TB 1: Ch.10]
9. Developing and Leading Effective Teams [TB 1: Ch.11]
10. Individual and Group Decision Making [TB 1: Ch.12]
11. Managing Conflict and Negotiating [TB 1: Ch.13]
12. Communicating in the Digital Age [TB 1: Ch.14]
13. Leadership, Influence, Empowerment, and Politics [[TB 1: Ch.15, 16]
14. Organizational Design, Effectiveness, and Innovation [TB 1: Ch.17]

Teaching Methodology:
Lectures, Written Assignments, Class Discussions

Course Assessment:
Sessional Exam, Home Assignments, Quizzes, Final Exam

Reference Materials:
1. Organizational Behavior by Robert Kreitnerand AngeloKinicki, McGraw-Hill/Irwin; 10 Edition (January 17, 2012). ISBN-10: 0078029368
2. Organizational Behavior by Stephen P. Robbins and Timothy A. Judge, Prentice Hall; 15th Edition (January 16, 2012). ISBN-10: 0132834871
3. Meeting the Ethical Challenges of Leadership: Casting Light or Shadow by Craig E. Johnson, SAGE Publications, Inc; 4thEdition (February 28, 2011). ISBN-10: 1412982227

BUSB-202 Business Economics			
Credit Hours:	3+0	**Prerequisites:**	None

Course Learning Outcomes (CLOs):		
At the end of the course the students will be able to:	**Domain**	**BT Level***
1. This course is mean for understanding core matters of economics so that student shall be able to understand what is going on globally. This course, along with Entrepreneurship course, shall help students to establish their own business.	C	2
***** BT= Bloom's Taxonomy, C=Cognitive domain, P=Psychomotor domain, A= Affective domain		

Course Content:

1. Introduction to Business and the economic environment [TB 1: Ch. 1]
2. The working of competitive markets [TB 1: Ch. 2]
3. Demand and the consumer [TB 1: Ch. 3]
4. Supply decisions in a perfectly competitive market [TB 1: Ch. 4]
5. Pricing and output decisions in imperfectly competitive markets [TB 1: Ch. 5]
6. Business growth and strategy [TB 1: Ch. 6]
7. Multinational corporations and business strategy in a global economy [TB 1: Ch. 7]
8. Government, the firm and the market [TB 1: Ch. 9]
9. The economy and business activity [TB 1: Ch. 10]
10. National macroeconomic policy [TB 1: Ch. 11]
11. The global trading environment [TB 1: Ch. 12]

Teaching Methodology:

Lectures, Class Discussions

Course Assessment:

Sessional Exam, Home Assignments, Quizzes, Final Exam

Reference Materials:

1. John Sloman and Elizabeth Jones, Essentials Economics for Business, 5th Ed., Pearson, 2017.
2. Alan Griffiths and Stuart Wall, Economics for Business & Management: A Student Text, Prentice Hall, 2005
3. Dermot McAleese, Economics for Business: Competition, Macro-stability and Globalization, 3rd Ed., Prentice Hall, 2009.

USB-402 Entrepreneurship			
Credit Hours:	3+0	**Prerequisites:**	None

Course Learning Outcomes (CLOs):

At the end of the course the students will be able to:	Domain	BT Level*
1. The course gives students the tools necessary to think creatively, to plan out whether their idea is marketable to investors, guide them through the launch their own business, or to support an employer in launching and growing an entrepreneurial venture.	C	2

* BT= Bloom's Taxonomy, C=Cognitive domain, P=Psychomotor domain, A= Affective domain

Course Content:

1. Entrepreneurship and the Entrepreneurial Mind-Set. [TB 1: Ch. 1]
2. Entrepreneurial Intentions and Corporate Entrepreneurship. [TB 1: Ch. 2]
3. Entrepreneurial Strategy: Generating and Exploiting New Entries. [TB 1: Ch. 3]
4. Creativity and the Business Idea. [TB 1: Ch. 4]
5. Identifying and Analyzing Domestic and International Opportunities. [TB 1: Ch. 5]

6. Intellectual Property and Other Legal Issues for the Entrepreneur. [TB 1: Ch. 6]
7. The Business Plan: Creatin and Starting the Venture. [TB 1: Ch. 7]
8. The Marketing Plan. [TB 1: Ch. 8]
9. The Organizational Plan. [TB 1: Ch. 9]
10. The Financial Plan. [TB 1: Ch. 10]
11. Sources of Capital. [TB 1: Ch. 11]
12. Informal Risk Capital, Venture Capital, and Going Public. [TB 1: Ch. 12]
13. Strategies for Growth and Managing the Implication of Growth. [TB 1: Ch. 13]
14. Succession Planning and Strategies for Harvesting and Ending the Venture. [TB 1: Ch. 15]

Teaching Methodology:
Lectures, Written Assignments, Class Discussions
Course Assessment:
Sessional Exam, Home Assignments, Quizzes, Final Exam
Reference Materials:

1. Entrepreneurship by Robert Hisrich, Michael Peters and Dean Shepherd, McGraw-Hill/Irwin; 9th Edition (September 27, 2012). ISBN-10: 0078029198
2. Entrepreneurship: Ideas in Action by Cynthia L. Greene, South-Western Educational Pub; 5th Edition (January 6, 2011). ISBN-10: 0538496894
3. Entrepreneurship by William D. Bygrave and Andrew Zacharakis, Wiley; 2nd Edition (October 12, 2010). ISBN-10: 0470450371
4. Entrepreneurship: Theory, Process, and Practice by Donald F. Kuratko, South-Western College Pub; 8th Edition (November 14, 2008). ISBN-10: 0324590911
5. Entrepreneurship: Successfully Launching New Ventures by Bruce R. Barringer and Duane Ireland, Prentice Hall; 4th Edition (October 27, 2011)

SS- 03 Foreign/Regional Langugae			
Credit Hours:	3+0	**Prerequisites:**	None

Course Learning Outcomes (CLOs):		
At the end of the course the students will be able to:	**Domain**	**BT Level***
1. The course will develop student's functional skills of the offered language.	C	3
* BT= Bloom's Taxonomy, C=Cognitive domain, P=Psychomotor domain, A= Affective domain		

Course Content:
1. Follow UOS's Relevant Department's Syllabus
Teaching Methodology:
Lectures, Written Assignments
Course Assessment:
Sessional Exam, Home Assignments, Quizzes, Final Exam

Contents of SE Reg lar Track Elective Courses

SEEC-401 Model-Driven Software Development			
Credit Hours:	3+0	**Prerequisites:**	None

Course Learning Outcomes (CLOs):		
At the end of the course the students will be able to:	**Domain**	**BT Level***
1. Understand the different types of architectures and the role they play in software systems.	C	2
2. Architecture creation and evolution, architecture analysis, and documenting the architecture.	C	3
3. To develop models and check them for specific properties using modeling tools.	C	3
***** **BT= Bloom's Taxonomy, C=Cognitive domain, P=Psychomotor domain, A= Affective domain**		

Course Content:

1. MDSD – Basic Ideas & Terminology, An overview of MDA Concepts, Architecture-Centric MDSD. [TB 1: Ch. 2]
2. A Typical Web Application: Application Development, Architecture Development. [TB 1: Ch. 3]
3. Common MDSD Concepts and Terminology, Model-Driven Architecture, Architecture-Centric Architecture, Generative Programming. Software Factories, Model-Integrated Computing, Language-Oriented Programming, Domain-Specific Modeling. [TB 1: Ch. 4]
4. Classification: MDSD vs. CASE, 4GL & Wizards, MDSD vs. Roundtrip Engineering, MDSD & Patterns, MDSD & Domain-Driven Design, MDSD, Data Driven Development & Interpreters, MDSD & Agile Software Development. [TB 1: Ch. 5]
5. Meta-modeling: What is Meta-modeling? Meta-levels vs. Level of Abstraction, MOF & UML, Extending UML, UML Profiles, Meta-modeling & OCL, Pitfalls in Meta-modeling. [TB 1: Ch. 6]
6. MDSD-Capable Target Architectures: Software Architecture in the Context of MDSD, What is a Sound Architecture? How do you Arrive at a Sound Architecture, Building Blocks for Software Archite ture, Architecture Reference Model, Balancing the MDSD Platform, Architecture Conformance, MDSD &CBD; SOA,BPM & MDSD. [TB 1: Ch. 7]
7. Building Domain Architecture: DSL construction, General Transformation Architecture, Technical Aspects of Building Transformation The Use of Interpreters. [TB 1: Ch. 8]
8. Code Generation Techniques: Code Generation – Why? Categorization, Generation Techniques. [TB 1: Ch. 9]
9. Model Transformations with QVT: History, M2M Language Requirements, Overall Architecture, An Example Transformation, The OMG Standardization Process & Tool Availability, Assessment. [TB 1: Ch. 10]
10. MDSD Tools: Roles, Architecture, Selection Criteria & Pointers: The Role of Tools in the Development Process, T ol Architecture & Selection Criteria, Pointers. [TB 1: Ch.

11]

11. The MDA Standard: Goals, Core Concepts, –UML 2.0, MOF-Meta Object Facility, XMI, PIM/PSM/PDM, Multi-stage Transformations, Action Languages, Core Models, Controlling the PIM to PSM Transformation, Executable UML. [TB 1: Ch. 12]

12. MDSD Process Building Block & Best Practices: Introduction, Separation between Application & Domain Architecture Development, Two-Track Iterative Development, Target Architecture Development Process, Product-Line. [TB 1: Ch. 13]

13. Testing: Test Types, Test in Model-Driven Application Development, Testing the Domain Architecture. [TB 1: Ch. 14]

14. Versioning: What is versioned? Projects & Dependencies, The Structure of Application Projects, Version Management & Build Process for Mixed Files, Modeling in a Team & Versioning of Partial Models. [TB 1: Ch. 15]

Teaching Methodology:
Lectures, Written Assignments, Presentations
Course Assessment:
Sessional Exam, Home Assignments, Quizzes, Presentations, Final Exam
Reference Materials:

1. Model-Driven Software Development: Technology, Engineering, Management by Thomas Stahl, Markus Voelter and Krzysztof Czarnecki, Publisher: Wiley; 1st Edition (May 19, 2006). ISBN-10: 0470025700

2. Model-Driven Software Engineering in Practice by Marco Brambilla, Jordi Cabot and Manuel Wimmer, Morgan & Claypool Publishers; 1st Edition (September 26, 2012). ISBN-10: 1608458822

3. The Pragmatic Programmer: From Journeyman to Master by Andrew Hunt and David Thomas, Addison-Wesley Professional; 1st Edition (October 30, 1999). ISBN-10: 020161622X

4. Model-Driven Software Development: Integrating Quality Assurance by JorgRech and Christian Bunse, Information Science Reference; 1st Edition (August 22, 2008). ISBN-10: 160566006X

5. Model-Driven Software Development with UML and Java by K. Lano, Course Technology (August 15, 2009). ISBN-10: 1844809528

SEEC-4 2 Software Engineering Economics			
Credit Hours:	3+0	**Prerequisites:**	None

Course Learning Outcomes (CLOs):		
At the end of the course the students will be able to:	**Domain**	**BT Level***
1. Explains how different cost estimation methods are applied.	C	4
2. Presents the fundamentals of production functions, marginal analysis, and future value in the domain of software engineering.	C	3
3. Important techniques such as software business case analysis.	C	3
4. Have a knowledge of software development process selection.	C	4
* BT= Bloom's Taxonomy, C=Cognitive domain, P=Psychomotor domain, A= Affective domain		

Course Content:

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 1: 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 1: 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 1: 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 1: 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 1: 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 1: 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 1: 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 1: 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 1: Ch. 23, 24]

10. Detailed COCOMO Cost Drivers: Computer Attributes –Execution Time, Main Storage Constraint, Virtual Machine Volatility, Computer Turn Around Time [TB 1: Ch 25]

11. Detailed COCOMO Cost Drivers-Personal Attributes: ACAP, AEXP, PCAP, VEXP, LEXP. [TB 1: Ch. 26]

12. Detailed COCOMO Cost Drivers: Project Attributes–Modern Programming Practices, Use of Software Tools, Schedule Constraint [TB 1: Ch 27]
Teaching Methodology:
Lectures, Written Assignments, Report Writing
Course Assessment:
Sessional Exam, Home Assignments, Quizzes, Presentations, Final Exam
Reference Materials:
1. Software Engineering Economics by Boehm, Prentice Hall, 1981.ISBN-10: 0138221227.
2. Estimating Software Costs: Bringing Realism to Estimating by Capers Jones, McGraw-Hill Osborne Media; 2nd Edition (April 19, 2007).ISBN-10: 0071483004
3. Software Cost Estimation with COCOMO II by Barry W. Boehm, Chris Abts, A. Winsor Brown and SunitaChulani, Prentice Hall (August 11, 2000). ISBN-10: 0130266922.
4. Software Cost Estimation and Sizing Methods, Issues, and Guidelines by Shari Lawrence Pfleeger, Rand Publishing (September 13, 2005). ISBN-10: 0833037137.
5. Software Engineering Economics and Declining Budgets by Pamela T. Geriner, Thomas R. Gulledge, William P. Hutzler, Springer London, Limited, (31-Jul-2012)

SEEC-403 Big Data Analytics			
Credit Hours:	3+0	**Prerequisites:**	None

Course Learning Outcomes (CLOs):		
At the end of the course the students will be able to:	**Domain**	**BT Level***
1. Understand the Big Data Platform and its Use cases.	C	2
2. Provide an overview of Apache Hadoop, HDFS Concepts and Interfacing with HDFS.	C	3
3. Understand Map Reduce Jobs and learn Apache Spark.	C	3
4. Apply analytics on Structured, Unstructured Data and Exposure to Data Analytics with Scala.	C	3
* BT= Bloom's Taxonomy, C=Cognitive domain, P=Psychomotor domain, A= Affective domain		

Course Content:
1. Overview of Big Data: This includes topics such as history of big data, its elements, career related knowledge, advantages, disadvantages and similar topics. [TB 1: Ch. 13, TB2: Ch. 7]
2. Big Data in Real Life: This module focuses on the application perspective of Big Data covering topics such as using big data in marketing, analytics, retail, hospitality, consumer good, defense etc.
3. Technologies for Handling Big Data: Big Data is primarily characterized by distributed data processing frameworks like Hadoop. This module cover topics such as Introduction to Hadoop, functioning of Hadoop, Cloud computing (features, advantages, applications) [TB 1: Ch. 3]
4. Hadoop EcoSystem: This includes learning about Hadoop and its ecosystem which includes HDFS, MapReduce, YARN, HBase, Hive, Pig, Sqoop, Zookeeper, Flume, Oozie etc.

5. Deeply Understanding MapReduce: This module should cover the entire framework of MapReduce and uses of mapreduce. [TB :3 Ch. 1,2]
6. Databases and Data Wareho ses: This module should cover all about databases, data warehouses, data mining, and their related introductory knowledge. [TB 1: Ch. 14]
7. Data Storage using HDFS: This includes an entire module of HDFS, HBase and their respective ways to store and manage data along with their commands. [TB 3: Ch. 12]
8. Big Data Semester Project: Discussion about how to collect real data, store data in HDFS, process distributed data using Apache Spark. Justify how it improves performance.
9. Learn Scala Basics: Learn variables, functions, loops, class, objects, case classes
10. Learn Scala: Learn Tuples, Map, Fold, Split, Array Concatenation, Lists, Iterators
11. Apache Spark: Learn How Spark is better than Hadoop, Resilient Distributed Datasets, Immutability, Learn Spark Configurations, Spark Context. [TB 3: Ch. 13]
12. Apache Spark: Understand Map Partition with Index, Accumulators, Broadcasts, and How to run an Apache Spark Job on Cluster [TB 3: Ch. 14]

Teaching Methodology:
Lectures, Written Assignments, Presentations
Course Assessment:
Sessional Exam, Home Assignments, Quizzes, Presentations, Final Exam
Reference Materials:
1. Cady, Field. *The Data Scien e Handbook*. John Wiley & Sons, 2017.   2. Stephens-Davidowitz, Seth, and Steven Pinker. Everybody lies: Big data, new data, and what the internet can tell us about who we really are. HarperLuxe, 2017.   3. Bill Chambers and Matei Zaharia. Spark: The Definitive Guide: Big Data Processing Made Simple, OReilly, 2018.

SEEC-404 Software CASE Tools & Applications			
Credit Hours:	3+0	**Prerequisites:**	None

Course Learning Outcomes (CLOs):

At the end of the course the students will be able to:	Domain	BT Level*
1. Provide an overview of CASE Tools and their types.	C	2
2. Use CASE Tools for data modeling, process modeling, and UI modeling.	C	3
* BT= Bloom's Taxonomy, C=Cognitive domain, P=Psychomotor domain, A= Affective domain		

Course Content:

1. Introduction to: CASE, Types of CASE Tools, Case Environment, Expectations about CASE and the Need for Tool Integration, Example of CASE tool Integration. [TB 1: Ch. No.1]
2. Approaches CASE Tool Integration, Conceptual Model of Integration, Evolution of Integrated CASE Environment Architectures [TB 1: Ch. No.2]
3. Integration as a Design Activity [TB 1: Ch. No.3]

4. Service Based Model of a CASE Environment: Overview of PSE Reference Model, Description of Reference Model Services, Uses of Reference Model [TB 1: Ch. No.4]

5. Properties and Types of Integration Mechanism: The Relationship between Data and Control Model, Presentation Integration [TB 1: Ch. No.5]

6. The Role of Process in Integrated CASE Environments: Nature of Process Integration, Process Integration and CASE Tools and Environments [TB 1: Ch. No.8]

7. Examples of Process and CASE Tool Interactions [TB1 :Ch. No.8]

8. Replacing the Message Service in a CASE Integration Framework: Background, Adding the ToolTalk Interface, Running the Experiment Scenario, Replacing the ToolTalk in the Emulation Framework [TB 1: Ch. No.10]

9. Integration of CASE Tools with CM Systems: Key Concepts Related to CM and CASE Tools Integration, CASE Tool Integration Scenarios Involving CM [TB 1: Ch. No.11]

10. Case Environments in Pract ce: Background and Studies, Observations, An Example of Transitional CASE Environment, CASE Environment Progress Over the Past Decade [TB 1: Ch. No.12]

11. Object-Oriented Analysis & Design Modeling: Business Process Models, Design Reuse, E-Commerce, ISO [Handouts]

12. Comparison of Popular CASE Tools (Online Material)

13. Practice Real Life Problem for Development Through CASE Tools

Teaching Methodology:
Lectures, Written Assignments, Presentations
Course Assessment:
Sessional Exam, Home Assignments, Quizzes, Presentations, Final Exam
Reference Materials:

1. Principles of CASE Tool Integration by Alan W. Brown, Oxford University Press, USA; 1stEdition, (September 1, 1994) ISBN-10: 0195094786

2. Computer Aided Software Engineering by Hausi A. Muller, Ronald J. Norman and Jacob Slonim, Springer; Softcover reprint of the original 1stEdition 1996 (September 27, 2011). ISBN-10: 1461286263.

3. A http://www.umsl.edu/~sauterv/analysis/6840_f09_papers/I%20Gusti/index.html

4. Most popular software CASE tool documentation

SEEC-405 -Commerce Applications Development			
Credit Hours:	3+0	**Prerequisites:**	None

Course Learning Outcomes (CLOs):		
At the end of the course the students will be able to:	**Domain**	**BT Level***
1. Understand the concepts and standards related to the discipline of E-Commerce.	C	2
2. Analyze complex real world problems found in E-Commerce.	C	3
* BT= Bloom's Taxonomy, C=Cognitive domain, P=Psychomotor domain, A= Affective domain		

Course Content:
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 1: Ch.1]

2. Planning an e-Commerce Framework: Designing a framework, Patterns, ModelView-Controller, Registry, Singleton, Structure, Building a framework, Routing rrequests. [TB 1: Ch.2]

3. Products and Categories: Product information, Category information, Structuring Content, Versioning, Building products, categories, and content functionality, Routing products and categories. [TB 1: Ch.3]

4. Product Variations and User Uploads: Giving user's choice, giving users control, shopping. [TB 1: 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/commen s. [TB 1: Ch.5]

6. The Shopping Basket: Creating a Basket, Basket Contents, Managing the Basket, Cleaning the Basket. [TB 1: Ch.6]

7. The Checkout and Order Pr cess: The Process, Authentication, Payment Method, Order Processed. [TB 1: Ch.7]

8. Shipping and Tax: Shipping Methods, Shipping Costs, Shipping Rules, Tracking, Tax Calculation. [TB 1: Ch.8]

9. Discounts, Vouchers, and Referrals: Discount codes, Purchasable Voucher Codes, Referrals. [TB 1: Ch.9]

10. Checkout: Checkout process consideration, Order process review, Authentication & Confirmation. [TB 1: Ch.10]

11. Taking Payment for Orders: Taking payment, Payment System, Payment gateway, Taking Payment Online, Taking payment offline. [TB 1: Ch.11]

12. User Account Features: User Account Area, Changing Details, Viewing & Managing Orders. [TB 1: Ch.12]

13. Administration: Dashboard, Managing Products and Categories, Managing Orders, Customers, Refunds, Voucher Codes, Shipping, etc. [TB 1: Ch.3]

14. Deploying, Security, and Maintenance, SEO. [TB 1: Ch.14, 15]

Teaching Methodology:

Lectures, Written Assignments, Project, Report Writing

Course Assessment:

Sessional Exam, Home Assignments, Quizzes, Project, Presentations, Final Exam

Reference Materials:

1. PHP 5 E-commerce Development by Michael Peacock, Packt Publishing (January 20, 2010). ISBN-10: 184719964X
2. E-Commerce, Kenneth Laudon and Carol Guercio Traver, 13th Edition, Pearson, 2017.
3. PHP 5 E-commerce Development, Michael Peacock, Packt Publishing, 2010.
4. Introduction to E-Commerce, Jeffrey F. Rayport, McGraw-Hill, 2nd Edition,, 2007.
5. Electronic Commerce, Gary Schneider, Course Technology; 12th Edition 2016

SEEC-406 Enterprise Resource Planning Systems			
Credit Hours:	3+0	**Prerequisites:**	None

Course Learning Outcomes (CLOs):

At the end of the course the students will be able to:	Domain	BT Level*
1. To comprehend the technical aspects of ERP systems.	C	2
2. To understand the steps and a tivities in the ERP life cycle.	C	2
3. Understand the concepts of reengineering and able to map business processes using mapping techniques.	C	3

* BT= Bloom's Taxonomy, C=Cognitive domain, P=Psychomotor domain, A= Affective domain

Course Content:

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

Teaching Methodology:

Lectures, Written Assignments, Presentations

Course Assessment:

Sessional Exam, Home Assignments, Quizzes, Presentations, Final Exam

Reference Materials:

1. Modern ERP: Select, Implement & Use Today's Advanced Business Systems by Marianne Bradford, lulu.com (October 19, 2009). ISBN-10: 0557012910
2. Managerial Issues of Enterprise Resource Planning Systems by David Olson, McGraw-Hill/Irwin; 1st Edition (September 10, 2003). ISBN-10: 0072861126
3. Enterprise Resource Planning by Bret Wagner by Ellen Monk, Course Technology; 3rd Edition (February 4, 2008). ISBN-10: 1423901797
4. ERP Systems by DimpiSrivastava by AartiBatra, I K International Publishing House (February 15, 2010). ISBN-10: 9380578148

SEEC-407 Mobile Application Development			
Credit Hours:	3+0	**Prerequisites:**	None

Course Learning Outcomes (CLOs):

At the end of the course the students will be able to:	Domain	BT Level*
1. Discuss different architectures & framework for Mobile Application development.	C	1

2. Develop mobile applications using current software development environments.	C	3
3. Compare the different performance tradeoffs in mobile application development.	C	3
* BT= Bloom's Taxonomy, C=Cognitive domain, P=Psychomotor domain, A= Affective domain		

Course Content:

1. What is Android? Obtaining the Required Tools, Installing and Configuring the Android SDK Manager, Creating Your First Android Application, Anatomy of an Android Application. [Tb1: Ch 1]
2. The Big Picture, How to Get Started, Your First Android Project, A bit About Eclipse, Enhancing Your First Project [Tb2: Ch 1-6]
3. Understanding Activities, Linking Activities Using Intents, Fragments, Calling Built-In Applications Using Intents, Displaying Notifications. [Tb1: Ch 2]
4. Understanding the Components of a Screen, Adapting to Display Orientation, Managing Changes to Screen Orienta ion, Utilizing the Action Bar, Creating the User Interface Programmatically, and Listening for UI Notifications. [Tb1: Ch 3]
5. Using Basic Views, Using Picker Views, Using List View to Display Long Lists, Understanding Specialized Fragments. [Tb1: Ch 4]
6. Using Image Views to Dis lay Pictures, Using Menus with Views, Analog Clock and Digital Clock Views. [Tb1: Ch 5]
7. Saving and Loading User Preferences, Persisting Data to Files, Creating and Using Databases. [Tb1: Ch 6]
8. Sharing Data in Android, using a Content Provider, Creating Your Own Content Providers, Using the Content Provider. [Tb1: Ch 7]
9. Sending SMS Messages Programmatically, Getting Feedback after Sending a Message, Sending SMS Messages Using Intent, Receiving SMS Messages, Sending E-mail. [Tb1:Ch 8]
10. Displaying Maps, Getting Location Data, Monitoring a Location, Building a Location Tracker. [Tb1:Ch 9]
11. Consuming Web Services Using HTTP, Accessing Web Services Using the Get Method, Consuming JSON Services, Sockets Programming. [Tb1:Ch 10]
12. Creating Your Own Services, Establishing Communication between a Service and an Activity, Binding Activities to Services, Understanding Threading. [Tb1:Ch 11]
13. Android games Development, Publishing Android Applications [Tb3, Tb1: Ch12]
14. Handling Telephone Calls, Fonts. [Tb2:Ch 41, 42]

Teaching Methodology:

Lectures, Written Assignments, Project, Report Writing

Course Assessment:

Sessional Exam, Home Assignments, Quizzes, Project, Presentations, Final Exam

Reference Materials:

1. Professional Android application development, Reto Meier, Wrox Programmer to Programmer, 2015.
2. iOS Programming: The Big Nerd Ranch Guide, Conway, J., Hillegass, A., & Keur, C., 5th Edition, 2014.
3. Android Programming: The Big Nerd Ranch Guides, Phillips, B. & Hardy, B., 2nd Edition, 2014.

SEEC-408 Enterprise Application Development			
Credit Hours:	3+0	**Prerequisites:**	None

Course Learning Outcomes (CLOs):		
At the end of the course the students will be able to:	**Domain**	**BT Level***
1. Develop desktop application of Java programming language.	C	3
2. Develop strong skills to cater Enterprise Application Development needs and challenges.	C	3
* BT= Bloom's Taxonomy, C=Cognitive domain, P=Psychomotor domain, A= Affective domain		

Course Content:
1. Object-Oriented Programming Review, Software Architectures Overview: Desktop, File/Server, 2-Tier Client/Server, Multi-Tier Client/Server. [TB 1: Ch. 1]
2. Challenges of Enterprise Application Development, the Platform for Enterprise Solutions, J2EE Scenarios. [TB 1: Ch. 2]
3. J2EE Platform Technologies: Component Technologies, Platform Roles, Platform Services, Service Technologies, Communication Technologies. [TB 1: Ch. 3]
4. The Client Tier: Client Considerations, General Design Issues and Guidelines, Design Issues and Guidelines for Browser Clients, Design Issues and Guidelines for Java Clients. [TB 1: Ch. 4]
5. The Web Tier: The Purpose of the Web Tier, Web-Tier Technologies, Web-Tier Application Structure, Web-Tier Application Framework Design. [TB 1: Ch. 5]
6. The Enterprise JavaBeans Tier: Business Logic and Business Objects, Enterprise Beans as J2EE Business Objects, Remote and Local Client Views, Entity Beans, Session Beans, Message-Driven Beans, Design Guidelines, Portability Guidelines. [TB 1: Ch. 6]
7. Integrating with the Enterprise Information System Tier: Integration Scenarios, J2EE Integration Technologies, Application Integration Design Approaches, Developing an Integration Layer. [TB 1: Ch. 7]
8. Packaging and Deployment: Packaging Components, Roles and Tasks, Packaging J2EE Applications, Deployment Descriptors, Deployment Tools. [TB 1: Ch. 8]
9. Transaction Management: Transactional Concepts, J2EE Platform Transactions, J2EE Transaction Technologies, Client Tier Transactions, Web Tier Transaction Guidelines, Enterprise JavaBeans Tier Transactions, EIS Tier Transactions, J2EE Resource Manager Types. [TB 1: Ch. 9]
10. Security: Security Threats nd Mechanisms, Authentication, Authorization, Protecting Messages, Auditing. [TB 1: Ch. 10]
11. J2EE Internationalization and Localization: Internationalization Concepts and Terminology, Using J2SE Internationalization APIs in J2EE Applications, Web Tier Internationalization, EIS Tier Internationalization, Internationalized Application Design, Internationalizing Applications with XML, Logging Messages. [TB 1: Ch. 11]
12. Architecture of the Sample Application: J2EE Architecture Approaches, Sample Application Overview, Designing the Sample Application, Architecture of the Sample Application. [TB 1: Ch. 12]
Teaching Methodology:
Lectures, Written Assignments, Presentations

Course Assessment:
Sessional Exam, Home Assignments, Quizzes, Presentations, Term Project, Final Exam
Reference Materials:
1. Designing Enterprise Applications with the J2EE™ Platform by Inderjeet Singh; Beth Stearns; Mark Johnson; 2nd Edition, Prentice Hall (March 25, 2002). Print ISBN-10: 0-201-78790-3
2. Mastering Enterprise JavaB ans 3.0 by Sriganesh, R.P., Brose, G., And Silverman, M. Wiley Publishing, Indianapolis, (2006). ISBN 0-471-78541-5.
3. Core J2EE Patterns: Best Practices and Design Strategies by Deepak Alur, Dan Malksand John Crupi, Prentice Hall; 2nd Edition (May 10, 2003). ISBN-10: 0131422464
4. Sun Certified Enterprise Architect for Java EE Study Guide by Mark Cade and Humphrey Sheil, Prentice H ll; 2nd Edition (February 8, 2010). ISBN-10: 0131482033

SEEC-301 Artificial Intelligence			
Credit Hours:	3+0	**Prerequisites:**	None

Course Learning Outcomes (CLOs):		
At the end of the course the students will be able to:	**Domain**	**BT Level***
1. Understand the basic principles in artificial intelligence.	C	2
2. Learn representation schemes, problem solving paradigms, constraint propagation, and search strategies.	C	3
3. Explore different areas of AI application such as knowledge representation, natural language processing, expert systems, vision and robotics.	C	2
* BT= Bloom's Taxonomy, C=Cognitive domain, P=Psychomotor domain, A= Affective domain		

Course Content:
1. Introduction: What is AI, Foundations of AI, History of AI. Intelligent Agents: Agents and Environments, The Nat re of Environments, The Structure of Agents [TB 1: Ch. 1, 2]
2. Problem Solving by Searching: Problem Solving Agents, Searching for Solutions, Uninformed Search Strategies:
3. Breadth-First Search, Dept -First Search, Depth-limited Search, Iterative Deepening, Depth-first Search, Comparison of Uninformed Search Strategies. [TB 1: 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 1: Ch. 4]
5. Constraint Satisfaction Problems: Backtracking Search for CSPs, Local Search for CSPs. Adversarial Search: Games, Minimax Algorithm, Alpha-Beta Pruning. [TB 1: 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 1: 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 1: Ch. 9]
8. Introduction to Prolog Progr mming
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 1: Ch. 10]
10. Reasoning with Uncertainty & Probabilistic Reasoning: Acting Under Uncertainty, Bayes' Rule and Its Use, [TB 1: Ch 13]
11. Representing Knowledge in an Uncertain Domain, The Semantics of Bayesian Networks. [TB 1: Ch. 14]
12. Learning from Observations: Forms of Learning, Inductive Learning, Learning Decision Trees [TB 1: Ch. 18]
13. Knowledge in Learning, Explanation-Based Learning, Inductive Logic Progrramming. [TB 1: 19]
14. Statistical Learning, Neural Networks, [TB 1: Ch. 20]
15. Philosophical Foundations: Weak AI, Strong AI, The Ethics and Risks of Developing Artificial Intelligence [TB 1: Ch. 26]

Teaching Methodology:
Lectures, Written Assignments, Presentations
Course Assessment:
Sessional Exam, Home Assignments, Quizzes, Presentations, Final Exam
Reference Materials:
1. Artificial Intelligence: A Modern Approach, by Russell and Norvig, Prentice Hall. 2nd Edition. ISBN-10: 0137903952
2. Artificial Intelligence: A Systems Approach by M. Tim Jones, Jones and Barrtlett Publishers, Inc; 1st Edition (December 26, 2008). ISBN-10: 0763773379
3. Artificial Intelligence in the 21st Century by Stephen Lucci , Danny Kopec, Mercury Learning and Information (May 18, 2012). ISBN-10: 1936420236

SEEC-409 Cloud Computing			
Credit Hours:	3+0	**Prerequisites:**	None

Course Learning Outcomes (CLOs):		
At the end of the course the students will be able to:	**Domain**	**BT Level***
1. Understand about fundamental concepts of distributed computing, how these techniques work inside today's most widely-used cloud computing systems.	C	1
2. Understanding the basic principles of cloud deployment and Service models.	C	2
3. Deployment of service models of Cloud through simulator/Vmware/Openstack etc.	C	2
*** BT= Bloom's Taxonomy, C=Cognitive domain, P=Psychomotor domain, A= Affective domain**		

Course Content:
1. Distributed systems, Characteristics, Design goals, Types of distributed systems [TB2:1]
2. What is Cloud Computing? Different perspectives, Properties and characteristics, Benefits [TB1: Preface]
3. Service and deployment models of Cloud computing, Service models: IaaS, PaaS, SaaS[TB1:2]
4. From IaaS to PaaS, PaaS and SaaS properties, Issues, characteristics and Implementation[TB9]
5. Modern On-Demand Computing, Amazon's Elastic Cloud, Amazon EC2 Service, Characteristics, Amazon SimpleDB, Amazon Simple Queue Service (Amazon SQS), Amazon CloudFront, Amazon Elastic Block Store (EBS) [TB1: 2]
6. Virtualization, From emulation to virtualization, Goals of virtualization, Types of Virtualization Hosted and Hypervisor, Server Virtualization, CPU Virtualization [TB1:4, 5]
7. Memory Virtualization: Background, Virtualization Techniques: Emulated TLB, Shadow Page Tables, Hardware supported Memory Virtualization, Nested Page Tables [6]
8. Virtualization Practicum. [TB 1: Appendix A]
9. Cloud Federation: Characterization and Conceptual Model, Voluntary or independent model, Horizontal, Vertical, Hybrid model, Architectural models for cloud federation: Semantics based, Market-oriented, Reservoir, Market-oriented, Reservoir, Service oriented architecture, Conceptual Model, Segments in a Federation [TB1: 5, 7]
10. Presence in the Cloud, Presence Protocols, Leveraging Presence, Presence Enabled, The Future of Presence, The Interrelation of Identity, Presence, and Location in the Cloud, Federated Identity Management, Cloud and SaaS Identity Management, Federating Identity, Identity-as-a-Service (IaaS), Compliance-as-a-Service (CaaS), The Future of Identity in the Cloud [TB1: 5]
11. Presence Protocols: XMPP, SIMPLE, SIP [8]
12. Privacy and Its Relation to Cloud-Based Information Systems, Privacy Risks and the Cloud, Cloud Security Challenges, Software-as-a-Service Security, Security Management (People), Security Governance, Risk Management, Risk Assessment, Security Portfolio Management, Security Awareness.[TB1:6]
13. End-User Access to Cloud Computing, YouTube, YouTube API Overview, Widgets, YouTube Player APIs, The YouTube Custom Player, YouTube Data API, Zimbra, Zimbra Collaboration Suite (ZCS), Facebook, Facebook Development, Zoho, Zoho CloudSQL, DimDim Collaborations[TB1:8]
14. Mobile Internet Device and the Cloud, [TB1: 9]
15. Cloud, IOT and Fog Computing [3,4]
Teaching Methodology:
Lectures, Written Assignments, Semester Project, Lab Assignments, Presentations
Course Assessment:
Sessional Exam, Home Assignments, Quizzes, Project, Presentations, Final Exam
Reference Materials:
1. 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

2. Distributed Computing: Principles and Applications Book by Mei-Ling L. Liu. ISBN-13: 978-0201796445
3. Internet of Things: Principle and Paradigms,book by rajkumar buyya and Amir vahid DastjerDi(Eds.), publisher: Morgan kaufmann, ISBN: 978-0-12-805395-9
4. https://arxiv.org/abs/1601.02752
5. *https://www.vmware.com/pdf/virtualization.pdf*
6. *https://www.vmware.com/pdf/virtualization_considerations.pdf*
7. https://www.researchgate.net/publication/270581440_Cloud_Federation_characterization_and_conceptual_model
8. https://xmpp.org/
9. Architecting the Cloud: Design Decision for Cloud Computing Service Models (SAAS, PAAS and IAAS) Publisher: Wiley India Private Limited; 2014 edition, ISBN-10: 8126550333

SEEC-410 Systems Programming			
Credit Hours:	3+0	**Prerequisites:**	None

Course Learning Outcomes (CLOs):		
At the end of the course the students will be able to:	**Domain**	**BT Level***
1. Introduction to systems programming, system programming languages and application of those languages to systems level problems.	C	2
2. Design, write, and test moderately complicated low-level programs using a systems programming language	C	3
* BT= Bloom's Taxonomy, C=Cognitive domain, P=Psychomotor domain, A= Affective domain		

Course Content:
1. Introduction to the Microsoft Windows Operating System,
2. File Processing, Memory Management, Memory Mapped Files and DLLs,
3. Process management, Threads and scheduling, Thread synchronization,
4. Inter-process Communication, Input/Output, Device Drivers (USB or Parallel Port),
5. File System Drivers, Filter Drivers
6. Introduction to Assembly Language, 80x86 families; program layout. [TB 1: Ch. 1.1, 1.2; 2,3]
7. Data Definitions, Basic Instructions. [TB 1: Ch. 3, 4]
8. Unsigned Arithmetic; Logic and Bit Operations. [TB 1: Ch. 6, 7]
9. Modules; Separate Assembly; Argument Passing [TB 1: Ch. 5,8]
10. Libraries; Combining Assembly and C Code [TB 1: Ch. 13]
11. String Instructions; Arrays [TB 1: Ch. 9]
12. Macros; Structures [TB 1: Ch. 10]
13. Floating Point Instructions [TB 1: Ch. 12]
14. Bit MS-DOS. [TB 1: Ch. 14]

15. BIOS Disk Accessing
16. BIOS Keyboard/Video/Graphics
17. Interrupts; TSR Programs
18. Accessing I/O Ports; 8253 Timer

Teaching Methodology:
Lectures, Written Assignments, Presentations

Course Assessment:
Sessional Exam, Home Assignments, Quizzes, Presentations, Final Exam

Reference Materials:
1. Assembly Language for x86 Processors by Kip R. Irvine, Prentice Hall; latest Edition ISBN-10: 013602212X
2. Windows System Programming 3rd edition, Johnson M. Hart, Addison Wesley
3. The Windows NT Device driver book 2nd edition, Art Baker, Prentice Hall.

SEEC-311 Management Information Systems			
Credit Hours:	3+0	**Prerequisites:**	None

Course Learning Outcomes (CLOs):		
At the end of the course the students will be able to:	**Domain**	**BT Level**[*]
1. Understand basic concepts of information technology management, its application, development themes, development methodologies, development tools and technologies of Information Systems.	C	2
2. Able to solve common business problems and produce effective solutions to business problems.	C	3
3. Able to design a database application to solve a business problem.	C	3
* BT= Bloom's Taxonomy, C=Cognitive domain, P=Psychomotor domain, A= Affective domain		

Course Content:
1. Introduction: Overview of Business Strategy Frameworks, Brief Overview of Organizational Strategies, Brief Overview of Information Systems Strategy [TB1: Ch. 1]
2. Understanding the IS Organization, What a Manager Can Expect ffrom the IS Organization, What the IS Organization Does Not Do, IT Governance. [TB1: Ch. 8]
3. Evolution of Information Resources, Information Resources as Strategic Tools, How Can Information Resources Be Used Strategically? Strategic Alliances, Risks.. Information Technology and Organizational Design, Information Technology and Management Control Systems, Information Technology and Culture. [TB1: Ch. 2 Ch.3]
4. Information Technology and the Design of Work. Information Technology and Changing Business Processes. Architecture and Infrastructure [TB1: Ch. 4,5,6,]
5. Information Systems Sourcing. Using Information Ethically [TB2: Ch. 7,9]
6. Techniques: Project management techniques, Organizational techniques, People techniques. IT Project Development Methodologies, Managing Businesss Knowledge [TB1: Ch. 11, 12]
7. Organizational Theory. Management and Control. Types of Business. Management,

System Theory, Types of Business Information System, Interaction of Business Systems. System Content. [TB2: Ch.4, 5, 6]
8. Computer System Concepts, Computers in Business, System Development [TB2: 10, 11, 14]

Teaching Methodology:
Lectures, Written Assignments, Presentations
Course Assessment:
Sessional Exam, Home Assignments, Quizzes, Presentations, Final Exam
Reference Materials:

4. Experiencing MIS, D. M. Kroenke, A. Gemino and P. Tingling. P. 4th Edition. Toronto: Pearson.2016.
5. Business driven informatio systems, P. Baltzan, B. Detlor, and C. Welsh, 4th Ed., McGraw Hill Ryerson Press, 2015.
6. Fundamentals of Information Systems by Ralph Stair and George Reynolds, Course Technology; 6th Edition (January 1, 2011). ISBN-10: 0840062184
7. Information Systems Deve opment: Methodologies, Techniques & Tools by David Avison and Guy Fitzgerald, McGraw-Hill; 4th Edition (May 1, 2006). ISBN-10: 0077114175
8. Information Systems Analysis and Design by Shouhong Wang and Hai Wang, Universal Publishers (January 1, 2012) ISBN-10: 1612330754

SEEC-411 Game Application Development			
Credit Hours:	3+0	**Prerequisites:**	None

Course Learning Outcomes (CLOs):		
At the end of the course the students will be able to:	**Domain**	**BT Level***
1. Introduction to game development theory, framework, production and management.	C	2
2. Learn how to create a complete computer game from start to finish.	C	3
***** BT= Bloom's Taxonomy, C=Cognitive domain, P=Psychomotor domain, A= Affective domain		

Course Content:
1. Building The Foundation, Historical Elements How Did We Get Here
2. Platform And Player Modes, What Is The Framework? [TB 1: Ch. 2]
3. Goals and Genres? What Are The Possibilities? [TB 1: Ch. 3]
4. Player Elements, Player Motivation, Geographic, Psychographics. [TB 1: Ch. 4]
5. Demographics, Gender, Generation, Rating, Applying Player Market to Platfform. [TB 1: Ch. 4]
6. Story and Character Development: Classic Charters, Traditional Story Structure, Story Element. [TB 1: Ch. 5]
7. Plot, Game Story Devices, Game Characters [TB 1: Ch. 5]
8. Character Development Element, Point-of-view, Visual Character Development, Verbal

Character Development, Movement, [TB 1: Ch. 5]

9. Visual Character Development, Verbal Character Development, Movements, Chracter Description, Game Storytelling and Documentation [TB 1: Ch. 5]
10. Gameplay: Rules to Play, Interactivity Modes, Game theory, Challenges, balance [TB 1: Ch. 6]
11. Levels: Level Design, Structure, Time, Space. [TB 1: Ch. 7]
12. Interface: Playe-Centerd Design, Interface & Game Feature, Interface Types, Usability. [TB 1: Ch. 8]
13. Audio: The Importance of Game Audio, Sound Effect, Voiceover, Music. [TB 1: Ch. 9]
14. Role & Responsibilities: Company Role, Team Roles, Tools, Business Side of Game Development. [TB 1: Ch. 10]
15. Production and Management, Development Phases, Game Documentation [**T**B 1: Ch. 11]

Teaching Methodology:

Lectures, Written Assignments, Presentations

Course Assessment:

Sessional Exam, Home Assignments, Quizzes, Presentations, Final Exam

Reference Materials:

1. Game Development Essentials by Jeannie Novak, Delmar Cengage Learning; 3rd Edition (August 17, 2011). ISBN-10: 1111307652
2. Game Development Essentials: An Introduction by Jeannie Novak, Delmar Cengage Learning; 3rd Edition (2011). ISBN-10: 1111307652
3. Game Development Essentials: Mobile Game Development by Kimberly Unger and Jeannie Novak, Delmar Cengage Learning; 1st Edition (2011). ISBN-10: 1418052655
4. Game Development Essentials: Game Interface Design by Kevin Saunders and Jeannie Novak, Delmar Cengage Learning; 2nd Edition (2012). ISBN-10: 1111642885
5. Game Development Essentials: Online Game Development by Rick Hall and Jeannie Novak, Delmar Cengage Learning; 1 Edition (2008). ISBN-10: 1418052671
6. Beginning 3D Game Development with Unity: All-in-one, multi-platform game development by Sue Blackman, Apress; 1st Edition (2011). ISBN-10: 1430234229
7. Game Coding Complete by Mike McShaffry and David Graham, Course Technology PTR, 4th Edition, (2012). ISBN-10: 1133776574
8. 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

EEC-426 Software Metrics			
Credit Hours:	3+0	**Prerequisites:**	None

Course Learning Outcomes (C Os):		
At the end of the course the students will be able to:	**Domain**	**BT Level***
CLO-1: Explains how quantitative and empirical methods are applied to software engineering problems	C	2
CLO-2: Presents the fundamentals of measurement, experimentation, data collection and analysis	C	3
CLO-3: Critically evaluate and discuss different software matrices of different applications in the real world with course participants and learners	C	3

CLO-4: Have a working knowledge of software size measurement (Function Point counting, etc.)	C	4

* BT= Bloom's Taxonomy, C=Cognitive domain, P=Psychomotor domain, A= Affective domain

Course Content:

1. Overview of software metrics : Measurement in Software Engineering, Scope of Software Metrics [TB: Ch.1]

2. The Basics of Measurement, Measurement and Models, Measurement Scales and Scale Types [TB: Ch.2]

3. Goal-based framework for software measurement: Classifying Software Measures, Determining What to Measure [TB: Ch.3]

4. Applying the Framework, Software Measurement Validation [TB: Ch.3]

5. Empirical investigation : Principles Of Empirical Studies, Planning Experiments, and Planning Case Studies as Quasi-Experiments, Relevant and Meaningful Studies [TB: Ch.4]

6.Analyzing Software Measurement Data: Statistical Distributions and Hypothesis Testing, Classical Data Analysis Techniques, Examples of Simple Analysis Techniques, Overview of Statistical Tests [TB: Ch.6]

7. Metrics for Decision Support: The Need for Causal Models: From Correlation and Regression to Causal Models, Bayes Theorem and Bayesian Networks (TB: Ch.7)

8. Measuring Internal Product Attributes: Size, Structure, Code Size, Design Size, Functional Size Measures and Estimators, Applications of Size Measures [TB: Ch.8, 9]

9. Functional Size Measures and   stimators, Applications of Size Measures [TB: Ch.8]

10. Design-Level Attributes, Object-Oriented Structural Attributes and Measures [TB: Ch.9]

11. Theory [TB: Ch.11]

12. Measuring External Product Attributes: Modeling Software Quality, Measuring Aspects of Quality, [TB: Ch.10]

13. Usability Measures, Maintainability Measures, and Security Measures [TB: Ch.10]

14. Software Reliability: Measurement And Prediction: Basics of Reliability [TB: Ch.11]

15. Software test metrics; Object-oriented metrics [Handouts]

Teaching Methodology:
Lecturing, Written Assignments, Project.

Course Assessment:
Sessional Exam, Home Assignments, Quizzes, Project, Presentations, Final Exam

Reference Materials:

1. Software Metrics: A Rigorous and Practical Approach, (3rd ed.), N.E. Fenton and J. Bieman, CRC Press, 2014,
2. Software Metrics: A Guide to Planning, Analysis, and Application, C. Ravindranath Pandian, Auerbach Publications, CRC Press Company, 2004.
3. Metrics and Models in Software Quality Engineering, Stephen H. Kan, 2nd ed., Addison-Wesley Professional, 2002.

SEEC-314 Multimedia Systems and Design			
Credit Hours:	3+0	**Prerequisites:**	None

Course Learning Outcomes (CLOs):		
At the end of the course the students will be able to:	**Domain**	**BT Level***
1. Understand complete process of multimedia system specifications, formats, design, testing, and prototyping.	C	2
2. Learn different tools and techniques for integrating multimedia content into a product.	C	3
* BT= Bloom's Taxonomy, C=Cognitive domain, P=Psychomotor domain, A= Affective domain		

Course Content:

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 Wi e 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]

Teaching Methodology:

Lectures, Written Assignments, Presentations

Course Assessment:

Sessional Exam, Home Assignments, Quizzes, Presentations, Final Exam

Reference Materials:

1. Multimedia Making It Work Eighth Edition by Tay Vaughan, McGraw-Hill Osborne Media; 8th Edition (October 9, 2010). ISBN-10: 0071748466
2. Fundamentals of Multimedia by Z. M. Li and M. S. Drew, Prentice Hall (2004), ISBN: 0-13-127256-X
3. Digital Multimedia by N. Chapman and J. Chapman. 2nd Edition, Wiley (2004). ISBN: 0-470-85890-7
4. The Technology of Video and Audio Streaming by David Austerberry, Focal Press; 2nd Edition (2004). ISBN-10: 0240805801
5. Multimedia Security: Watermarking, Steganography, and Forensics by Frank Y. Shih, CRC Press; 1st Edition (2012). ISBN-10: 1439873313
6. Multimedia Computing by Daniel Cunliffe and Geoff Elliott, Lexden Publishing Ltd. (2005). ISBN-10: 1904995055
7. Multimedia Foundations: Core Concepts for Digital Design by Vic Costello, Ed Youngblood and Susan Youngblood, Focal Press; 1st Edition (2012). ISBN-10:

0240813944

SEEC-414 Virtual Reality			
Credit Hours:	3+0	**Prerequisites:**	None

Course Learning Outcomes (CLOs):		
At the end of the course the students will be able to:	**Domain**	**BT Level***
1. Understand fundamental techniques, processes, technologies and equipment used in virtual reality systems.	C	2
2. Acquire the basic knowledge about the physiology of human vision, hearing, and perception.	C	2
3. Understand the human interaction with virtual reality interfaces.	C	2
4. Introduce and review recent applications of virtual reality.	C	2
* BT= Bloom's Taxonomy, C=Cognitive domain, P=Psychomotor domain, A= Affective domain		

Course Content:

1. Definition of VR, Modern Experiences, Historical Perspective. [TB1: Ch 1]
2. Overview of VR Systems: Hardware, Sensors, Displays, Software, Virtual World Generator, Game Engines, Human Senses, Perceptual Psychology, Psychophysics. [TB1: Ch 2]
3. Geometric Modelling, Transforming Rigid Bodies, Yaw, Pitch, Roll, Axis-angle Representation, Quaternions, 3D Rotation Inverses and Conversions, Homogeneous Transforms, Transforms to Displays, Look-at and Eye Transforms, Canonical View and Perspective Transforms, Viewport Transforms. [TB1: Ch 3]
4. Light Propagation, Lenses and Images, Diopters, Spherical Aberrations, Optical Distortion; More Lens Aberrations; Spectral Properties; The Eye as an Optical System; Cameras. [TB1: Ch 4]
5. Parts of the Human Eye, Photoreceptors and Densities, Scotopic and Photopic Vision, Display Resolution Requirements, Eye Movements, Neural Vision Structures, Sufficient Display Resolution, Other Implications of Physiology on VR. [TB1: Ch 5]
6. Depth Perception, Motion Perception, Vection, Stroboscopic Apparent Motion, Color Perception, Combining Information From Multiple Cues And Senses, Implications Of Perception On VR. [TB1: Ch 6]
7. Graphical Rendering, Ray Tracing, Shading, BRDFs, Rasterization, Barycentric Coordinates, VR Rendering Problems, Anti-Aliasing, Distortion Shading, Image Warping (Time Warp), Panoramic Rendering. [TB1: Ch 7]
8. Velocities, Acceleration, Vestibular System, Virtual World Physics, Simulation, Collision Detection, Avatar Motion, Vection. [TB1: Ch 8]
9. Tracking Systems, Estimating Rotation, IMU Integration, Drift Errors, Tilt and Yaw Correction, Estimating Posi ion, Camera-Feature Detection Model, Perspective N-Point Problem, Sensor Fusion, Lighthouse Approach, Attached Bodies, Eye Tracking, Inverse Kinematics, Map Building, SLAM. [TB1: Ch 9]
10. Remapping, Locomotion, Manipulation, Social Interaction, Specialized Interaction Mechanisms. [TB1: Ch 10]

11. Sound Propagation, Ear Physiology, Auditory Perception, Auditory Localization, Fourier Analysis, Acoustic Modeling, Hrtfs, Rendering, Auralization. [TB1: Ch 11]
12. Perceptual Training, Recommendations for Developers, Best Practices, VR Sickness, Experimental Methods That Involve Human Subjects. [TB1: Ch 12]
13. Touch, Haptics, Taste, Smell, Robotic Interfaces, Telepresence, Brain-Machine Interfaces. [TB1: Ch 13]

Teaching Methodology:

Lectures, Written Assignments, Presentations

Course Assessment:

Sessional Exam, Home Assignments, Quizzes, Presentations, Final Exam

Reference Materials:

1. Virtual Reality by Steven M. LaValle. Cambrigde University Press (2017).
2. Fundamentals of Computer   raphics by Peter Shirley, MichaelAshikhmin, and Steve Marschner. A K Peters/CRC Press; 3rd Edition (2009). ISBN: 1568814690

SEEC-415 IOT			
Credit Hours:	3+0	**Prerequisites:**	None

Course Learning Outcomes (CLOs):		
At the end of the course the students will be able to:	**Domain**	**BT Level***
1. Understanding the structure of Internet of Things.	C	1
2. Understand the basic principles of implementing IoT with Fog and Cloud.	C	2
3. Familiarity with Programming frameworks and Big Data analytics in real IoT Applications.	C	2
* BT= Bloom's Taxonomy, C=Cognitive domain, P=Psychomotor domain, A= Affective domain		

Course Content:

1. Internet of Things: An Overview, IoT emergence, Internet of EveryThing. [TB1:Ch 1, 3]
2. IoT infrastructures: Open Source Semantic web architecture for managing IoT resources in Cloud. [TB1:Ch 2]
3. Device/Cloud Collaboration Framework for Intelligence Applications IoT. [TB1: Ch,3]
4. Communication Protocols for IoT, Network Layers, Transport and Application layer [TB1: Ch 1, 13]
5. Fog Computing: Principles, Architectures, and Applications.[TB1: Ch 4]
6. Programming Frameworks for Internet of Things, Embedded device Programming languages, IoT programming languages [TB1: Ch 5]
7. Virtualization on Embedded Boards as Enabling Technology for the Cloud of Things[TB1: Ch 6]
8. Micro Virtual Machines (MicroVMs) for Cloud-Assisted Cyber-Physical Systems [TB1: Ch 7]
9. Design and Implement Scalable, Flexible, and open IoT solutions using Web technologies [TB4: Ch 1]
10. IoT data management and Analytics: IoT and Cloud, Real time Analytics in IoT and Fog

Computing, [TB1: Ch 8, TB2 : Ch 1]
11. A Framework for Distributed Data Analysis for IoT [TB1:Ch 9]
12. Security and Privacy in the Internet of Things, TinyTO: Two-Way Authentication for Constrained
    Devices in the Internet of Things [TB2 : Ch 12]
13. Internet of Things Applications, Monitoring and Actuating, Internet of Vehicles and Applications[Tb1 : Ch 15, 16]
14. Cloud-Based Smart-Facilities Management, IoT Services LifeCycle, Scheduling and Resource Management, Validating Applications and use cases [TB1:Ch 17]

Teaching Methodology:

Lectures, Written Assignments, Semester Project, Lab Assignments, Presentations

Course Assessment:

Sessional Exam, Home Assignments, Quizzes, Project, Presentations, Final Exam

Reference Materials:

1. Internet of Things: Principle and Paradigms 1st Edition, ISBN-10: 012805395X
2. Big Data Analytics: Tools and Technology for Effective Planning, Published October 26, 2017, ISBN 9781138032392
3. https://pdfs.semanticscholar.org/2006/d0fca0546bdeb7c3f0527ffd299cff7c7ea7.pdf
4. Building the Web of Things, ISBN-10:9781617292682

SEE -416 Semantic Web Techniques			
Credit Hours:	3+0	**Prerequisites:**	None

Course Learning Outcomes (CLOs):		
At the end of the course the students will be able to:	**Domain**	**BT Level***
1. This course introduces techniques that are useful stand-alone and can be integrated for building a semantic web.	C	2
* BT= Bloom's Taxonomy, C=Cognitive domain, P=Psychomotor domain, A= Affective domain		

Course Content:
1. Introduction to the semantic web.   2. Introduction to ontologies.   3. Ontology languages for the semantic web.   4. Resource Description Framework (RDF).   5. Lightweight ontologies: RDF Schema.   6. Web Ontology Language (OWL).   7. Query language for RDF: SPARQL.   8. Ontology Engineering.   9. Semantic web and Web 2.0 and applications of Semantic Web.
Teaching Methodology:
Lectures, Written Assignments, Presentations
Course Assessment:
Sessional Exam, Home Assignments, Quizzes, Presentations, Final Exam
Reference Materials:

1. Introduction to the Semantic Web and Semantic Web Services, Liyang Yu, Chapman and Hall/CRC, 2007
2. Build Flexible Applications with Graph Data, Toby Segaran, Colin Evans, Jamie Taylor,302 pages O'Reilly Media, 2009
3. Foundations of Semantic Web Technologies, Pascal Hitzler, Markus Krotzsch, Sebastian Rudolph.

SEEC-417 Mobile Computing			
Credit Hours:	3+0	**Prerequisites:**	None

Course Learning Outcomes (CLOs):

At the end of the course the students will be able to:	Domain	BT Level*
1. Grasp the concepts and features of mobile computing technologies and applications.	C	1
2. Difficulties in Mobile App Development and standing of Mobile Application Development Today.	C	2
3. Design and implement Mobile Application	C	3
* BT= Bloom's Taxonomy, C=Cognitive domain, P=Psychomotor domain, A= Affective domain		

Course Content:

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: Desi n Patterns for Limited Memory, Strategies for Allocating Variable to Memory, Memory Management in Mobile Java, Symbian OS Memory Management. [TB1]
4. Mobile Applications: Components of Mobile Application, Workflow for Application Development, Techniques for Composing Application, Application Models iin 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, Features in MIDP Java, Symbian OS Security. [TB1]

10. Introduction to Mobile Application Development with Android [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]

Teaching Methodology:
Lectures, Written Assignments, Presentations
Course Assessment:
Sessional Exam, Home Assignments, Quizzes, Presentations, Final Exam
Reference Materials:

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& Scott Gowell, Wrox; 1st Edition (September 4, 2012). ISBN-10: 1118203909
3. 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.
4. 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.
5. Fundamentals of Mobile and ervasive Computing by Frank Adelstein, Sandeep KS Gupta, Golden Richard III and Loren Schwiebert, McGraw-Hill Professional; 1st Edition (2004). ISBN-10: 0071412379.
6. Mobile Design Pattern Galler : UI Patterns for Mobile Applications by Theresa Neil, O'Reilly Media (2012). ISBN-10: 1449314325.
7. 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.
8. Beginning Android 4 Application Development by Wei-Meng Lee, Wrox; 1st Edition (March 6, 2012). ISBN-10: 1118199545

SEEC-418 Data Warehousing			
Credit Hours:	3+0	**Prerequisites:**	None

Course Learning Outcomes (CLOs):		
At the end of the course the students will be able to:	**Domain**	**BT Level***
1. Learn concepts and skills for designing data warehouses and creating data integration workflows.	C	2
2. Able to use tools for data warehousing: MS SQL and Teradata.	C	3
***** BT= Bloom's Taxonomy, C=Cognitive domain, P=Psychomotor domain, A= Affective domain**		

Course Content:
1. Introduction to Data Warehousing: Brief History, Characteristics, Architecture, Data Staging and ETL, Multidimentional 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 1: Ch. 3]
4. User Requirement Analysis: Interviews, Glossary-based Requirement Analysis, Additional Requirements. [TB 1: Ch. 4]
5. Conceptual Modeling: Dimensional Fact Model, Events and Aggregation, Temporal Aspects, Overlapping Fact Shcemata, Formalizing the Dimensional Fact Model. [TB 1: 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 1: 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

Teaching Methodology:

Lectures, Written Assignments, Presentations

Course Assessment:

Sessional Exam, Home Assignments, Quizzes, Presentations, Final Exam

Reference Materials:

1. Data Warehouse Design: Modern Principles and Methodologies by MatteoGolfarelli and Stefano Rizzi, McGraw-Hill Osborne Media; 1st Edition (May 26, 2009). ISBN-10: 0071610391
2. Building the Data Warehouse by William H. Inmon, Wiley; 4th Edition (2005). ISBN-10: 0764599445
3. The Data Warehouse Lifecy le 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
4. Data Warehousing Fundamentals for IT Professionals by PaulrajPonniah, Wiley; 2ndEdition (2010). ISBN-10: 0470462078
5. Data Mining and Data Warehousing: Practical Machine Learning Tools Techniques by Ram Kumar Singh and AmitAsthana, LAP LAMBERT Academic Publishing (2012). ISBN-10: 3659118419

SEEC-419 Data Mining			
Credit Hours:	3+0	**Prerequisites:**	None

Course Learning Outcomes (CLOs):		
At the end of the course the students will be able to:	**Domain**	**BT Level***
1. Understand the applications, concepts, and techniques of data mining.	C	2
2. Learn different data mining tools and apply basic data mining techniques to actual problems.	C	3
*** BT= Bloom's Taxonomy, C=Cognitive domain, P=Psychomotor domain, A= Affective domain**		

Course Content:

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 1: 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 1: 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 1: 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 1: Ch. 11]
12. Genetic Algorithms: Fundamentals of GAs, Optimization Using GAs, Schemata, TSP,

Machine Learning Using GAs, GAs for Clustering. [TB 1: Ch. 13]
13. Fuzzy Sets and Fuzzy Logic: Fuzzy Sets, Fuzzy-Set Operations, Extension Principle and Fuzzy Relations, Fuzzy Logic and Fuzzy Inference Systems, Multifactorial Evaluation, Extracting Fuzzy Models from Data, Data Mining and Fuzzy Sets
14. Visualization Methods: Perception and Visualization, Scientific Visualization and Information Visualization, Parallel Coordinates, Radial Visualization, Visualization Using Self-Organizing Maps, Visualization Systems for Data Mining
15. Data Mining Tools: Weka, CBA and Yale, etc.

Teaching Methodology:

Lectures, Written Assignments, Presentations

Course Assessment:

Sessional Exam, Home Assignments, Quizzes, Presentations, Final Exam

Reference Materials:

1. Data Mining: Concepts, Models, Methods, and Algorithms by MehmedKantardzic, Wiley-IEEE Press; 2nd Edition (August 16, 2011). ISBN-10: 0470890452
2. Data Mining: Concepts and Techniques, Third Edition (The Morgan Kaufmann Series in Data Management Systems) by Jiawei Han, MichelineKamber and Jian Pei, Morgan Kaufmann; 3rd Edition (2011).ISBN-10: 0123814790
3. Principles of Data Mining (Adaptive Computation and Machine Learning) by David J. Hand, HeikkiMannila and Padhraic Smyth, A Bradford Book (August 1, 2001). ISBN-10: 026208290X
4. Data Mining and Data Warehousing: Practical Machine Learning Tools Techniques by Ram Kumar Singh and AmitAsthana, LAP LAMBERT Academic Publishing (2012). ISBN-10: 3659118419
5. 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
6. Building the Data Warehouse by William H. Inmon,Wiley; 4th Edition (2005).ISBN-10: 0764599445

SEEC-420 Business Intelligence and Analytics			
Credit Hours:	3+0	**Prerequisites:**	None

Course Content:
1. Business Intelligence - An Introduction, Value Drivers, Performance Metrics and Key Performance Indicators, Use Cases for BI. [TB 1: Ch. 1, 2]
2. BI Success Factors. Strategic Versus Tactical Planning, BI Strategy and Plan. [TB 1: Ch. 3,4]
3. BI Environment, BI and Analytics Platform and Strategy, Organizational BII Framework, Services & Systems Evaluation. [TB 1: Ch. 5]
4. Business Process and Information Flow: Information Need & Flow, Information Processing & Information Flow, Information Flow Model, Modeling Frameworks. [TB 1: Ch. 6]
5. Data Requirements Analysis: Business Uses of Information, Metrics: Facts, Qualifiers, and Models, Defining Business Rules, Data Requirement Analysis, Assessing Suitability. [TB 1: 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 1: Ch. 8, 9]

7. Data Profiling: Data Sources, Data Profiling Activities, Data Model Inference, Attribute Analysis, Relationship Analysis, Management Issues. [TB 1: 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 1: 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 1: 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 1: Ch. 13]

11. Deriving Insight from Data: Customer Profiles, Behavior, and Lifetime Value; Demographics, Psychographics, Geographic; Geographic Data, Behavior Analysis. [TB 1: Ch. 15, 16]

12. Knowledge Discovery & Delivery: Business Drivers, KD Virtuous Cycle, Direct Versus Unidirectional Knowledge Discovery, Data Mining Activities, Data Mining Techniques. [TB 1: 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 1: Ch. 18]

14. Installations, Configuring and Maintaining the BI Server, Creating Repositories from Relational Sources, Creating Repositories from OLAP Data Sources, Creating Reports Using Answers and Dashboards.

Teaching Methodology:
Lectures, Written Assignments, Presentations

Course Assessment:
Sessional Exam, Home Assignments, Quizzes, Presentations, Final Exam

Reference Materials:

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

2. Oracle Business Intelligence 11g Developers Guide by Mark Rittman, McGraw-Hill Osborne Media; 1st Edition (September 18, 2012). ISBN-10: 0071798749

3. 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

4. Business Intelligence by Elizabeth Vitt, Michael Luckevich, and StaciaMisner, Microsoft Press (December 22, 2008). ISBN-10: 073562660X

5. The Data Warehouse Mentor: Practical Data Warehouse and Business Intelligence Insights, by Robert Laberge, 1st Edition, McGraw-Hill Companies, (2012). ASIN: B008UYJJ8C

6. Business Intelligence: A Managerial Approach by Turban, Sharda, Delen, King, 2nd Edition, Prentice Hall (2011). ISBN: 13-978-0-136-10066-9

7. Business Intelligence in Plain Language: A practical guide to Data Mining and Business Analytics by Jeremy Kolb, Applied Data Labs Inc. (2012). ASIN: B009K7INOY

SEEC-302 Database Administration & Management			
Credit Hours:	3+0	**Prerequisites:**	None

Course Learning Outcomes (CLOs):		
At the end of the course the students will be able to:	**Domain**	**BT Level***
1. Fully understand the concepts and technical issues of database administration.	C	2
2. Develop understanding of internal functionality of DBMS.	C	3
3. Able to perform database administration tasks like backup and recovery and performance tuning of databases.	C	3
***** BT= Bloom's Taxonomy, C=Cognitive domain, P=Psychomotor domain, A= Affective domain		

Course Content:

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 Instanc : 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, Ope ations 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, Insta ce 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.

Teaching Methodology:

Lectures, Assignments, Presentations

Course Assessment:

Sessional Exam, Home Assignments, Quizzes, Final Exam

Reference Materials:

1. Oracle Database 11g DBA Handbook by Bob Bryla and Kevin Loney, McGraw-Hill Osborne Media; 1st Edition (December 6, 2007). ISBN-10: 0071496637
2. 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
3. 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
4. Oracle Database 11g The Complete Reference by Kevin Loney, McGraw-Hill Osborne Media; 1st Edition (2008). ISBN-10: 0071598758
5. Oracle Database 11g Release 2 Performance Tuning Tips & Techniques (Oracle Press) by Rich Niemiec, McGraw-Hill Osborne Media; 1st Edition (2012). ISBN-10: 0071780262
6. Online Material URL http://otn.oracle.com

SEEC-422 Advance Database Management			
Credit Hours:	3+0	**Prerequisites:**	None

Course Learning Outcomes (CLOs):		
At the end of the course the students will be able to:	**Domain**	**BT Level**[*]
1. Explore the salient features of various types of databases.	C	3
2. Provide an overview data warehousing, OLAP and data mining.	C	3
3. Lean about transaction processing, concurrency control, crash recovery and database security.	C	3
* BT= Bloom's Taxonomy, C=Cognitive domain, P=Psychomotor domain, A= Affective domain		

Course Content:
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 Concu rency 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: Introduc ion 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 Transformati n 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.

Teaching Methodology:
Lectures, Written Assignments, Presentations
Course Assessment:
Sessional Exam, Home Assignments, Quizzes, Presentations, Final Exam
Reference Materials:

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

SEEC-423 Business Process Management			
Credit Hours:	3+0	**Prerequisites:**	None

Course Learning Outcomes (CLOs):		
At the end of the course the students will be able to:	**Domain**	**BT Level***
1. Understand the key Terms an concepts in Business Process Management.	C	2
2. Learn about the major methodologies and techniques for implementing BPM.	C	2
3. Learn what a BPM management and process-centric organization is and how it works.	C	2

4. Understand the metrics and measurements critical to managing processes	C	3
5. Learn how to identify critical processes.	C	3

* BT= Bloom's Taxonomy, C=Cognitive domain, P=Psychomotor domain, A= Affective domain

Course Content:

1. Introduction: Motivation and Definitions, Business Process Lifecycle, Classification of Business Processes, Goals, Structure, and Organization. [TB 1: Ch. 1]
2. Evolution of Enterprise Systems Architectures: Traditional Application Development, Enterprise Applications and their Integration, Enterprise Modeling and Process Orientation, Workflow Management, Enterprise Services Computing. [TB 1: Ch. 2]
3. Business Process Modeling: Foundation, Conceptual Model and Terminology, Abstraction Concepts, From Business Functions to Business Processes, Activity Models and Activity Instances, Process Models and Process Instances, Process Interactions, Modeling Process Data, Modeling Organization, Modeling Operation, Business Process Flexibility, Architecture of Process Execution Environments. [TB 1: Ch. 3]
4. Process Orchestrations: Control Flow Patterns, Petri Nets, Event-driven Process Chains, Workflow Nets, Graph-Based Workflow Language, Business Process Model and Notation. [TB 1: Ch. 4]
5. Process Choreographies: Motivation and Terminology, Development Phases, Process Choreography Design, Process Choreography Implementation, Service Interaction Patterns, Choreography Modeling in BPMN. [TB 1: Ch. 5]
6. Properties of Business Processes: Data Dependencies, Object Lifecycle Conformance, Structural Soundness, Soundness, Relaxed Soundness, Weak Soundness, Lazy Soundness, Soundness Criteria Overview. [TB 1: Ch. 6]
7. Business Process Management Architectures: Workflow Management Architectures, Flexible Workflow Management, Web Services and their Composition, Advanced Service Composition, Data-Driven Processes: Case Handling. [TB 1: Ch. 7]
8. Business Process Management Methodology: Dependencies between Processes, Methodology Overview, Phases in Detail. [TB 1: Ch. 7]

Teaching Methodology:

Lectures, Written Assignments, Presentations

Course Assessment:

Sessional Exam, Home Assignments, Quizzes, Presentations, Final Exam

Reference Materials:

1. Business Process Managem nt: Concepts, Languages, Architectures by Mathias Weske, Springer; 2nd Edition (May 3, 2012). ISBN-10: 3642286151.
2. Business Process Management Common Body Of Knowledge by Yvonne LedererAntonucci, et. al., CreateSpace Independent Publishing Platform (March 8, 2009). ISBN-10: 1442105666
3. Process Management: A Guide for the Design of Business Processes by Jörg Becker, Martin Kugeler and Michael Rosemann, Springer; 2nd Edition (January 21, 2011). ISBN-10: 3642151892
4. Business Process Management, Second Edition: Practical Guidelines to Successful Implementations by John Jeston and Johan Nelis, Butterworth-Heinemann; 2nd Edition (March 24, 2008). ISBN-10: 0750686561
5. Process Management: Practical Guidelines to Successful Implementation by T.S. Malik, Global India Publications Pvt Ltd; 1st Edition (December 31, 2009). ISBN-10:

9380228368

6. Business Process Management: Practical Guidelines to Successful Implementations by John Jeston& Johan Nelis, Butterworth-Heinemann; 2nd Edition (March 24, 2008). ISBN-10: 0750686561

7. BPMN Method and Style with BPMN Implementer's Guide: A structured approach for business process modeling and implementation using BPMN 2.0 by Bruce Silver, Cody-Cassidy Press (October 17, 2011). ISBN-10: 0982368119

8. Workflow Modeling: Tools for Process Improvement and Application Development by Alec Sharp and Patrick M Dermott, Artech House; 2nd Edition (October 31, 2008). ISBN-10: 1596931922

9. Process Analysis and Improvement: Tools and Techniques by Seppanen, Marvic S., Kumar, Sameer & Chandra, Charu (2005). McGraw-Hill

10. Business Process Change: A Guide for Business Managers and BPM and Six Sigma Professionals (The MK/OMG Press) by Paul Harmon and Business Process Trends, Morgan Kaufmann; 2nd Edition (July 27, 2007). ISBN-10: 0123741521

SEEC-424 Knowledge Management			
Credit Hours:	3+0	**Prerequisites:**	None

Course Learning Outcomes (CLOs):		
At the end of the course the students will be able to:	**Domain**	**BT Level***
1. Appraise current thought on knowledge management in the light of contemporary debates on knowledge productivity, strategic capability and organizational learning.	C	2
2. Apply theories of knowledge management relevant to current workplace practice.	C	3
3. Apply the tools and techniques of knowledge management.	C	3
* BT= Bloom's Taxonomy, C=Cognitive domain, P=Psychomotor domain, A= Affective domain		

Course Content:
1. History and paradigms of knowledge management; Types of knowledge: Explicit Knowledge, Tacit Knowledge, Embedded Knowledge, Embrained knowledge, Embodied knowledge, Encoded knowledge, Encultured knowledge; Organizational Internal & External Knowledge; Managers' Knowledge; Personal knowledge. Knowledge Economy: Knowledge Revolution, Globalization, Knowledge Economy, Knowledge Workers, Knowledge Artifacts, Knowledge Agents; Knowledge Management: Definitions, Knowledge management Cycles, Benefits of KM, Implications for KM, KM Core Competencies. [TB1: Ch. 1, 2, 4]
2. KM Processes: Knowledge Discovery/ Detection, Knowledge Capture and Codification, Knowledge Organization, Knowledge Sharing, Explicit Knowledge Sharing, Knowledge transfer, Knowledge Acquisition, Knowledge Verification, Knowledge Utilization, Knowledge Creation, Knowledge Reuse; [TB1: Ch. 3]
3. KM Frameworks and Models: The SECI Model, Alen Frost's Model, Boisot's KM Model, Hedlund's KM Model, Earl's KM Model, Carayannis's KM Model, Wiig's KM Model, Edvinsson's Model of Intellectual Capital, Snowden's KM Model,

Inkpen&Dinur's KM Model. [TB1: Ch. 4]

4. KM Frameworks and Models: Van Buren's Model of IC Management,, Bukowitz& Williams's KM Model, Gamble & Blackwell's KM Model, Demerest's KM Model, Frid's KM Model, Stankosky&Baldanza's KM Framework, Kogut& Zander's KM Model, Botha et. al. KM Model, Integrated Knowledge Management Model. [TB1: Ch. 4]

5. 4 Knowledge Capture and Codification: Tacit Knowledge Capture at the Individual, Group, and Organizational Levels, xplicit Knowledge Codification, Cognitive Maps, Decision Trees, Knowledge Taxonomies, The Relationships among Knowledge Management, Competitive Intelligence, Business Intelligence, and Strategic Intelligence; Strategic and Practical Implications of Knowledge Capture and Codification [TB2: Ch. 4]

6. Knowledge Sharing and Communities of Practice: Sociograms and Social Network Analysis, Knowledge-Sharing Communities, Types of Communities, Roles and Responsibilities in CoPs, Knowledge Sharing in Virtual CoPs, Obstacles to Knowledge Sharing, Strategic and Practical Implications of Knowledge Sharing. [TB2: Ch. 5]

7. Knowledge Application: Knowledge Application at the Individual Level, Characteristics of Individual Knowledge Workers, Bloom ' s Taxonomy of Learning Objectives, Task Analysis and Modeling, Knowledge Application at the Group and Organizattional Levels, Knowledge Reuse, Knowle ge Repositories, E-Learning and Knowledge Management Application, Strategic & Practical Implications of Knowledge Application. [TB3: Ch.6]

8. The Role of Organizational Culture: Different Types of Cultures, Organizational Culture Analysis, The Effects of Culture on Individuals, Organizational Maturity Models, KM Maturity Models, CoP Maturity Models, Transformation to a Knowledge-Sharing Culture, Impact of a Merge on Culture, Impact of Virtualization on Culture, Strategic and Practical Implications of Organizational Culture. [TB2: Ch.7]

9. Knowledge Management Tools: Knowledge Capture and Creation Tools, Content Creation Tools, Data Mining and Knowledge Discovery, Blogs, Mashups, Content Management Tools, Folksonomies and Social Tagging/Bookmarking, Personal Knowledge Management (PKM), Knowledge Sharing and Dissemination Tools, Groupware and Collaboration Tools, Wikis, Social Networking, Web 2.0, and KM 2.0, Knowledge Acquisition and Application Tools, Intelligent Filtering Tools, Adaptive Technologies, Strategic and Practical Implications of KM Tools and Techniques. [TB2: Ch. 8]

10. Knowledge Management Strategy: Developing a Knowledge Management Strategy, Knowledge Audit, Gap Analysis, The KM Strategy Road Map, Balancing Innovation and Organizational Structure, Types of Knowledge Assets Produced. [TB2: Ch. 9]

11. The Value of Knowledge Management: KM Return on Investment (ROI) and Metrics, The Benchmarking Method, The Balanced Scorecard Method, The House of Quality Method, The Results-Based Assessment Framework, Measuring the Success of Communities of Practice. [TB2: Ch. 10]

12. Organizational Learning and Organizational Memory: How Do Organizations Learn and Remember? Frameworks to Assess Organizational Learning and Organizational Memory, The Management of Organizational Memory, Organizational Learning, The Lessons Learned Process, Organizational Learning and Organizational Memory Models, A Three-Tiered Approach to Knowledge Continuity. [TB2: Ch. 11]

13. The KM Team: Major Categories of KM Roles, Senior Management Roles, KM Roles and Responsibilities within Organizations, The KM Profession, The Ethics of KM. [TB2: Ch. 12]

Teaching Methodology:

Lectures, Written Assignments, Presentations
Course Assessment:
Sessional Exam, Home Assignments, Quizzes, Presentations, Final Exam
Reference Materials:
1. Essentials of Knowledge Management: Concepts, Theories and Practices by M. A. Pasha & S. Pasha, Innovators Knowledge Services (2012). ISBN:978-969-9791-04-8 2. Knowledge Management in Theory and Practice by KimizDalkir, The MIT Press; 3nd Edition (March 4, 2011). ISBN-10: 0262015080 3. The Knowledge Management Toolkit: Orchestrating IT, Strategy, and Knowledge Platforms by AmritTiwana, Prentice Hall; 2nd Edition (August 29, 2002). ISBN-10: 013009224X 4. Principles of Knowledge Management: Theory, Practice and Cases by EliieGeisler and NilminiWickramasinghe, M.E.Sharpe (January 15, 2009). ISBN-10: 0765613220 5. Knowledge Management: Concepts, Methodologies, Tools and Applications (6-volume set) by Murray E. Jennex, IGI Global; Reprint Edition (August 10, 2007). ISBN-10: 1599049333